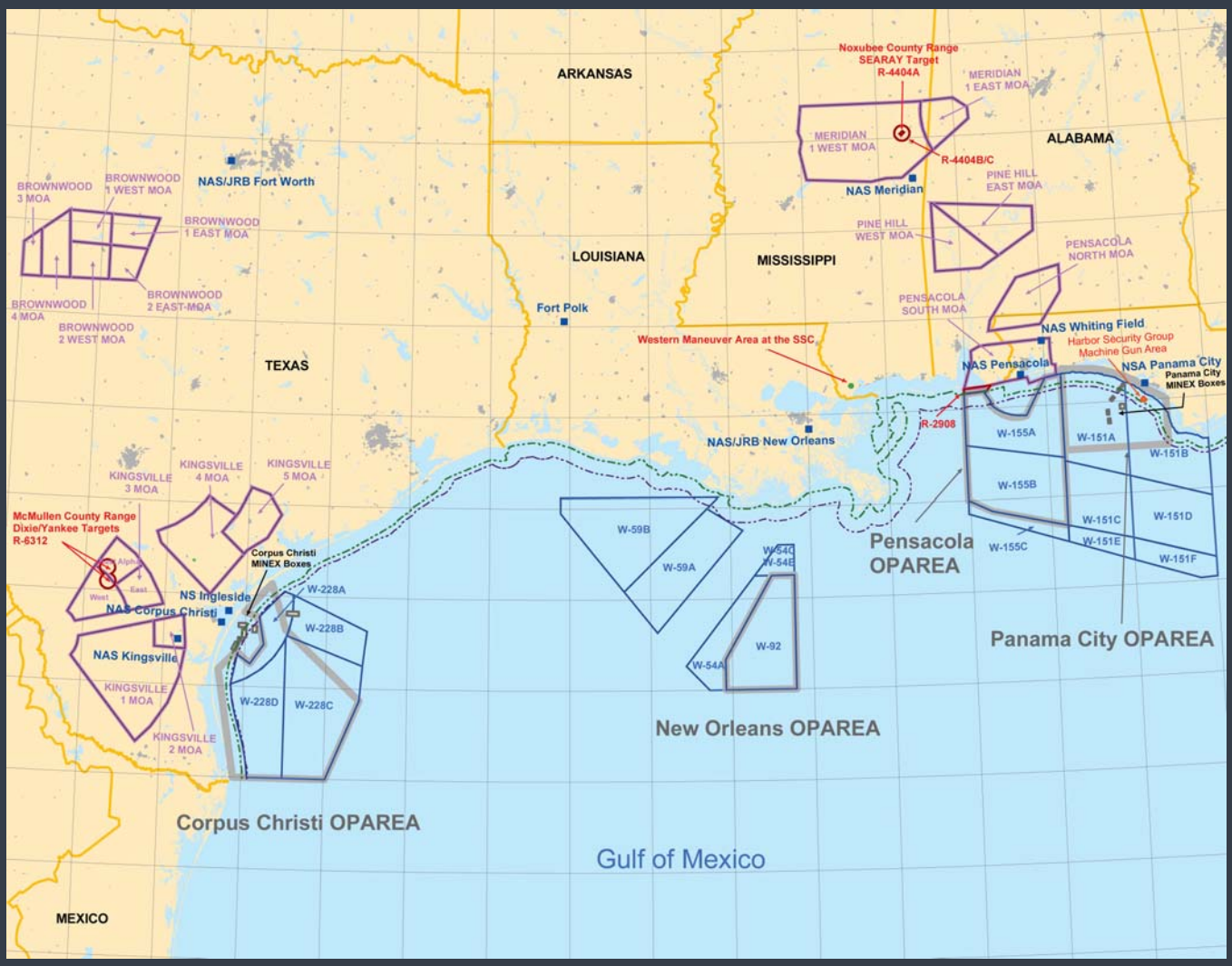
Gulf of Mexico Range Complex Final Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) Volume 1



Prepared by:

United States Fleet Forces

December 2010

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GULF OF MEXICO RANGE COMPLEX
FINAL ENVIRONMENTAL IMPACT STATEMENT/ OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (FINAL EIS/OEIS)

Lead Agency

Department of the Navy

Action Proponent:

United States Fleet Forces

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Abstract:

The Department of the Navy has prepared this Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts over a 10-year planning horizon associated with Navy training; research, development, testing, and evaluation activities; and associated range capabilities enhancements in the Gulf of Mexico (GOMEX) Range Complex. The Study Area is composed of four operating areas (OPAREAs) (i.e., Corpus Christi, New Orleans, Pensacola, and Panama City); at-sea special use airspace (warning areas); the area from the shoreline to the Corpus Christi, Pensacola, and Panama City OPAREAs; overland airspace (military operating areas) in Texas, Mississippi, Alabama, and Florida; the NSA Panama City Demolition Pond; and two inland range areas- the McMullen County Range and Noxubee County Range. The potential effects to physical, biological, and man-made environments from the testing and training alternatives were studied to determine how the proposed action could affect these resources. The National Marine Fisheries Service is a Cooperating Agency for this Final EIS/OEIS.

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ACRONYMS AND ABBREVIATIONS

A-A	Air-to-Air
A-G	Air-to-Ground
A-S	Air-to-Surface
AADT	Annual Average Daily Traffic
AAMEX	Air-to-Air Missile Exercise
AAV	Amphibious Assault Vehicle
ACC	Air Combat Command
ADC	Acoustic Device Countermeasure
ADEM	Alabama Department of Environmental Management
AEER	Advanced Extended Echo Ranging
AEGIS	Airborne Early Warning/Ground Environment Integration Segment
AIC	Air Interceptor Control
AICUZ	Air Installation Compatibility Use Zone
AIM	Air Intercept Missile
ACHP	Advisory Council on Historic Preservation
ACM	Air Combat Maneuvering
AEAU	Alternative Energy and Alternate Use
AFAST	Atlantic Fleet Active Sonar Training
AFB	Air Force Base
AFVOSF	Armored Fighting Vehicle Operating Storage Facility
AGL	Above Ground Level
AIC	Air Intercept Control
AFL	Auxiliary Landing Field
ALMDS	Airborne Laser Mine Detection System
Al_2O_3	Aluminum Oxide
AMCM	Airborne Mine Countermeasure
AMNS	Airborne Mine Neutralization System
AMRAAM	Advanced Medium-Range Air- to-Air Missile
AMW	Amphibious Warfare
APE	Area of Potential Effect
APPS	Act to Prevent Pollution from Ships
AQCR	Air Quality Control Region
AQM	Air-Launched Drone Missile Target
APE	Area of Potential Effect
ARG	Amphibious Ready Group
ARPA	Archaeological Resources Protection Act
ARTCC	Air Route Traffic Control Center
A-SEL	A-weighted SEL
ASROC	Rocket-Assisted Anti-Submarine Torpedo
ASTM	American Society for Testing and Materials
ASW	Anti-Submarine Warfare
ATC	Air Traffic Control
AUTEC	Atlantic Undersea Test and Evaluation Center
AW	Air Warfare
BA	Biological Assessment
BDU	Bomb Dummy Unit
BE	Biological Evaluation
BFM	Basic Fighter Maneuvers
BMP	Best Management Practice
BO	Biological Opinion
BOMBEX	Bombing Exercise
BP	British Petroleum
BQM	Air- or Surface-Launched Drone Missile Target
BRAC	Base Realignment and Closure
BRS	Behavioral Response Study
BTS	Bureau of Transportation Statistics
C	Celsius
C2W	Command and Control Warfare
CAA	Clean Air Act
CAMA	Coastal Area Management Act
CAS	Commercial Air Services
CATEX	Categorical Exclusion
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFMETR	Canadian Forces Maritime Experimental and Test Ranges
CFR	Code of Federal Regulations
CG	Cruiser
CH_4	Methane
CHAFFEX	Chaff Exercise
CHPT	Cherry Point
CHRIMP	Consolidated Hazardous Materials Reutilization and Inventory Management Program
CINCLANTFLTINST	Commander, in Chief, U.S. Atlantic Fleet Instruction
CIWS	Close-In Weapon System
CJTFEX	Combined Joint Task Force Exercise
CMP	Coastal Management Plan
CNA	Center for Naval Analysis
CNATRA	Chief of Naval Air Training
CNIC	Commander Naval Installations Command
CNO	Chief of Naval Operations
CO	Commanding Officer or Carbon Monoxide
CO_2	Carbon Dioxide
COMINEWARCOM	Mine Warfare Command
COMNAVREG SE	Commander, Navy Region Southeast
COMPTUEX	Composite Training Unit Exercise
CRC	Coastal Resources Commission
CRE	Comprehensive Range Evaluation
CREEM	Centre for Environmental and Ecological Modeling
CSAR	Combat Search and Rescue
CSB	Cape San Blas
CSG	Carrier Strike Group
CSW	Crew-served weapon
CTR	Coastal Test Range
CVN	Nuclear Aircraft Carrier
CWA	Clean Water Act
CZMA	Coastal Zone Management Act

dB	decibel
dBA	decibel (A-weighted)
dd	distance doubled
DDG	Guided Missile Destroyer
DEIS	Draft Environmental Impact Statement
DENR	Department of Environment and Natural Resources (NC)
DEQ	Department of Environmental Quality
DGPS	Differential Global Positioning System
DIN	dissolved inorganic nitrogen
DIP	dissolved inorganic phosphorus
DLQ	Deck Landing Qualifications
DNL	Day-Night Average Sound Level
DO	Dissolved oxygen
DoC	Department of Commerce
DOCD	Development Operations Coordination Document
DoD	Department of Defense
DOE	Department of Energy
DoI	Department of the Interior
DoN	Department of the Navy
DoS	Department of State
DoT	Department of Transportation
DTE	Detect-to-Engage
DVD	Digital Versatile Disk
DWQ	Division of Water Quality (NC)
EA	Environmental Assessment
EC	Electronic Combat
ECM	Electronic Countermeasures
EEZ	Exclusive Economic Zone
EFD	Energy Flux Density
EFH	Essential Fish Habitat
EGMTTA	Eastern Gulf of Mexico Testing and Training Areas
EGTTR	Eglin Gulf Test and Training Range
EIS	Environmental Impact Statement
EMATT	Expendable Mobile ASW Training Target
EMR	Electromagnetic Radiation
EO	Executive Order
EOD	Explosive Ordnance Disposal
EP	Exploration Plan
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
ESG	Expeditionary Strike Group
ESG COMPTUEX	Expeditionary Strike Group Composite Training Unit Exercise
ETP	Eastern Tropical Pacific
EW	Electronic Warfare
FAA	Federal Aviation Administration
FAD	Fish Aggregating Device
FACSFAC	Fleet Area Control and Surveillance Facility
FCLP	Field Carrier Landing Practice
FCTC	Fleet Combat Training Center
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FFG	Guided Missile Frigates
FIP	Federal Implementation Plan
FIREX	Firing Exercise
FL	Flight Level
FLAREX	Flare Exercise
FMP	Fishery Management Plan
Fps	feet per second
FR	Federal Register
FRP	Fleet Response Plan
FRS	Fleet Replacement Squadron
FRTP	Fleet Response Training Plan
F-SEL	Flat weighted SEL
ft	feet
FWPCA	Federal Water Pollution Control Act
FWS	Future Water Supply
FXP	Fleet Exercise Publication
FY	Fiscal Year
g/L	grams per liter
GAM	Generalized Additive Model
GHG	Greenhouse Gas
GINS	Gulf Island National Seashore
GMFMC	Gulf of Mexico Fishery Management Council
GOMEX	Gulf of Mexico
GPS	Global Positioning System
GTFP	Green Turtle fibropapillomatosis
GulfCet	Gulf Cetaceans
GUNEX	Gun Exercise
GWP	Global Warming Potential
H_2	Hydrogen
H_2O	Water
HAB	harmful algal blooms
HAPC	Habitat Areas of Particular Concern
HARPS	High Frequency Acoustic Recording Packages
HAZMINCEN	Hazardous Material Minimization Center
HCl	Hydrochloric Acid
HE	high explosive
HFAS	High Frequency Active Sonar
HF/M3	High Frequency Marine Mammal Monitoring
HITS	Historical Temporal Shipping
HMS	High Melting Explosive
HMX	Octogen
HQW	High Quality Waters
HRC	Hawaii Range Complex
HSO_3	Hydrogen Sulfite (Bisulfite)
Hz	Hertz
IBA	Important Bird Area
ICAO	International Civil Aviation Authority
ICMP	Integrated Comprehensive Monitoring Plan
IEER	Improved Extended Echo Ranging

IEF	In Ex Fish
IFAW	International Fund for Animal Welfare
IFE	In-Flight Emergencies
IFH	Improved Flex Hose
IFR	Instrument Flight Rules
IHA	Incidental Harassment Authorization
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator System
in	inch
IOC	Initial Operational Capability
IRSSS	Improved Remote Strafe Scoring System
ISE	Independent Steaming Exercise
ISR	Intelligence, Surveillance and Reconnaissance
ITA	Incidental Take Authorization
ISTT	Improved Surface Tow Target
IUSS	integrated undersea surveillance system
IWC	International Whaling Commission
JASSM	Joint Air-to-Surface Stand-off Missile
JAX	Jacksonville
JFCOM	Joint Forces Command
JIEDDO	Joint Improvised Explosive Device Defeat Organization
JNTC	Joint National Training Capability
JP-8 Fuel	Jet Propulsion Fuel, type 8
JPATS	Joint Primary Aircraft Training System
JRB	Joint Reserve Base
JRTC	Joint Readiness Training Center
JSF	Joint Strike Fighter
JTA	Joint Test Assembly
JTEN	Joint Training and Experimentation Network
JTFEX	Joint Task Force Exercise
kg	kilogram
kHz	kilohertz
km	kilometer
km^2	square kilometer
LATR	Large Area Tracking Range
LAANG	Louisiana Air National Guard
LCAC	Landing Craft Air Cushion
LCS	Littoral Combat Ship
LCU	Landing Craft Utility
LDEO	Lamont-Doherty Earth Observatory
L_{dn}	Day-Night Average Sound Level (formula version)
L_{dnmr}	Onset-rate adjusted monthly day-night average sound level
L_{eq}	1 second averaged equivalent sound level
LDFW	Louisiana Department of Fish and Wildlife
LFA	Low Frequency Active
LIDAR	Light Detection and Ranging
LiBr	Lithium Bromide
$LiSO_2$	Lithium sulfur dioxide
LLC	Limited Liability Company
LMRS	Long-Term Mine Reconnaissance System
LNG	Liquified Natural Gas
LOA	Letter of Authorization
m	meter
M&S	Modeling and Simulation
MARAD	Maritime Administration
MARPOL	International Convention for the Prevention of Pollution from Ships
MBTA	Migratory Bird Treaty Act
MCM	Mine Countermeasures
MCO	Marine Corps Order
MEM	Military Expended Materials
MESG	Mobile Expeditionary Security Group
MEU	Marine Expeditionary Unit
MFA	Mid-frequency Active
MFAS	multi-function active sensor
MFAS	mid-frequency active sonar
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
µPa	microPascals
mg/L	milligrams per liter
mg/m^3	miligrams per cubic meter
mi	mile
mi^2	square mile
MINEX	Mining Exercise
MIO	Maritime Interception Operations
MISSILEX	Missile Exercise
MIW	Mine Warfare
MLO	Mine-like Objects
mm	Millimeter
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOA	Military Operating Area
MOUT	Military Operations on Urban Terrain
Mph	miles per hour
MBTA	Migratory Bird Treaty Act
MPCD	marine pollution control device
MRA	Marine Resource Assessment
MSAT	Marine Species Awareness Training
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MSR	Mobile Sea Range
MTE	Major Training Exercises
MU	Management Unit
MW	megawatt
N_2	Nitrogen
N45	Environmental Readiness Division
N/A	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAB	Naval Amphibious Base
NALC	Navy Ammunition Logistic Code
NALF	Naval Auxiliary Landing Field
NAMS	National Air Monitoring Site

NAO	North Atlantic Oscillation
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NASOCEANAINST	NAS Oceana Instruction
NAVAIRES	Naval Air Reserve
NAVDIVESALTRACENINST	Naval Diving & Salvage Training Center Instruction
NAVEDTRA	Naval Educational Training
NAVFAC	Naval Facilities Engineering Command
NAWQC	National Ambient Water Quality Criteria
NCA	National Coastal Assessment
NDAA	National Defense Authorization Act
NDZ	No Discharge Zone
NECC	Navy Expeditionary Combat Command
NEFMC	New England Fishery Management Council
NEODS	Naval Explosive Ordnance Disposal School
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NEPM	non-explosive practice munition
NERR	National Estuarine Research Reserve
NEW	Net Explosive Weight
NH_3	Ammonia
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
nm	Nautical Miles
nm^2	Square Nautical Miles
NMFS	National Marine Fisheries Service
NMMA	National Marine Manufacturers Association
No.	number
NO_x	Nitrogen Oxides
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Agency
NOI	Notice of Intent
NOLF	Navy Outlying Landing Field
NODE	Navy OPAREA Density Estimate
NOTAM	Notice-to-Airmen
NOTMAR	Notice-to-Mariners
NPDES	National Pollution Discharge Elimination System
NRC	National Research Council
NRHP	National Register of Historic Places
NSA	Naval Support Activity
NSFS	Naval Surface Fire Support
NSW	Naval Special Warfare Or Nutrient Sensitive Waters
NSWC	Naval Surface Warfare Center
NSWCPC	Naval Surface Warfare Center Panama City
NTAD	National Transportation Atlas Database
NTTL	Navy Tactical Task List
NWS	Naval Weapons Station
OAMCM	Organic Airborne Mine Countermeasures
OB/OD	Open Burn/Open Detonation
OC	Ocean Conservancy
OCE	Officer Conducting the Exercise
OCM	Oil Content Monitor
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OEA	Overseas Environmental Assessment
OEIS	Overseas Environmental Impact Statement
OMCM	Organic Mine Countermeasures
OOD	Officer of the Deck
OPA	Oil and Pollution Act
OPAREA	Operating Area
OPFOR	Opposition Force
OPNAV	Office of the Chief of Naval Operations
OPNAVINST	Chief of Naval Operations Instruction
ORW	Outstanding Resource Waters
OTC	Officer in Tactical Command
P2	Pollution Prevention
Pa	Pascals
PAA	Planning Awareness Area or Primary Assigned Aircraft
PACFIRE	Pre-Action Calibration Firing
PAH	polycyclic aromatic hydrocarbon
Pb	Lead
$PbCl_2$	Lead Chloride
$PbCO_3$	Lead Carbonate
$PbOH_2$	Lead Hydroxide
PBR	Potential Biological Removal
PCB	polychlorinated biphenyls
PCD	Panama City Division
PEIS	Programmatic Environmental Impact Statement
PERSTEMPO	Navy Personnel Tempo of Operations
PL	Public Law
pm	Particulate matter
pm_{10}	particulate matter less than 10 microns in diameter
PMAP	Protective Measures Assessment Protocol
pna	primary nursery areas
POC	Point of Contact
POEA	Programmatic Overseas Environmental Assessment
POL	petroleum, oils, and lubricants
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PRMAR	Navy Primary Mission Areas
psf	pounds per square foot
psu	practical salinity units
PSW	Precision Strike Weapon
PTP	Pre-deployment Training Plan
PTS	Permanent Threshold Shift
PVC	polyvinyl chloride
PWC	Personal Watercraft
R&D	Research and Development
RAICUZ	Range Air Installations Compatible Use Zones
RCD	Required Capabilities Document
RCMP	Range Complex Management Plan

RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Test and Evaluation
RDX	rapid-detonating explosive or Royal Demolition Explosive
REC	Regional Environmental Coordinator
REEFEX	Ship to Reef
REXTORP	recoverable exercise torpedo
RF	radio frequency
RFF	Request for Forces
RFMC	Regional Fishery Management Council
RHIB	Rigid Hull Inflatable Boat
RITA/BTS	Research and Innovative Technology Administration's Bureau of Transportation Statistics
rms	root mean squared
ROD	Record of Decision
RONA	Record of Non-Applicability
ROV	Remotely Operated Vehicle
RSG	Range Sustainability Group
RSO	Range Safety Officer
S-A	Surface-to-Air
SAB	South Atlantic Bight
SAFMC	South Atlantic Fishery Management Council
SARA	Superfund Amendments and Reauthorization Act
SAV	Submerged Aquatic Vegetation
SCP	Spill Contingency Plan
SDB	Small Diameter Bomb
SDWA	Safe Drinking Water Act
SEAC	Submarine Exercise Area Coordinator
SEAD	Suppression of Enemy Air Defenses
SEASWITI	Southeast Anti-Submarine Integration Training Initiative
SEIS	Supplemental Environmental Impact Statement
SEL	Sound Exposure Level
SEPTAR	Seaborne Powered Target
SESEF	Shipboard Electronic Systems Evaluation Facility
SFH	Strong Flex Hose
SHPO	State Historic Preservation Office
SiO_2	Silicon Dioxide
SINKEX	Sinking Exercise
SIP	State Implentation Plan
SLA	Submerged Lands Act
SLAMS	State and Local Air Monitoring Site
SMCA	Sunken Military Craft Act
SMCMEX	Mine Countermeasures - Surface
SME	Subject Matter Expert
SO_x	Sulfur Oxides
SOF	Special Operations Forces
SOP	Standard Operating Procedure
SOCAL	Southern California
SPL	sound pressure level
SRI	Santa Rosa Island
S-S	Surface-to-Surface
SSC	Stennis Space Center
SSG	Surface Strike Group
SSN	Nuclear Submarine
SST	Sea Surface Temperature
STW	Strike Warfare
SUA	Special Use Airspace
SUBOA	Submarine Operating Area
SUBOPAUTH	Submarine Operating Authority
SURTASS	Surveillance Towed Array Sensor System
SUW	Surface Warfare
SW	Swamp waters
SWAP	Severe Weather Avoidance Plan
SWSS	Sperm Whale Seismic Survey
T&R	Training & Readiness
T&E	Testing & Evaluation
TA	Test Area
TACAN	Tactical Air Navigation
TALD	Tactical Air-Launched Decoy
TAMU	Texas A&M University
TAP	Tactical Training Theater Assessment and Planning
TACTS	Tactical Air Combat Training System
TCTS	Tactical Combat Training System
TDS	Total Dissolved Solids
TED	Turtle-Excluder Device
TGLO	Texas General Land Office
TL	Transmission Loss
TLAM	Tactical Land Attack Missile
TMDL	total maximum daily load
TNT	trinitrotoluene
TORPEX	Torpedo Exercise
TR	Trout waters
TRACKEX	Tracking Exercise
TRAWING	Training Air Wing
TSP	total suspended particulates
TSPI	Time, Space, and Position Information
TTS	Temporary Threshold Shift
UAM-V	Variable Grid Urban Airshed Model
UAV	Unmanned Aerial Vehicle
UCAV	Unmanned Combat Air Vehicle
UJTL	Universal Joint Task List
ULT	Unit Level Training
UN	United Nations
UNDET	Underwater Detonation
UNDS	Uniform National Discharge Standards
U.S.	United States
USACE	United States Army Corp of Engineers
USAF	United States Air Force
USCOE	United States Corp of Engineers
USDOI	United States Department of the Interior
U.S.C.	United States Code
USCB	United States Census Bureau

USCG	United States Coast Guard
USCOP	United States Commission on Ocean Policy
USE	Uncommon Stranding Event
USEPA	U.S. Environmental Protection Agency
USFF	United States Fleet Forces
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
USVI	U.S. Virgin Islands
USWTR	Undersea Warfare Training Range
UUV	Unmanned Underwater Vehicle
VACAPES	Virginia Capes
VAST	Virtual At-Sea Training
VDH	Virginia Department of Health
VEM	Versatile Exercise Mine System
VERC	Virginia Emergency Response Council
VFR	Visual Flight Rules
VLA	vertical launch anti-submarine rocket
VOC	Volatile Organic Compound
V/STOL	Vertical/Short Take-Off and Landing
WMA	Water Management Administration
WFF	Wallops Flight Facility
WISS	Weapons Impact Scoring System
WQIP	Water Quality Infrastructure Program
WQMIRA	Water Quality Monitoring, Information, and Restoration Act
WQS	Water Quality Standards
WR	War Reserve
WSEP	Weapons Systems Evaluation Program
XBT	expendable bathythermograph
XO	Executive Officer

EXECUTIVE SUMMARY

The United States (U.S.) Department of the Navy (DoN, Navy) has prepared this Final Environmental Impact Statement (FEIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts over a 10-year planning horizon associated with Navy; training, research, development, testing, and evaluation (RDT&E) activities, and associated range capabilities enhancements in the Gulf of Mexico offshore operating areas (OPAREAs), inland ranges and associated air space, hereafter referred to as the Gulf of Mexico (GOMEX) Range Complex. The GOMEX Range Complex (Figure ES-1) geographically encompasses offshore, near-shore, and onshore OPAREAs, ranges, and special use airspace (SUA).

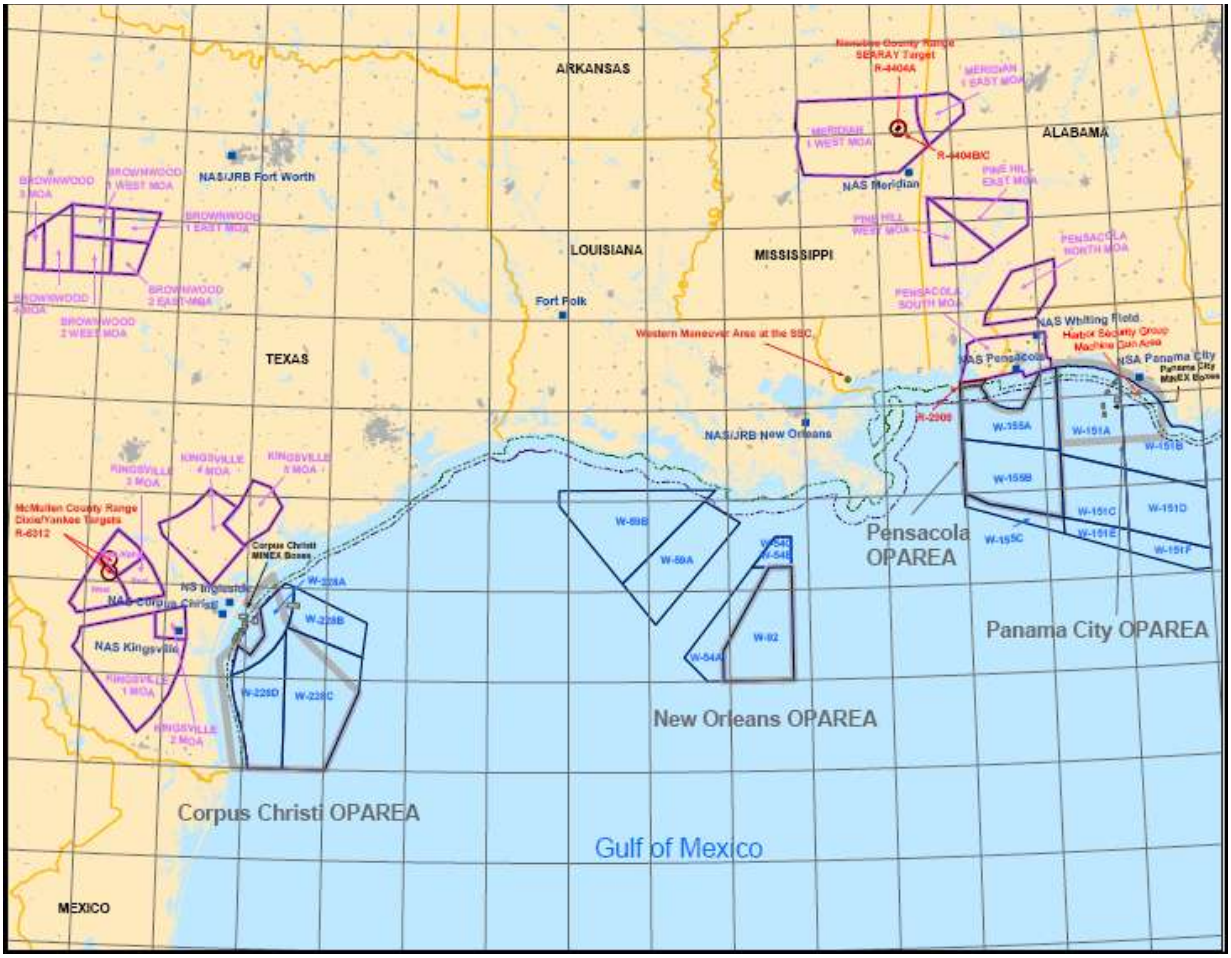

Figure ES-1: Gulf of Mexico Range Complex

The GOMEX Range Complex includes 17,440 square nautical miles (nm^2) of offshore surface and subsurface OPAREA and 12,072 nm^2 of shallow ocean area less than 100 fathoms (600 feet [ft]) deep. These offshore OPAREAs include overlying SUA called warning areas. The GOMEX Range Complex also contains 19.8 mi^2 of land area, comprised of two land targets (i.e., McMullen County Range and Noxubee County Range). These land ranges have associated restricted airspace. In addition to the land

ranges, the Range Complex includes several high altitude overland airspace areas called Military Operating Areas (MOAs). Finally, the Range Complex includes several other training areas, including the Naval Support Activity (NSA) Panama City Demolition Pond and the Western Maneuver Area at the Stennis Space Center (SSC). The geographic scope (or "Study Area") for this Final EIS/OEIS includes the airspace; seaspace; and undersea space of the GOMEX Range Complex, as described above, including the area from the mean high tide line, up to and extending seaward from the near-shore boundary of the OPAREAs. Environmental planning for the Western Maneuver Area at the SSC was recently completed. Therefore, that area is not included in the Study Area and its documentation is incorporated by reference into this Final EIS/OEIS.

This Final EIS/OEIS has been prepared by the Navy in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] § 4321); the Council of Environmental Quality (CEQ) Regulations for implementing the procedural provisions of NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500-1508); Department of the Navy Procedures for Implementing NEPA (32 CFR 775); Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*; and Department of Defense (DoD) regulations implementing EO 12114 (32 CFR Part 187). The proposed action requires analysis of potential impacts within and outside U.S. Territory; therefore, this document was written to satisfy the requirements of both NEPA and EO 12114. The Navy has made changes to this Final EIS/OEIS based on comments received during the public comment period. These changes included factual corrections, additions to existing information, and improvements or modifications to the analyses presented in the Draft EIS/OEIS. None of the changes between the Draft and Final EIS/OEIS resulted in substantive changes to the proposed action, alternatives, or the significance of the environmental consequences of the proposed action. Additional revisions in this Final EIS/OEIS amplify information previously provided, including a more detailed description of Maritime Security Operations and more detailed Weapon System data sheets located in Appendix E.

In accordance with 50 CFR §402.14 the Navy has prepared a separate Biological Evaluation to assess the potential effects from the proposed action on marine resources and anadromous fish (fish that live in the ocean but breed in freshwater rivers and streams) protected by the National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA). NMFS signed the Programmatic Biological and Conference Opinions on 22 November 2010 (Appendix C). In accordance with the Marine Mammal Protection Act (MMPA) (16 U.S.C. §1371[a][5]), the Navy has submitted a request for Letter of Authorization to the NMFS for the incidental taking of marine mammals by the proposed action (Appendix C). The Navy has prepared a separate Consultation Package in accordance with legal requirements set forth under regulations implementing Section 7 of the ESA (50 CFR 402; 16 U.S.C 1536 (c)) for listed species under jurisdiction of the U.S. Fish and Wildlife Service (USFWS). USFWS concurred with the Navy's conclusions in a letter dated March 9, 2009 (Appendix C) that the proposed action for increased training operations and enhanced capabilities would have no effect or is not likely to adversely affect the federally-listed species under USFWS jurisdiction. The Record of Decision for this Final EIS/OEIS will address any additional mitigation measures which may result from these ongoing regulatory processes.

A separate EIS/OEIS was prepared by the DoN to evaluate the effects associated with the littoral and expeditionary warfare activities proposed for the Naval Surface Warfare Center Panama City Division (NSWC PCD), Florida Study Area, which includes St. Andrew Bay (SAB) and Warning Areas W-151, W-155, and W-470. Warning Areas 151 and 155 are also part of the GOMEX Range Complex Study Area. The NSWC PCD EIS/OEIS (ROD signed 15 Jan 2010; *Federal Register* Volume 175, Number 15) is separate and distinct from the GOMEX Range Complex EIS/OEIS because those activities are conducted by a separate organization within the DoN. Effects associated with the activities on NSWC PCD are addressed in the cumulative impacts analysis of this Final EIS/OEIS.

ES 1.0 Purpose and Need

The purpose for the proposed action is to:

- Achieve and maintain Fleet readiness using the GOMEX Range Complex to support and conduct current, emerging, and future training operations and RDT&E operations to support the requirements of the Fleet Response Training Plan (FRTP);
- Expand warfare missions supported by the GOMEX Range Complex; and
- Upgrade and modernize existing range capabilities to enhance and sustain Navy training and RDT&E.

The need for the proposed action is to provide range capabilities for training and equipping combat-capable naval forces ready to deploy worldwide. In this regard, the GOMEX Range Complex furthers the Navy's execution of its Congressionally-mandated roles and responsibilities under Title 10 U.S.C §5062. For further information on the purpose and need for the proposed action refer to Chapter 1 of the Final EIS/OEIS.

ES 2.0 Description of Proposed Action and Alternatives

The Navy has identified the need to support and conduct current and emerging training and RDT&E operations in the GOMEX Range Complex. The proposed action does not indicate major changes to GOMEX Range Complex facilities, operations, training, or RDT&E capacities over the 10-year planning period. Rather, the proposed action would result in relatively small-scale but critical enhancements to the GOMEX Range Complex that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission.

ES 2.1 Proposed Action

The proposed action is to support and conduct current and emerging training and RDT&E operations in the GOMEX Range Complex. To achieve this, the Navy proposes to:

- Maintain training and RDT&E operations at current levels if the No Action Alternative is selected.

If either Alternative 1 or 2 is selected, then:

- Increase or modify training and RDT&E operations from current level as necessary.
- Implement enhanced range complex capabilities.

The decision-maker for this Final EIS/OEIS will decide both the level and mix of training and testing, and range capability enhancements, that best meet Navy requirements within the GOMEX Range Complex. The following sections discuss the alternatives with respect to the components that make up the proposed action.

ES 2.2 Alternatives

Alternatives in this Final EIS/OEIS were evaluated to ensure they met the purpose and need, giving due consideration to range complex attributes such as: the capability to support current and emerging Fleet tactical training and RDT&E requirements; the capability to support realistic, essential training at the level and frequency sufficient to support the FRTP; and the capability to support training requirements while following Navy Personnel Tempo of Operations guidelines. Three alternatives are analyzed in this Final EIS/OEIS:

1. The No Action Alternative – Under the No Action Alternative, training operations, vessel movements, and major range events would continue at current levels. Evaluation of the No-

Action Alternative provides a credible baseline for assessing environmental impacts of Alternative 1 and Alternative 2 (Preferred Alternative).

2. Alternative 1 – No Action Alternative plus: elimination of Mine Warfare training; certain adjustments to training levels as shown in Tables 2.2-4 through 2.2-6; and implementation of enhancements, as necessary to meet the components of the proposed action. This alternative is composed of all operations currently conducted – the No Action Alternative – with modifications to current training or introduction of new training. Specifically, the training modifications would include:
    a. conducting new unit level training associated with Strike Fighter Squadron VFA-204 air-to-surface bomb training; and
    b. elimination of mine warfare training (mine countermeasures and mine neutralization) within the GOMEX Range Complex. The proposed range enhancements under Alternative 1 are to use more commercial aircraft to serve as oppositional forces rather than using Navy aircraft for Air Intercept Control Exercises; and
3. Alternative 2 (Preferred Alternative) – Alternative 1 plus: implementation of additional enhancements to enable the Navy to meet foreseeable needs, including implementation of the Joint National Training Capability (JNTC) within the GOMEX Range Complex. Unlike Alternative 1, under Alternative 2, the Navy proposes to eliminate the use of High Explosive (HE) bombs during major exercise air-to-surface bombing events. Non-explosive Practice Munition (NEPM) bombs will continue to be used during major exercises. During one unit level training event, four HE bombs would be used under Alternative 2.

With the elimination of Mine Warfare training and the reduction of the number of HE bombs used during major BOMBEXes, Alternative 2 best meets the Navy's purpose and need; thus, it is the Preferred Alternative. In addition, Alternative 2 would reduce environmental impacts. For detailed information on each alternative refer to Chapter 2 of the Final EIS/OEIS.

ES 2.3 Alternatives Considered but Eliminated from Further Analysis

Other approaches that were considered but eliminated because they did not meet the purpose and need included:

- No training alternative;
- Using alternative range complex locations;
- Conducting simulated training only; and
- Only using practice ammunition or what is called non-explosive practice munitions (NEPM) within the GOMEX Range Complex.

These were eliminated from further analysis, because none would be effective in putting into practice the FRTP. Specifically:

- If the Navy did not conduct training exercises along the East Coast and Gulf of Mexico, it would not be able to meet its obligations, as identified in Title 10 United States Code, Section 5062.
- The GOMEX Range Complex is an important component in the available suite of Navy training and testing capabilities. The proximity of the GOMEX Range Complex to existing naval installations produces important advantages relating to features such as travel times, costs of operations, and personnel tempo of operations that could not be achieved at any other range complex.

- Although simulated training and practice ammunition are widely used, including in many Navy operations, they are no substitute for realistic field conditions. The experience of live training provided by actually operating a combat system or handling explosive ammunition cannot be replicated through simulation, particularly as it relates to the physical reaction invoked by the danger, noise, and visual effects associated with these systems. Similarly, individuals and groups must be able to practice and hone their skills in communication, maneuvering, operating systems, repairing equipment, and firing weapons in an environment that is realistic and that replicates the high energy and stress of what they would encounter in an actual combat situation.

ES 3.0 Public Involvement

NEPA requires federal agencies to prepare an EIS for proposed actions that may significantly affect the quality of the human and natural environments. The EIS must disclose significant environmental impacts and inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. The Navy is the lead agency for the proposed action. The NMFS is a cooperating agency for this Final EIS/OEIS.

A notice of intent to develop the Draft EIS/OEIS was published in the Federal Register on August 31, 2007, and in five local newspapers. The newspaper notices were run five times in each newspaper. Four scoping meetings were held (Panama City and Pensacola, FL, New Orleans, LA, and Corpus Christi, TX) for the public to help define and prioritize issues and convey these issues to the agencies through both oral and written comments.

During the scoping process, public comments included requests for: (i) the DEIS/OEIS when available; (ii) evaluation of potential impacts to commercial shipping; (iii) evaluation of potential impacts to the tourism industry; (iv) evaluation of potential impacts to marine mammals and essential fish habitat; (v) evaluation of potential impacts to the coastal zones; and (vi) evaluation of potential impacts to submerged cultural resources. This Final EIS/OEIS addresses all comments received.

The Draft EIS/OEIS was provided to the U.S. Environmental Protection Agency for review and comment in accordance with its responsibilities and notice of availability of USEPA comments was published in the *Federal Register* (Vol 74, No. 1, January 2, 2009). The Navy also placed notices in local newspapers announcing the availability of the Draft EIS/OEIS and public hearings. The Draft EIS/OEIS was circulated for internal/agency review and made available for general review in public libraries. Public hearings were held in Panama City and Pensacola, FL, New Orleans, LA, and Corpus Christi, TX 2-6 February 2009. Public and agency comments were received via the GOMEX web site, facsimile, and regular mail. The public comment period for the Draft EIS/OEIS ended on 16 February 2009. Ten letters from agencies and the public containing 18 comments were received. This Final EIS/OEIS incorporates, and formally responds to, all public comments received on the Draft EIS/OEIS. Responses took the form of corrections of data inaccuracies, clarifications of and modifications to analytical approaches, inclusion of additional data or analyses, and modification of the proposed action or alternatives. Public and agency comments and Navy responses are located in Appendix F.

ES 4.0 Comparison of Alternatives and Effects

The comparison of alternatives presented in Table ES-1 is based on the information and analyses presented in Chapter 3 (Affected Environment and Environmental Consequences). The environmental stressors associated with each warfare area and operations were evaluated for each resource or issue in assessing potential environmental impacts under each alternative. There were no recordable differences in potential impacts between the alternatives for the following resources and issues:

- Hazardous Materials and Hazardous Waste;
- Water Resources;
- Air Quality;
- Airborne Noise;
- Land Use;
- Cultural Resources;
- Transportation;
- Demographics;
- Regional Economy;
- Recreation;
- Environmental Justice;
- Public Health and Safety

The potential impacts would generally be temporary, short-term, minor, and/or localized changes to these resources or issues. As defined under NEPA, no significant impacts in U.S. Territorial Seas and no significant harm in Non-Territorial Waters to resources or issues were identified considering implementation of mitigation measures described in Chapter 5. In addition, resources were evaluated in accordance with Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (Eagle Act), Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), and the National Historic Preservation Act (NHPA). As a result of reduction of high explosive BOMBEXs by 92 percent in Alternative 2 and the cessation of Mine Warfare training, there is a substantial decrease in the number of marine mammals and sea turtles potentially impacted compared to the No Action Alternative. The potential impacts presented in Table ES-1 form the basis for providing choices to the decision maker.

The Atlantic Fleet Active Sonar Training (AFAST) Final EIS/OEIS is incorporated by reference in this Final EIS/OEIS for active sonar and Anti-Submarine Warfare associated activities as they pertain to the GOMEX Range Complex. The reader should refer to the AFAST Final EIS/OEIS (available at http://afasteis.gcsaic.com) for the full description and analysis of active sonar activities along the East Coast and within the Gulf of Mexico. The AFAST Final EIS/OEIS Record of Decision (74 FR 5650) was signed on January 23, 2009. A summary of the environmental consequences due to sonar activities in the GOMEX Range Complex is provided by resource area in Section 3.20.

TABLE ES-1
COMPARISON OF ALTERNATIVES AND EFFECTS

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Bathymetry, sediments, and soil	Localized disturbance of soft bottom benthic habitats from underwater detonations. Long-term minor impacts to benthic habitats from strikes and accumulation of Non-explosive Practice Munitions (NEPM) (Section 3.1.3.1).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. Slight increase in potential impacts to benthic habitats from strikes and accumulation of NEPM (Section 3.1.3.2).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. An increase in potential impacts to benthic habitat from strikes and accumulation of NEPM (Section 3.1.3.3).
Marine Communities	Localized disturbance of soft bottom benthic habitats from underwater detonations. Long-term minor impacts to benthic habitats from strikes and accumulation of Non-explosive Practice Munitions (NEPM) (Section 3.6.3.1).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. Slight increase in potential impacts to benthic habitats from strikes and accumulation of NEPM (Section 3.6.3.2).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. An increase in potential impacts to benthic habitat from strikes and accumulation of NEPM (Section 3.6.3.3).

TABLE ES-1
COMPARISON OF ALTERNATIVES AND EFFECTS (Continued)

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Marine Mammals	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 760 non-injurious potential exposures, and 31 injurious exposures. Under ESA, proposed activities may affect listed whale species and the West Indian manatee (Section 3.7.3.3).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 2,103 non-injurious potential exposures, and 70 injurious potential exposures. Under ESA, proposed activities may affect listed whale species and the West Indian manatee (Section 3.7.3.4).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposure, 92 non-injurious potential exposures, and 2 injurious potential exposures. Under ESA, proposed activities may affect listed whale species and the West Indian manatee. The Navy has submitted to NMFS a Request for a Letter of Authorization under MMPA and has initiated the ESA Section 7 formal consultation process with NMFS for listed whales. NMFS concluded ESA Section 7 formal consultation with Navy (Appendix C) for listed and proposed whales. The Navy completed consultation with USFWS for the West Indian manatee (Section 3.7.3.5).
Sea Turtles	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 16 non-injurious exposures, and 0 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.2).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 39 non-injurious exposures, and 2 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.3).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, no non-injurious exposures, and 0 injurious exposures. Under ESA, proposed activities may affect listed species. NMFS concluded ESA Section 7 formal consultation with Navy (Appendix C) for listed and proposed sea turtles. (Section 3.8.3.4).

TABLE ES-1
COMPARISON OF ALTERNATIVES AND EFFECTS (Continued)

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Fish	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level effects. Under ESA, proposed activities may affect listed species Section (3.9.3.1).	Fish would no longer be affected by Mine Neutralization underwater detonations because these exercises would no longer occur. Fish affected by HE BOMBEX would increase because the number of HE bombs dropped would increase. No population-level effects. Under ESA, proposed activities may affect listed species Section (3.9.3.2).	Fish would no longer be affected by Mine Neutralization underwater detonations because these exercises would no longer occur. The number of fish affected by HE BOMBEX would decrease because the number of HE bombs dropped would decrease. No population-level effects. Under ESA, proposed activities may affect listed species Section (3.9.3.1). NMFS concluded ESA Section 7 formal consultation with Navy (Appendix C) for listed and proposed fish (Section 3.9.3.3)
Essential Fish Habitat (EFH)	No adverse affect to EFH. Any impacts associated with NEPM strikes would be minimal based on the small area affected. Other impacts would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Therefore, EFH consultation with NMFS is not required. (Section 3.9.3.1)	No adverse affect to EFH. Any impacts associated with NEPM strikes would be minimal based on the small area affected. Other impacts would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Therefore, EFH consultation with NMFS is not required. (Section 3.9.3.2)	No adverse affect to EFH. The area of benthic EFH potentially affected by NEPM strikes would increase, but the impacts would be minimal based on the small area affected. Other impacts would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Therefore, EFH consultation with NMFS is not required. (Section 3.9.3.3)

TABLE ES-1
COMPARISON OF ALTERNATIVES AND EFFECTS (Continued)

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Seabirds and Migratory Birds	Under ESA, vessel movements, aircraft overflights, and underwater detonations may affect brown pelicans. Under MBTA, no long-term population-level effect would occur to migratory bird populations (Section 3.10.3.1).	Under ESA, vessel movements, aircraft overflights, and underwater detonations may affect brown pelicans. Under MBTA, no long-term population-level effect would occur to migratory bird populations (Section 3.10.3.2).	Under ESA, vessel movements, aircraft overflights, and underwater detonations may affect brown pelicans. Under MBTA, no long-term population-level effect would occur to migratory bird populations. Substantial decrease in potential impacts compared to No Action and Alternative 1 due to decrease in HE bomb use in non-territorial waters. The Navy completed consultation with the USFWS regarding its determination of effect for Alternative 2 and the brown pelican (Section 3.10.3.3).
Terrestrial Biological Resources	Under ESA, proposed activities may affect listed species. Under MBTA, no long-term population-level effect would occur to migratory bird populations. No significant impact on vegetation or wetlands would be expected. (Section 3.11.3.1)	Under ESA, proposed activities may affect listed species. Under MBTA, no long-term population-level effect would occur to migratory bird populations. No significant impact on vegetation or wetlands would be expected. (Section 3.11.3.2)	Under ESA, proposed activities may affect listed species. Under MBTA, no long-term population-level effect would occur to migratory bird populations. No significant impact on vegetation or wetlands would be expected.
Terrestrial Biological Resources (Cont)			The Navy completed consultation with the USFWS regarding its determinations of effect for Alternative 2 and terrestrial species. (Section 3.11.3.3)
Atlantic Fleet Active Sonar Training (AFAST)	Potential impacts to resources or issues from AFAST and the proposed action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the proposed action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the proposed action combined are less than significant. (Section 3.20)

ES 5.0 Mitigation and Monitoring

The Navy recognizes that the proposed action has the potential to impact marine and other resources in the vicinity of training. Chapter 5 describes the Navy's overall mitigation and monitoring approach as well as specific mitigation measures that would be implemented to protect marine mammals, sea turtles, and other resources during training activities. Some of these measures are generally applicable and others are designed to apply to certain geographic areas and/or for specific types of Navy training.

The Navy believes that a comprehensive approach to mitigation for the GOMEX Range Complex requires focus on: (1) mitigation by avoidance, in which adverse impacts are avoided altogether by altering the location, design, or other aspect of an activity, and (2) minimization of impacts when avoidance is not feasible. An important complement to the avoidance and minimization of impacts is monitoring to track compliance with take authorizations, impacts on protected resources, and effectiveness of mitigation measures. Taken together, these three elements – avoidance, minimization, and monitoring comprise the Navy's integrated approach to addressing potential environmental impacts.

The Navy is committed to demonstrating environmental stewardship while executing its National Defense Mission and is responsible for compliance with a suite of Federal environmental and natural resources laws and regulations that apply to a wide variety of environments. Consistent with the cooperating agency agreement with NMFS, mitigation and monitoring measures presented in this Final EIS/OEIS focus on the requirements for protection and management of marine resources.

Between 2004 and 2008, the Navy provided over $94 million to universities, research institutions, federal laboratories, private companies, and independent researchers around the world for marine life research. The Navy continues funding a significant amount of marine research directly applicable to its training activities. The Navy spent nearly $22 million for continued marine mammal research in FY09. Major topics of Navy-supported research include the following:

- Better understanding of marine species distribution and important habitat areas;
- Developing methods to detect and monitor marine species before and during training;
- Understanding the effects of sound on marine mammals, sea turtles, fish, and birds; and
- Developing tools to model and estimate potential effects of sound.

This research is directly applicable to Atlantic Fleet training activities, particularly with respect to the investigations of the potential effects of underwater noise sources on marine mammals and other protected species. Additional details can be found in Section 5.4.

ES 6.0 Cumulative Impacts

The Navy's past experience in preparing cumulative impacts analyses under NEPA was used in this section of the Final EIS/OEIS. The proposed action will not make radical changes to the GOMEX Range Complex facilities, operations, training, or RDT&E capacities. Rather, the actions proposed in Alternative 1 and 2 are incremental adjustments to the no action alternative that would result in relatively small-scale, but critical, enhancements that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission.

Various types of past and present actions not related to the proposed action have the potential to impact the resources evaluated in this Final EIS/OEIS. Over two dozen activities including, but not limited to, military activities adjacent to the GOMEX OPAREAs, offshore oil and gas activities, maritime traffic, scientific research, and marine ecotourism were analyzed for direct, indirect, and cumulative effects. The environmental consequences conclusions and incremental contribution and cumulative impacts from past, present, and reasonably foreseeable future projects and activities for each resource evaluated in this Final EIS/OEIS were used for summarizing direct, indirect, and cumulative impacts. Most of the summary conclusions on past, present, and reasonably foreseeable future actions for the resources evaluated indicated no adverse impacts and potential for minor, but recoverable, adverse impacts. Fewer summary conclusions indicated potential for moderate, but recoverable, adverse impacts. No summary conclusions showed potential for major, non-recoverable, adverse impacts (Table ES-2).

TABLE ES-2
SUMMARY OF CUMULATIVE IMPACTS BY RESOURCE AREA

		Bathymetry/Sediments	Hazardous Waste/Materials	Water Resources	Air Quality	Noise Environment	Marine Communities	Marine Mammals	Sea Turtles	Fish	Seabirds/Migratory Birds	Biological Resources at McMullen and Noxubee Co Ranges	Land Use	Cultural Resources	Transportation	Demographics	Regional Economy	Recreation	Environmental Justice	Public Health and Safety
Past and Present Actions	Military Training Activity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	*
	MMS: Oil and Gas	**	*	**	**	*	*	**	**	*	NE	**	NE	*	NE	NE	NE	NE	NE	NE
	State Oil and Gas	**	*	**	**	*	*	**	**	*	NE	**	NE	*	NE	NE	*	*	NE	NE
	Dredging	**	**	**	**	*	**	NE	**	**	NE	NE	NE	*	NE	NE	NE	NE	NE	NE
	Commercial and Recreational Fishing	*	**	NE	NE	*	**	**	***	**	NE	**	NE	*	NE	NE	NE	NE	NE	NE
	Maritime Traffic	*	*	*	NE	*	NE	**	*	NE	NE	NE	NE	*	*	NE	*	*	NE	NE
	Scientific Research	NE	*	NE	NE	NE	*	*	*	*	NE	*	NE	NE	NE	NE	NE	NE	NE	NE
	Military Expended Materials	---	---	*	NE	NE	**	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Environmental Contamination and Biotoxins	---	---	**	NE	NE	**	**	**	**	**	**	NE	NE	NE	NE	NE	NE	NE	NE
	Marine Ecotourism	NE	*	*	NE	*	NE	*	*	NE	NE	NE	NE	NE	NE	NE	*	*	NE	NE
Future Actions	Military Training Activity	*	*	*	*	*	*	*	*	*	*	*	NE	*	NE	NE	NE	NE	NE	*
	MMS	NE	*	NE	NE	*	NE	NE	NE	NE	*	NE	NE	NE	NE	*	NE	NE	NE	NE
	USCOE	**	**	**	*	*	**	**	**	**	**	**	**	*	NE	NE	NE	NE	NE	NE
	Offshore LNG	*	NE	*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
GOMEX Proposed Action		*	*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	NE	*	NE	NE
Cumulative Impacts		*	*	*	*	*	*	**	**	*	*	*	NE	*	*	NE	NE	*	NE	NE

NE= No Adverse Impacts; *=Potential for minor, but recoverable, adverse impacts; **=Potential for moderate, but recoverable, adverse impacts
***=Potential for major, non-recoverable, adverse impacts; --- = not applicable
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CHAPTER 1 PURPOSE AND NEED FOR PROPOSED ACTION

1.1 INTRODUCTION

The United States (U.S.) Department of the Navy (DoN, Navy) has prepared this Final Environmental Impact Statement (FEIS) / Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with Navy Atlantic Fleet and Chief of Naval Education and Training, Navy research, development, testing, and evaluation (RDT&E) activities, and associated range capabilities enhancements in the Gulf of Mexico (GOMEX) Range Complex. The Navy's mission is to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. Title 10 United States Code (U.S.C.) Section 5062 directs the Chief of Naval Operations to train all naval forces for combat. The Chief of Naval Operations meets that direction, in part, by conducting at-sea training and exercises, and by ensuring that naval forces have access to ranges, operating areas (OPAREA), and airspace where the Navy can develop and maintain skills for wartime missions and conduct RDT&E of naval weapons systems. For purposes of this Final EIS/OEIS, exercises and training do not include combat operations, operations in direct support of combat, the RDT&E activities described and analyzed within the Panama City EIS, or other activities conducted primarily for purposes other than training (ex., humanitarian assistance following hurricanes).

Generally, the proposed action is to support and conduct current and emerging training and RDT&E operations in the GOMEX Range Complex. The decision-maker is to determine both the level and mix of training to be conducted and the range capabilities enhancements to be made within the GOMEX Range Complex that best meet the needs of the Navy.

The focus of this Final EIS/OEIS is the GOMEX Range Complex as depicted in Figure 1.1-1. This Complex consists of targets and instrumented areas, airspace, oceanic (surface and subsurface) OPAREAs, and inland range facilities. The Range Complex does not include base installations and facilities such as Outlying Landing Facilities (OLF). The activities analyzed in this Final EIS/OEIS include current, emerging, and future proposed Navy training and RDT&E operations within Navy-controlled OPAREAs, airspace, and land ranges, and Navy-funded range capabilities enhancements (including infrastructure improvements). The actual study area is further defined in Section 1.5. An EIS/OEIS was prepared by the DoN to evaluate the effects associated with the littoral and expeditionary warfare activities proposed for the Naval Sea Warfare Center, Panama City Division (NSWC PCD) Study Area, which includes St. Andrew Bay (SAB) and Warning Areas W-151, W-155, and W-470. Warning Areas 151 and 155 are also part of the GOMEX Range Complex Study Area. The NSWC PCD EIS/OEIS is separate and distinct from the GOMEX Range Complex EIS/OEIS because those activities are conducted by a separate organization within the DoN. Effects associated with the activities on NSWC PCD are addressed in the cumulative impacts analysis of this Final EIS/OEIS.

United States Fleet Forces (USFF) prepared a separate EIS/OEIS for Atlantic Fleet Active Sonar Training (AFAST) activities along the U.S. East Coast and Gulf of Mexico (including the GOMEX Range Complex) that evaluated the potential impacts of active sonar training on the marine environment. The Final AFAST EIS/OEIS Record of Decision (74 FR 5650) was signed on January 23, 2009. Figure 1.1-2 illustrates the AFAST Study Area as it encompasses the East Coast and GOMEX Range Complexes. The analysis in this Final EIS/OEIS for active sonar and anti-submarine warfare associated activities, as they pertain to the GOMEX Range Complex, is taken from the Final AFAST EIS/OEIS and is incorporated into Chapter 3 (Section 3.20) of this document to assess the impact of the proposed action and other past, present, and reasonably foreseeable actions.

This Final EIS/OEIS has been prepared by the Navy in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. Section 4321 *et seq*.); the Council of Environmental Quality

(CEQ) Regulations for implementing the procedural provisions of NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500-1508); Department of the Navy Procedures for Implementing NEPA (32 CFR 775); Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*; and Department of Defense (DoD) regulations implementing EO 12114 (32 CFR Part 187). The provisions of NEPA apply to major federal actions with effects that occur within U.S. Territory while EO 12114 applies to major federal actions with effects that occur outside of U.S. Territory, including marine waters seaward of U.S. territorial seas -- greater than 12 nautical miles (nm) offshore. Navy policy states that the DoN will comply with NEPA for proposed actions within 12 nm of the U.S (DoN, 2000). The proposed action presented in this Final EIS/OEIS requires analysis of potential impacts within and outside U.S. Territory; therefore, this document is written to satisfy the requirements of both NEPA and EO 12114.

1.2 BACKGROUND

The Navy has been training in the area now defined as the GOMEX Range Complex, with systems similar to those employed today, for national defense purposes for over 70 years. The land, air, sea space, and subsurface space of the Complex has and continues to provide a safe and realistic training and testing environment to ensure military personnel are ready to carry out assigned missions in furtherance of its Congressionally mandated duty. The GOMEX Range Complex provides the infrastructure and proximity that allows for all levels of training and the efficient use of resources.

1.2.1 Navy Training

1.2.1.1 Navy Operations

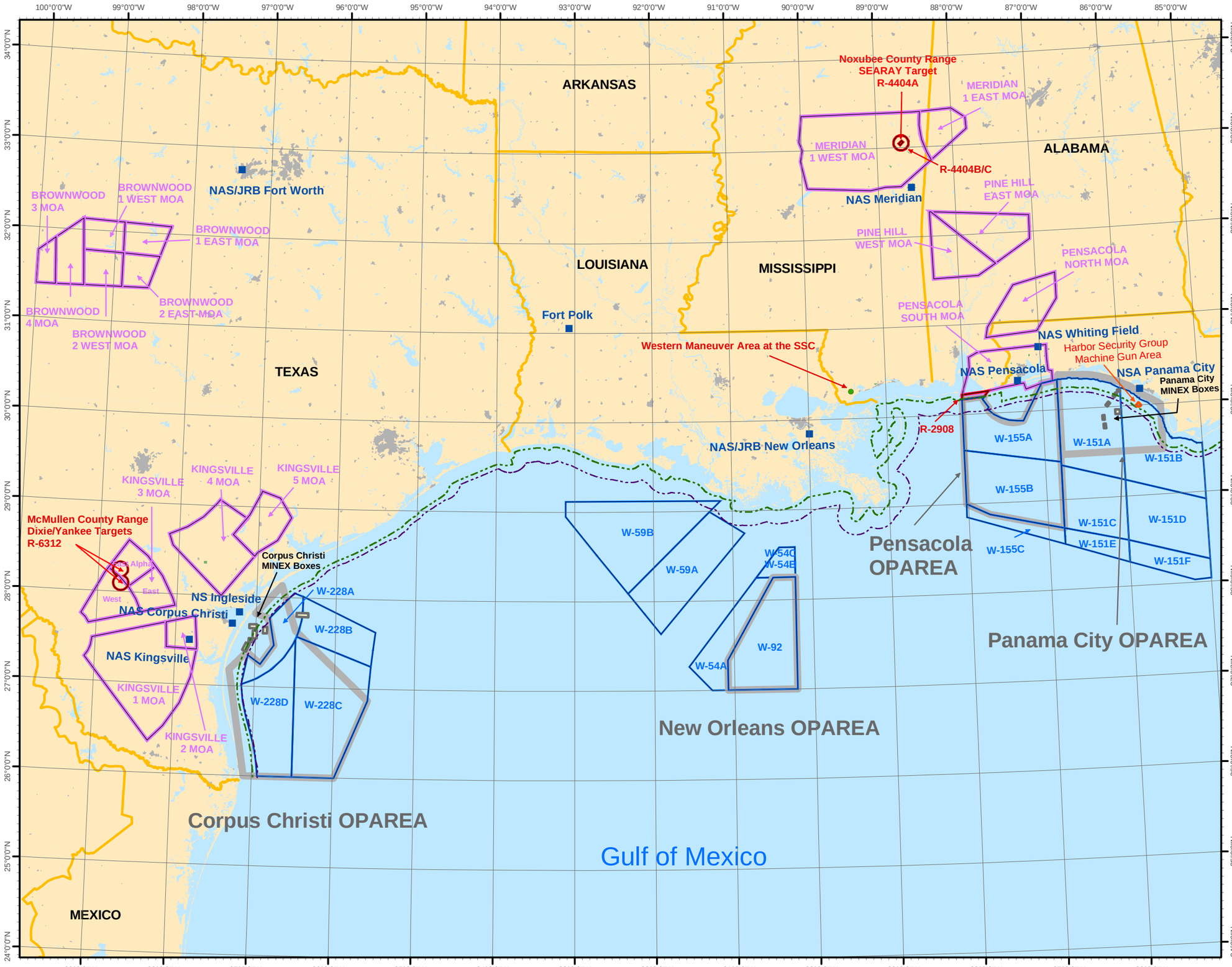
The United States maintains its military forces to ensure the freedom and safety of all Americans, both at home and abroad. The Preamble of the U.S. Constitution established the principle that the people of the United States will provide for the common defense. Article 1, Section 8 states, “The Congress shall have power to provide for the common defense…provide and maintain a Navy,” and “to make rules for the government and regulation of the land and naval forces.” To implement these constitutionally mandated duties, Congress provided Title 10 U.S.C., Section 5062, which states: “The Navy shall be organized, trained and equipped primarily for prompt and sustained combat incident to operations at sea.”

The Navy and Marine Corps generally organize deployed forces into strike groups. The number and composition of individual units comprising a strike group is tailored to meet specific missions and expected threats. A Carrier Strike Group (CSG), consisting of an aircraft carrier and its embarked airwing, plus several surface combatant ships and submarines, can project power ashore primarily via aircraft or missiles. An Expeditionary Strike Group (ESG)[1], consisting of amphibious ships, surface

[1] In mid-2009, the U.S. Navy and U.S. Marine Corps re-established the use of the terminology "Amphibious Ready Group/Marine Expeditionary Unit (ARG/MEU)" to describe the naval amphibious forces that train and deploy on a rotational basis. An ARG/MEU consists of an Amphibious Squadron (PHIBRON) with the following naval surface ships (1 LHA/D, 1 LPD, and 1 LSD), and embarked naval support elements and MEU which may train and/or deploy with other naval surface ships or submarines. When a ARG/MEU is led by a flag or general officer it is referred to as an Expeditionary Strike Group (ESG). For the purpose of the GOMEX FEIS/OEIS, the document will refer to naval amphibious forces that train and deploy on a rotational basis as ESGs.

GOMEX Range Complex

Figure 1.1-1

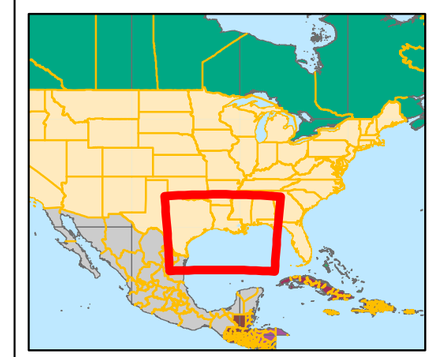


Legend

- State Seaward Extent
  - *TX & FL 9 nm; AL, MS & LA 3 nm*
- 12 nm Territorial Limit

Special Use Airspace

- Military Operating Areas (MOA)
- Restricted Airspace (R-)
- Warning Areas (W)
- Operating Areas (OPAREA)



N

1:4,586,240

25 12.5 0 25 50 75 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 15 (Meters)

Sources:
National Geospatial Intelligence Agency (NGA) Database;
Special Use Airspace Document AP/1A;
COMLANTFLT 3120.26E Document.

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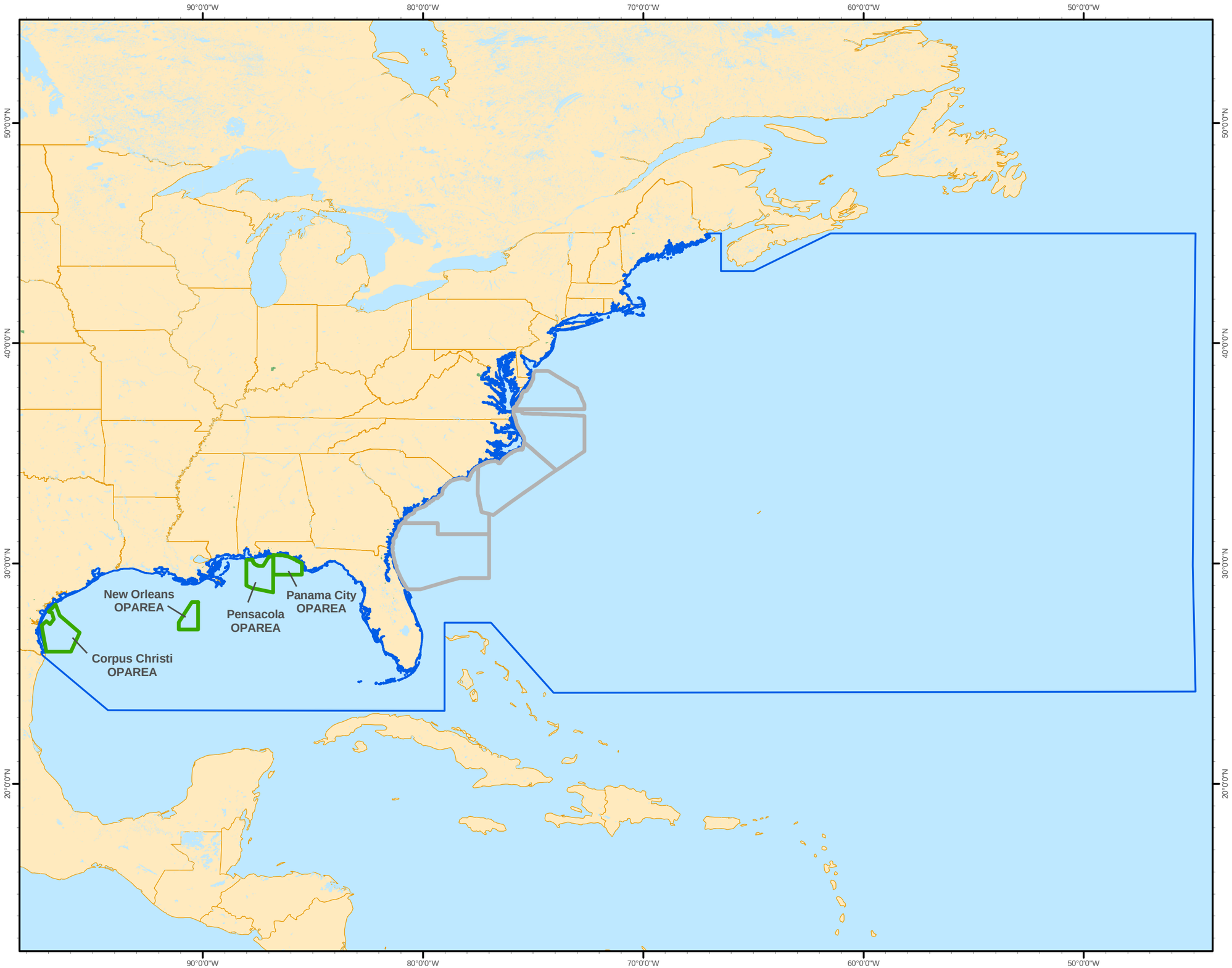
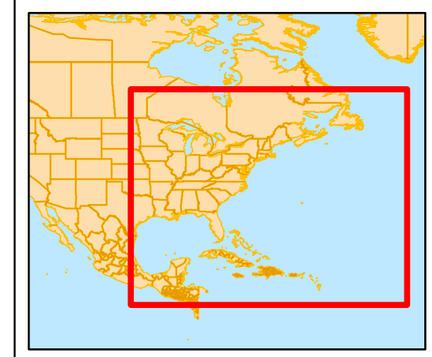


AFAST Study Area

Figure 1.1-2

Legend

- GOMEX OPAREAs
- OPAREAs (Other)
- Atlantic Fleet Active Sonar Training (AFAST) Study Area



N

1:18,580,000

100 50 0 100 200 300 Nautical Miles

150 75 0 150 300 450 Kilometers

Coordinate System: WGS 1984

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combatant ships, submarines, and an embarked Marine Expeditionary Unit (MEU)[2], can additionally project power ashore via amphibious landing of personnel, armor, and equipment. Traditionally, a CSG or ESG normally operates on a two- to three-year cycle that begins with major maintenance and work-up training before culminating in a six- to eight-month deployment. A Surface Strike Group (SSG), consisting of one to three surface combatant ships, is specially organized to conduct a typically short-term, limited objective.

The Joint Chiefs of Staff determine deployment of naval forces based on world-wide requirements and commitments. While the Navy always has several strike groups deployed to provide global naval presence and engagement, the 21st Century security environment has spawned more frequent requests from combatant commanders for additional Navy forces ranging in size from individual and single units to strike groups. Emergent missions have included major combat, maritime and theater security, homeland defense, support of civil authorities, anti-terrorism/force protection, and humanitarian assistance/disaster relief operations. This rapid response of forces to supplement naval forces on routine deployment is referred to as "surge." Surge refers to the capability to quickly deploy Navy assets, sometimes to multiple locations, in response to world events. In order for the Navy to be "surge-ready", it must be able to quickly modify its routine training schedule to allow for earlier certification of units before deploying them.

The Navy developed the Fleet Response Plan (FRP) as a deliberate process to ensure continuous availability of agile, flexible, trained, and ready surge-ready capable forces. The goal of the FRP is to provide a standing ability to deploy six CSGs in a very short time, and one more soon thereafter. FRP addresses all aspects of maintaining these surge-capable Navy forces, such as maintenance, manning, and deployment schedules. The GOMEX Range Complex Final EIS/OEIS addresses the training side of FRP—the Fleet Response Training Plan (FRTP), described in more detail below.

1.2.1.2 Why the Navy Trains

Operational requirements for deploying combat-ready naval forces world-wide drive and shape training doctrine and procedures. The nature of modern warfare and security operations has become increasingly complex. The threat is global, and the tactics, weapons, and forces arrayed against the U.S. military span the gamut from crude to extremely sophisticated. To effectively counter the array of threats, naval forces bring together thousands of sailors and marines, their equipment, vehicles, ships, and aircraft, and often other U.S. services or coalition partners, all of which need to work together as a cohesive team to achieve success. Developing the leadership and management skills to choreograph all these disparate elements, from logistics to the coordinated employment of weapons at the tactical level, requires extensive, challenging training. In particular, modern weaponry presents both tremendous opportunity and challenges. Smart weapons, used properly, are very accurate and actually allow naval forces to accomplish their missions with greater precision and far less undesired destruction than in past conflicts. However, they are very complex and skills honed for optimum employment are perishable. Realistic, regular training provides all elements of the Navy-Marine Corps team, from the individual to the strike group, with the "hands on" experience and confidence crucial to success and survival in this environment.

[2] The MEU (Special Operations Capable) is a task organized unit of a type known as a Marine Air Ground Task Force or MAGTF. MAGTFs consist of ground combat, aviation combat, combat logistics, and command and control elements, and vary in size depending on the nature of the intended mission.

The Navy mission in a maritime environment presents unique challenges. CSGs, ESGs, and SSGs offer combatant commanders unprecedented flexibility and firepower to defeat or suppress threats world-wide. Naval forces can simultaneously carry out operations on and below the ocean surface, on land, and in the air. To optimize all of this capability, Navy training activities must focus on achieving proficiency in eight functional areas, known as Primary Mission Areas or, more commonly, warfare areas. These are: Air Warfare (AW), Amphibious Warfare (AMW), Surface Warfare (SUW), Anti-submarine Warfare (ASW), Mine Warfare (MIW), Strike Warfare (STW), Electronic Combat (EC), and Naval Special Warfare (NSW). Each training event addressed in the Final EIS/OEIS is categorized under one of the warfare areas. Appendix D describes each of these warfare areas and individual training exercises in greater detail.

1.2.1.3 Fleet Response Training Plan (FRTP)

The Navy designed the FRTP to support the training requirements of a surge-capable Fleet that meets FRP goals outlined above. FRTP formalizes the traditional Navy building block approach to training in a way that brings the strike groups to the required level of combat readiness earlier in the training cycle, and sustains that readiness longer. Training proceeds on a continuum, advancing through four phases:

Maintenance Phase is the preferred period during which major shipyard- or depot-level repair and most personnel turnover occur. Ships and squadrons focus on individual and team training. This level of training could involve the aircrew of a single aircraft flying basic instrument or tactics flights, or fire control crews for a ship's anti-aircraft systems employing their weapons in a simulated environment at a weapons school.

Basic Phase continues individual and team training, but the focus shifts to unit-level training (ULT), assessment, and certification requirements during which all members of the ship or squadron employ their ship or aircraft tactically. This phase is characterized by high-volume, short-duration, individual and unit training exercises. Examples of ULT could include a single destroyer conducting damage control, weapons employment, and navigation drills over a two-day underway period, or a two-plane flight of F/A-18s performing defensive maneuvers and weapons delivery training against an opposition force at a nearby bombing range during a two-hour sortie.

Integrated Phase brings all the individual units together as a strike group to synthesize staff actions and coordinate operations in a challenging, multi-warfare environment. Generally, integrated phase training occurs during a limited number of major exercises, each lasting one to four weeks. This phase includes strike-group-level assessment and certification prior to deployment. Major exercises for CSGs would include multi-ship air defense and anti-submarine warfare exercises, and 10-plane bombing strikes at multiple target sites, all occurring simultaneously in a realistic battle scenario.

Sustainment Phase begins upon completion of the Integrated Phase, and lasts through deployment and for several months following return to homeport before the strike group stands down and the individual units begin their maintenance period. Sustainment consists of a variety of training evolutions designed to sustain the combat readiness levels attained in the prior three phases. This phase could include several major training exercises with other U.S. and allied services in a joint/coalition environment, as well as a continuation of individual, unit, and integrated-level training exercises. A major sustainment exercise could include elements of a CSG and an ESG operating together with units from the U.S. Air Force (USAF) and/or allied navies during a 10-day battle problem.

FRTP involves acceleration of the training cycles of multiple strike groups, which could entail near-simultaneous execution of similar training events. Deployment schedules must remain flexible and responsive to the nation's security needs. The Navy must ensure that its training areas can support the entire training continuum as needed.

1.2.1.4 Range Complexes

Training must be as realistic as possible to provide the initial experience and confidence necessary to ensure success and survival in combat. The Navy often employs simulators and synthetic training to provide early skill repetition and to enhance teamwork, but live training in a realistic environment is vital to success. A range complex, such as the GOMEX Range Complex, is a set of co-located areas of sea space, subsurface space, land ranges, and overlying airspace designated for military training and testing operations (see Figure 1. 1-1). Range complexes provide a controlled and safe environment with threat-representative targets where military ships and aircraft can train in realistic, combat-like conditions throughout the graduated buildup needed for combat ready deployment. The integration of subsurface ranges and OPAREAS with land training ranges, safety landing fields, and amphibious landing sites are critical to this realism, allowing execution of multi-dimensional exercises in complex scenarios. Also, range instrumentation captures data on the effectiveness of tactics and equipment, providing feedback for constructive criticism. Live-fire training ensures the ability to place ordnance on target with the required level of precision in a stressful environment. Live training, most of it accomplished in the waters off the nation's east and west coasts and the Caribbean Sea, will remain the cornerstone of readiness as the Navy transforms its military forces for a security environment characterized by uncertainty and surprise.

1.2.2 Tactical Training Theater Assessment and Planning (TAP) Program

In 2004, Commander, U.S. Atlantic Fleet and Commander, U.S. Pacific Fleet funded the Tactical Training Theater Assessment and Planning (TAP) Program to serve as the overarching Fleet training area sustainment program. The purpose of TAP is to support Navy objectives that: 1) promote use and management of ranges (such as the GOMEX Range Complex) in a manner that supports national security objectives and a high state of combat readiness, and 2) ensure the long-term viability of range assets while protecting human health and the environment. The TAP Program focuses specifically on the sustainability of ranges, OPAREAs, and airspace that support the FRTP.

The TAP Program represents the first time the Navy has managed its ranges on a broad, complex-wide basis. One element of the TAP Program is development of the required capabilities document (RCD) (DoN, 2006b), and a companion document, the range complex management plan (RCMP) (DoN, 2006a). Another TAP Program element is environmental planning documentation (*e.g.*, this Final EIS/OEIS), which assesses the potential for environmental impacts associated with activities/actions conducted within a range complex. These documents are described below.

The purpose of the RCD is to quantitatively define the required capabilities that allow Navy ranges to support mission-essential training in an unconstrained environment over a 10-year planning horizon. In sum, the RCD defines what is needed in an ideal sense. The RCD uses several factors to determine range capability requirements, including: range attributes, range-related systems, training levels, and Navy Primary Mission Areas.

- Range attributes: These include four range operational elements or training media, namely airspace, sea space, subsurface space, and land area. The geographic breadth of water and land area, water depth, and air space needed to conduct specific types of training occurring at the range are detailed in the RCD.
- Range-related systems: These include systems and infrastructure for scheduling, communications, meteorological data, targets, training instrumentation, and opposition force simulation.
- Training levels: the three levels are:

1. Basic, or unit-level training, involves a single ship, aircraft, submarine, or small unit, not integrated with other operations;
2. Intermediate training involves integrated expeditionary or carrier strike group or air wing operations as part of a major exercise; and
3. Advanced training involves multiple strike group and/or services in major, fully integrated, comprehensive and/or joint force exercises.

- Primary Mission Areas listed in Section 1.2.1.2.

The Navy has developed an RCMP for each range complex, including the GOMEX Range Complex (DoN, 2006a). The RCMP is an integrated sustainment planning and management document that:

- Describes baseline condition of range complex capabilities, current training and RDT&E operations, environmental documentation/coverage, and encroachment issues;
- Recommends projects and investments based on rigorous assessment of gaps between current range complex capabilities and those required to support the strategic vision; and
- Develops a range complex management structure, outreach plan, and investment strategy for long-term range sustainment.

RCMPs are developed using the RCD to define requirements needed to support warfare areas of individual range complexes. The Final Draft RCMP for the GOMEX Range Complex was completed in 2006. The RCMP iterates the strategic vision for the complex, which is to provide sustainable and modernized ocean operating areas, airspace, land, ranges, range infrastructure, training facilities, and resources to fully support Navy training requirements in accordance with the complex's roles and missions.

The roles and missions for the GOMEX Range Complex include providing training opportunities for eight naval warfare mission areas, specifically: AW, ASW, SUW, MIW, STW, AMW, NSW, and EC at varying levels of training complexity. The GOMEX Range Complex also provides training opportunities for logistics or mission area training, including: new pilot flight instruction, salvage diver training, underwater demolitions, security force training, and specialized diver training. RDT&E is conducted in the GOMEX Range Complex on new aircraft, ships, and weapons designed to support each of these naval warfare missions.

Of these roles and missions, the GOMEX RCMP (DoN, 2006a) identifies moderate to severe capabilities shortfalls in several warfare mission areas, especially for intermediate and advanced level training, when compared to the complex's required capabilities. In an attempt to remedy the identified shortfalls, the GOMEX RCMP makes recommendations for range enhancements, some of which may have an impact on the environment. Those recommended range enhancements that have the potential to impact the environment, as well as current, emerging, and future training and RDT&E operations, are the primary focus of this Final EIS/OEIS, and are further described in Chapter 2.

1.3 PURPOSE AND NEED

The purpose for the proposed action is to:

- Achieve and maintain Fleet readiness using the GOMEX Range Complex to support and conduct current, emerging, and future training operations and RDT&E operations;
- Expand warfare missions supported by the GOMEX Range Complex; and
- Upgrade and modernize existing range capabilities to enhance and sustain Navy training and RDT&E.

The need for the proposed action is to provide range capabilities for the training and equipping of combat-capable naval forces ready to deploy worldwide. In this regard, the GOMEX Range Complex

furthers the Navy's execution of its Congressionally-mandated roles and responsibilities under Title 10 U.S.C. Section 5062.

To implement this Congressional mandate, the Navy needs to:

- Maintain current levels of military readiness by training in the GOMEX Range Complex;
- Accommodate future increases in operational training tempo in the GOMEX Range Complex and support the rapid deployment of naval units or strike groups;
- Achieve and sustain readiness of ships and squadrons so the Navy can quickly surge significant combat power in the event of a national crisis or contingency operation consistent with the FRTP;
- Support the acquisition and implementation into the Fleet of advanced military technology. The GOMEX Range Complex must adequately support the testing and training needed for new vessels, aircraft, and weapons systems; and
- Maintain the long-term viability of the GOMEX Range Complex while protecting human health and the environment and enhancing the quality and communication capability and safety of the range complex.

Support to current, emerging, and future training and RDT&E operations, including implementation of range enhancements, entails the actions that were evaluated in this Final EIS/OEIS. These assessed actions include:

- Increased use of contractor-operated aircraft that simulate enemy aircraft during training (Commercial Air Services Support for Fleet Opposition Forces [OPFOR] and Electronic Warfare Threat Training);
- Support of basic flight instruction and mission area training for pilot proficiency; and
- Implementation of the Joint National Training Capability (JNTC) within the GOMEX Range Complex.

1.4 OVERVIEW OF THE GOMEX RANGE COMPLEX

1.4.1 Summary Description

The GOMEX Range Complex geographically encompasses airspace, sea space, subsurface space, and land areas located near the Gulf Coast of the United States (Figure 1.1-1). Table 1.4-1 identifies the main geographic elements of the GOMEX Range Complex.

TABLE 1.4-1
COMPONENTS OF THE GOMEX RANGE COMPLEX

COMPONENT AREA	DESCRIPTION	ADDRESSED IN THIS FINAL EIS/OEIS?
OPAREAs	There are four OPAREAs located within the GOMEX Range Complex (Pensacola, Panama City, New Orleans and Corpus Christi). These OPAREAs are located along the Gulf Coast between Florida and Texas. The GOMEX Range Complex includes 17,440 nm^2 of offshore surface and subsurface OPAREA and 12,072 nm^2 of shallow ocean area less than 100 fathoms (600 feet [ft]) deep. The areas for each OPAREA are as follows: Panama City = 3,084 nm^2 Pensacola = 4,882 nm^2 New Orleans = 2,607 nm^2 Corpus Christi = 6,867 nm^2	Yes
Special Use Airspace (SUA) –Offshore	Warning areas generally overlying the ocean OPAREAS, designated W-151A/B/C/D/E/F, W-155A/B/C, W-92, W-54A/B/C, and W-228A/B/C/D.	Yes
	W-59A/B	No[3]
SUA Not Associated with Offshore OPAREAs	Meridian 1 East and West Military Operation Area (MOA); Pine Hill East and West MOAs; Pensacola North and South MOAs; R-2908; Brownwood 1-4 MOAs; Kingsville 1-5 MOAs	Yes
Navy-operated Land Ranges and Associated SUA	The GOMEX Range Complex contains 19.8 mi^2 of land area. Two land target range areas are operated by the Navy along with associated SUA. <u>Noxubee County Range</u>: Air-to-ground training range (non-explosive practice munitions (NEPM) only). The range includes the SEARAY Target and SUA designated as R-4404A-C. <u>McMullen County Range</u>: Air-to-ground training range (NEPM only). Includes the SUA designated as R-6312A-C. McMullen County Range includes the Yankee and Dixie Targets.	Yes
	<u>Western Maneuver Area at the Stennis Space Center (SSC)</u>: Current operations conducted at the SSC ranges include: • Riverine patrol and interdiction; • Insertion and extractions; • Inland reconnaissance and surveillance operations; • External air transport; • Fastroping; • Medical evacuation; and • Simulated close air support.	No. An EIS was previously prepared for Navy operations within the Western Maneuver Area. The existing EIS is referenced in this GOMEX Range Complex Final EIS/OEIS, and will be supplemented as appropriate for changes to operations.

[3] Although within the vicinity of the GOMEX Range Complex, W-59A/B is not included in the Final EIS/OEIS Study Area because it is scheduled by the 159th Fighter Wing, New Orleans Air National Guard.

TABLE 1.4-1 (Continued)
COMPONENTS OF THE GOMEX RANGE COMPLEX

COMPONENT AREA	DESCRIPTION	ADDRESSED IN THIS FINAL EIS/OEIS?
Navy-Operated Small Arms Range	Camp Keller Small Arms Range: The Naval Construction Battalion in Gulfport, Mississippi (MS) utilizes approximately 2,500 acres of National Forest land under an EA and Special Use Permit issued by the U.S. Forest Service for the National Forests in Mississippi. This facility has been in continuous use since World War II. The main facility on Camp Keller is the outdoor firing range that is used to qualify personnel that are preparing for deployment overseas.	No. Currently there is an Environmental Assessment (EA) being prepared to assess the potential effects of a proposed Joint Improvised Explosive Device Defeat Organization (JIEDDO) Battle Course at Camp Keller.
Navy-operated underwater demolition pond	Naval Support Activity (NSA) Panama City Demolition Pond. This shallow body of water at NSA Panama City is 94 yards wide and up to 11 feet deep. The current training events that occur at the pond include: • Salvage diver training; • Underwater demolitions; • Security force training; and • Diver training. A variety of small underwater detonations are conducted in conjunction with these training events.	Yes
Security Group Training Areas	Harbor Security Group Machine Gun Area: This over-water training range is located approximately 8 miles off the coast from Panama City, Florida. The range is used for machine gun training by boat crew members. A firing cone is established and non-participating boat crews are positioned as safety lookouts. Prior to the event a Notice-to-Mariners (NOTMAR) is issued. Mobile Expeditionary Security Group Training Area: This over-water training range is located approximately 8 miles off shore southeast of Corpus Christi, TX. The training area is located within a box previously used for mine warfare training (E3). The training area is used for small arms gunfire training and anti-swimmer grenade training.	Yes

1.4.2 Mission of the GOMEX Range Complex

The mission of the GOMEX Range Complex is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support Navy training requirements. The GOMEX Range Complex provides critical support for Navy operational readiness training and for RDT&E.

Training at the GOMEX Range Complex historically has been diverse, including ship and aircraft maneuvers, gunnery and bombing exercises, joint training exercises, and RDT&E of new systems or

weapons platforms. Numerous commands and their subordinate units across multiple naval warfare areas use the GOMEX Range Complex. Typical range users include Carrier Strike Groups and the component elements of these formations such as naval aviation squadrons, submarine groups, and surface forces. Less frequent users include Navy commands devoted to specific RDT&E events, and other DoD entities.

This Final EIS/OEIS considers impacts from typical users of the Range Complex, and also considers less frequent user's training operations. Non-Navy DoD, and other federal agency units, who want to use components of the Range Complex and whose activities are not clearly within the scope and scale of activities discussed in this document will require separate NEPA/EO 12114 documentation. In addition to its central role in the pre-deployment training of large naval formations, the GOMEX Range Complex is utilized as a "backyard" range for advanced and pre-deployment workup training of units with home stations on the Gulf Coast of the United States. Access to capable range facilities located in the vicinity of homeports and stations is a critical component of naval readiness. The Navy strives, and in many cases is required by law, to track and where possible limit "personnel tempo," meaning the amount of time Sailors and Marines spend deployed away from home. Personnel tempo is an important factor in family readiness, morale, and retention. The availability of a "backyard" range is critical to Navy efforts in these areas.

1.5 Scope and Content of the EIS/OEIS

The geographic scope of this Final EIS/OEIS (referred to from this point forward as the Study Area) includes all components of the GOMEX Range Complex and each OPAREA, including the area from the mean high tide line, up to and extending seaward to each OPAREA's boundary. As stated in Table 1.4-1, several Military Operating Areas (MOAs) not associated with offshore OPAREAs and land-based ranges are also included in the Study Area. Figure 1.5-1 depicts the Study Area for this Final EIS/OEIS. This Final EIS/OEIS provides an evaluation of current, emerging, and proposed future training and RDT&E activities, and associated enhancements as identified in the GOMEX RCMP. Chief of Naval Air Training (CNATRA) helicopter training sorties are not covered in this EIS/OEIS because they do not fly within the GOMEX Study Area.

By Presidential Proclamation 5928, issued December 27, 1988, the United States extended its territorial sea, wherein the United States exercises sovereignty and jurisdiction under international law, from 3 nm (5.6 kilometers [km]) to 12 nm (22 km) in conformity with the United Nations Convention on the Law of the Sea. The proclamation expressly provides that it does not extend or otherwise alter existing federal law or any associated jurisdiction, rights, legal interests, or obligations. Thus, the proclamation did not alter existing legal obligations under NEPA or other federal environmental statutes. Figure 1.1-1 depicts the 12 nm territorial sea established by Presidential Proclamation 5928 as it relates to the GOMEX offshore areas.

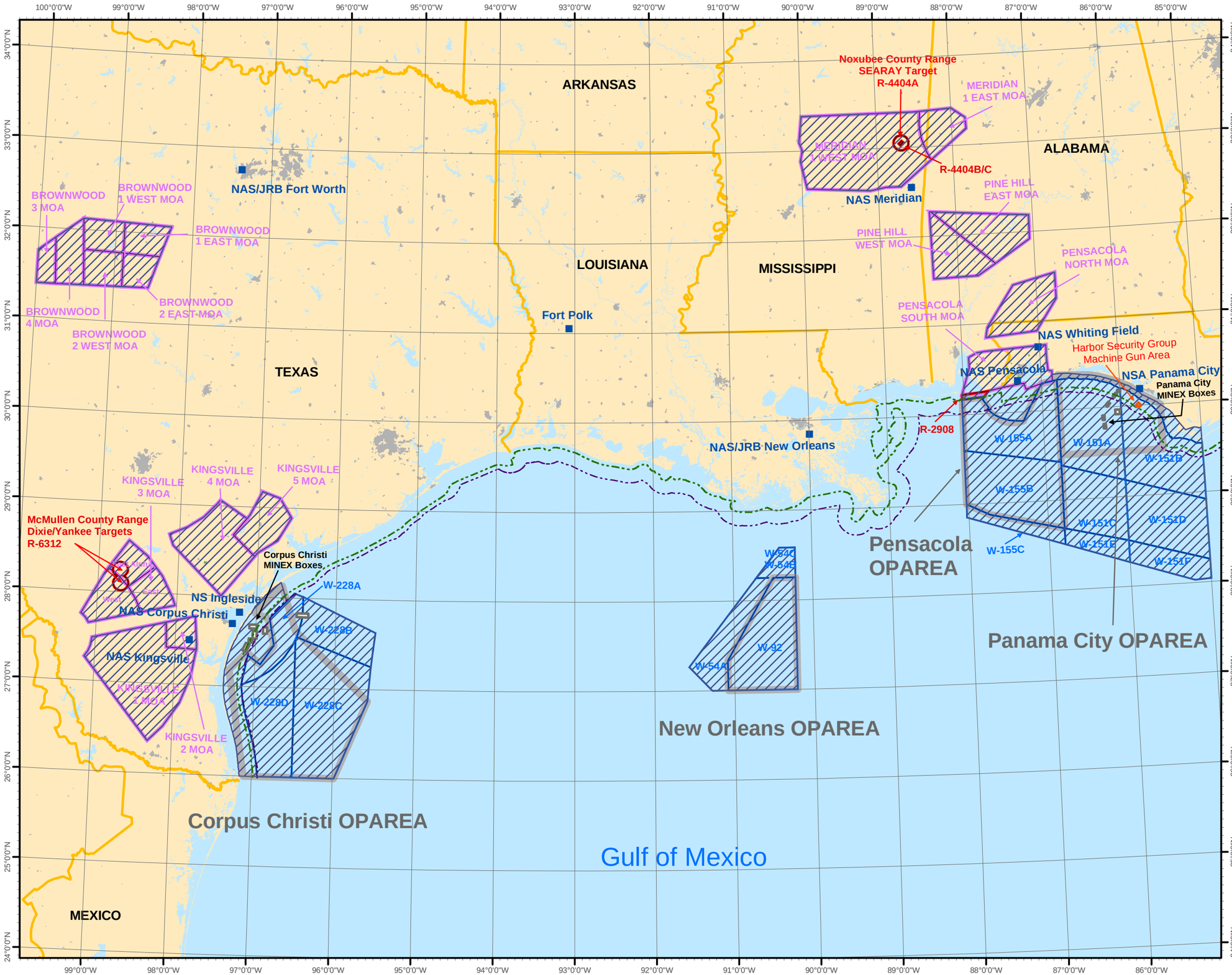
Impacts to these areas and those portions of the inner sea range within these boundaries are subject to analysis under NEPA. Impacts in the areas outside U.S. territorial waters, often referred to as the global commons, are analyzed using procedures set out in EO 12114 and associated implementing regulations.

1.5.1 Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities EIS/OEIS

An EIS/OEIS was prepared by the DoN to evaluate the effects associated with the littoral and expeditionary warfare activities proposed for the NSWC PCD Study Area, which includes St. Andrew Bay (SAB) and Warning Areas W-151, W-155, and W-470. Warning Areas 151 and 155 are also part

GOMEX EIS/OEIS Study Area

Figure 1.5-1

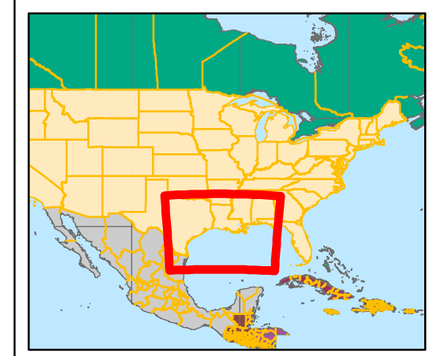


Legend

- State Seaward Extent
  - *TX & FL 9 nm; AL, MS & LA 3 nm*
- 12 nm Territorial Limit
- EIS Study Area

Special Use Airspace

- Military Operating Areas (MOA)
- Restricted Airspace (R-)
- Warning Areas (W)
- Operating Areas (OPAREA)



N

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25 12.5 0 25 50 75 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 15 (Meters)

Sources:
National Geospatial Intelligence Agency (NGA) Database;
Special Use Airspace Document AP/1A;
COMLANTFLT 3120.26E Document.

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of the GOMEX Study Area. The NSWC PCD EIS/OEIS is separate and distinct from the GOMEX Range Complex EIS/OEIS and briefly described here. These activities involve a variety of naval assets including ships, aircraft, and underwater systems that support eight primary RDT&E capabilities: air, surface, and subsurface operations, sonar, laser, electromagnetic, live ordnance, and projectile firing operations occurring within the NSWC PCD Study Area. The potentially affected resources have been studied to evaluate if changes in NSWC PCD RDT&E, particularly sonar use and ordnance detonations, would affect the marine environment, air environment, and water surface environment. The proposed action was to improve NSWC PCD's capabilities to conduct new and increased mission operations for DoN and customers within the three military operating areas and SAB. Three Alternatives were analyzed in the Final EIS/OEIS. The No Action Alternative addressed historical and current mission activities (referred to cumulatively as "baseline mission activities") within the NSWC PCD Study Area. Alternative 1 addressed baseline mission activities, as well as identified (known) future (five-year) NSWC PCD requirements. Alternative 2 addressed baseline mission activities, as well as identified future NSWC PCD RDT&E requirements at an increased tempo, in order to maximize NSWC PCD operational capability. Potential effects associated with the alternatives were identified and evaluated. The U.S. Navy concluded that there would be no significant impact to geology and sediments, air quality, water quality, biological resources, marine habitats, invertebrates, fish, essential fish habitat (EFH), birds, socioeconomics, airspace, artificial reefs, safety, cultural and historical resources, low-income and minority populations, children, or coastal zone resources. NSWC PCD activities have the potential to expose marine mammals and sea turtles to sound likely to result in Level A and Level B harassment. NSWC PCD will implement mitigation measures and management practices to reduce the level of effects to the environment. NSWC PCD consulted with NMFS under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA), respectively, and the results have been incorporated into the Record of Decision for the Final EIS/OEIS (ROD signed 15 Jan 2010; *Federal Register* Volume 175, Number 15).

1.6 THE ENVIRONMENTAL REVIEW PROCESS

1.6.1 National Environmental Policy Act

In 1969, Congress enacted NEPA, which provides for the consideration of environmental issues in federal agency planning and decision-making. Regulations for federal agency implementation of the act were established by the CEQ. NEPA requires an early and open process to determine the scope of issues that should be analyzed in an EIS before an alternative is selected for implementation. The NEPA process is designed to involve and inform the public and local, state and federal agencies of the potential environmental consequences of a federal agency's proposed action.

NEPA requires federal agencies to prepare an EIS for proposed actions that may significantly affect the quality of the human and natural environments. The EIS must disclose significant environmental impacts and inform decision-makers and the public of reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. The Navy is the lead agency for the proposed action. The National Marine Fisheries Service (NMFS) is a cooperating agency for this Final EIS/OEIS.

The Scoping Process: Scoping is an early and open process for developing the "scope" of issues to be addressed in the EIS/OEIS and for identifying significant issues related to a proposed action. During scoping, the public helps define and prioritize issues and convey these issues to the agency through both oral and written comments. The first step in the NEPA process is preparation of a Notice of Intent (NOI) to develop the Draft EIS (DEIS). The NOI for this project was published on August 31, 2007 in the *Federal Register* (Volume 72, No. 169, Pages 50333-50335). The NOI provided an overview of the

proposed action and the scope of the DEIS/OEIS. The NOI also included an announcement of public scoping meetings. A copy of the NOI is available in Appendix B. Notice was also published in five local newspapers. The newspaper notices were run five times in each newspaper. The NOI included Navy Point of Contact (POC) information, a list of information repositories, the project website address (www.GOMEXRangeComplexEIS.com), a request for public comments, and the dates and locations of the scoping meetings. Agencies and other interested parties were also forwarded letters advising of the NOI. Copies of Agency Correspondence are provided in Appendices C, G, and L. The following regional newspapers were used to publish the NOI and scoping meeting locations:

Florida
- *Pensacola News Journal* (Pensacola, Florida)
- *Panama City News-Herald* (Panama City, Florida)

Louisiana
- *The Times-Picayune* (New Orleans, Louisiana)

Mississippi
- *The Meridian Star* (Meridian, Mississippi)

Texas
- *Caller-Times* (Corpus Christi, Texas)-Bi-lingual

Scoping meetings were held in four locations, as follows:

Meeting Dates	Meeting Locations
September 24, 2007	**Gulf Coast Community College** 5230 W. Highway 98 Panama City, FL 32401
September 25, 2007	**Pensacola Junior College (Warrington Campus)** 5555 West Highway 98 Pensacola, FL 32507
September 26, 2007	**Alfred Bonnabel High School** 2801 Bruin Drive Metairie, LA 70003
September 28, 2007	**Holiday Inn-Emerald Beach** 1102 South Shoreline Boulevard, Corpus Christi, TX 78401

Eleven comments were received during the scoping comment period. Comments were received via the website and via letter from individuals, groups, and federal and state agencies. Agencies responding included: the Padre Island National Seashore; the Florida Department of Environmental Protection; the U.S. Army; the Florida Department of State - Division of Historic Resources; the Louisiana Department of Natural Resources, and the Panama City Port Authority. The topics covered in the comments included requests for: (i) the DEIS/OEIS when available; (ii) evaluation of potential impacts to commercial shipping; (iii) evaluation of potential impacts to the tourism industry; (iv) evaluation of potential impacts to marine mammals and essential fish habitat; (v) evaluation of potential impacts to the coastal zones; and (vi) evaluation of potential impacts to submerged cultural resources. These public comments received during the scoping process helped guide development of the DEIS/OEIS, specifically toward emphasis on the resource areas of particular concern.

Draft EIS/OEIS: After scoping, the DEIS/OEIS was prepared to provide an assessment of the potential impacts of the proposed action and alternatives on the environment. The Draft EIS/OEIS was provided to the U.S. Environmental Protection Agency (USEPA) for review and comment in accordance with its responsibilities and Notice of Availability of USEPA comments was published in the *Federal Register* (Vol 74, No. 1, January 2, 2009). The Navy also placed notices in local newspapers announcing the availability of the Draft EIS/OEIS and public hearings. The Draft EIS/OEIS was circulated for internal/agency review and made available for general review in public

libraries. The public comment period for the DEIS/OEIS ended on February 16, 2009. Public hearings were held to accept public comments on the DEIS/OEIS at the following dates and locations:

Meeting Dates	Meeting Locations
February 2, 2009	**Bay Point Marriott** 4200 Mariott Drive, Panama City Beach, FL 32408
February 3, 2009	**New World Inn** 600 South Palafox Street, Pensacola, FL 32502
February 4, 2009	**New Orleans Marriott** 555 Canal Street, New Orleans, LA 70130
February 6, 2009	**Holiday Inn- Emerald Beach Hotel** 1102 South Shoreline Boulevard, Corpus Christi, TX 78401

Final EIS/OEIS: Public and agency comments on the DEIS/OEIS were received via the GOMEX web site, facsimile, and regular mail. Ten letters from agencies and the public containing 22 comments were received. This Final EIS/OEIS incorporates, and formally responds to, all agency and public comments received on the DEIS/OEIS. Responses took the form of corrections of data inaccuracies, clarifications of and modifications to analytical approaches, inclusion of additional data or analyses, and modification of the proposed action or alternatives. Public and agency comments and Navy responses are located in Appendix F.

The Final EIS/OEIS will be filed with the USEPA and a USEPA Notice of Availability will be published in the *Federal Register*. The Final EIS/OEIS will be distributed/made available during a 30-day "no action" period.

Finally, a Record of Decision (ROD) will be issued, no less than 30 days after the Final EIS/OEIS is made available and published in the *Federal Register* and local newspapers. The ROD will be a concise summary of the decision made by the Navy from the alternatives presented in the Final EIS/OEIS. Specifically, the ROD will state the decision, identify alternatives considered, and discuss other (non-environmental) considerations that influenced the decision identified. The ROD will also describe the implementation of practical measures intended to avoid effects from the chosen alternative and explain any decision not to implement any of these measures. The ROD will also detail any additional mitigation measures which may result from ongoing regulatory processes. Once these regulatory processes are complete, and the ROD is published, the Navy can implement the proposed action.

1.6.2 Executive Order 12114

EO 12114, *Environmental Effects Abroad of Major Federal Actions*, directs federal agencies to provide for informed decision-making for major federal actions outside the United States, including the global commons, the environment of a non-participating foreign nation, or impacts on protected global resources. An OEIS is required when an action has the potential to significantly harm the environment of the global commons. Global commons are defined as "geographical areas that are outside of the jurisdiction of any nation, and include the oceans outside territorial limits and Antarctica. Global commons do not include contiguous zones and fisheries zones of foreign nations" (32 CFR 187.3).

1.7 RELATED ENVIRONMENTAL DOCUMENTS

1.7.1 Documents Incorporated By Reference

In accordance with CEQ regulations for implementing NEPA, the following relevant material to the proposed action is being incorporated by reference, with the intent of reducing the size of the document. The following paragraph provides a brief description of the document incorporated by reference into this Final EIS/OEIS.

EIS/OEIS: Atlantic Fleet Active Sonar Training (AFAST). The Navy prepared an EIS/OEIS (DoN, 2009a) for the use of active sonar and other sources (see Table 3.19-1 of this Final EIS/OEIS) of underwater energy during training operations in the East Coast and Gulf of Mexico OPAREAS of the United States. The types of active sonar analyzed include those using mid- and high- frequencies, as well as small explosive charges used in certain anti-submarine warfare devices. AFAST documentation does not include any sources of low frequency sonar. The Navy's ASW and MIW sonars and other acoustic source systems were studied across a number of environments for a myriad of U.S. Navy training operations in the EIS/OEIS. In addition to incorporating the AFAST EIS/OEIS by reference, the GOMEX Range Complex EIS/OEIS includes a summary of effects from active sonar sources utilized in the GOMEX Range Complex based on the analysis of effects from the Final AFAST EIS/OEIS (see Section 3.20). *(Record of Decision January 23, 2009; Federal Register Volume 74, Number 16).*

1.7.2 Other Relevant Environmental Documents

The following environmental documents are relevant to the GOMEX Final EIS/OEIS and referred to in this Final EIS/OEIS.

Final EIS/OEIS: Naval Surface Warfare Center Panama City (NSWCPC) Mission Activities (DoN, 2009b): An EIS was prepared to evaluate potential environmental consequences associated with new and increased NSWCPC mission activities in three military operating areas in the northern Gulf of Mexico and in St. Andrews Bay. Existing and evolving activities include RDT&E, and in-service engineering for MIW, special warfare, amphibious warfare, diving, and other naval missions taking place primarily in the coastal region. Activities generally include air, surface, and subsurface operations requiring use of sonar, lasers, HE ordnance, and electromagnetic fields. *(Record of Decision January 15, 2010).* For more information visit: http://www.navsea.navy.mil/nswc/panamacity/environment/docs.aspx

Draft EA: T-6 Joint Primary Aircraft Training System (JPATS) Solo Capability at Navy Outlying Landing Fields Naval Air Station Whiting Field, Florida (DoN, 2009c). The Navy is conducting an EA to assess and disclose the known and potential environmental consequences, both beneficial and adverse, of the proposed modification and expansion of NOLFs in the NAS Whiting Field training area to meet operational requirements. Key issues to be analyzed in the EA are the potential impacts of the acquisition of additional private property at selected NOLFs to accommodate the expanded runways, associated construction of new facilities and infrastructure at the NOLFs, and environmental impacts of T-6 operations and runway modifications at the selected NOLFs. The draft EA is currently available for public review. For more information visit the project website at: http://www.navyolfextensions.com. (FONSI is pending)

Final EA: Assessment of Naval Air Station Corpus Christi, Texas for Compatibility with the T-6 Joint Primary Aircraft Training System (DoN, 2009d). The Navy prepared an EA for the deployment, operation and maintenance of the T-6 JPATS at Naval Air Station Corpus Christi (NASCC). The proposed action would involve infrastructure and facilities upgrades at NASCC to support the JPATS program. This proposed action would also include the purchase and upgrade of Goliad Field for use as the primary Outlying Landing Field (OLF) to support the T-6 training operations at NASCC. (FONSI signed December 2009).

Final EA/OEA: Atlantic Fleet Training in Key West Range Complex (DoN, 2009e). EA/OEA identifies and evaluates the potential effects of current and future Navy air warfare and electronic

combat training in the Key West Range Complex. Air warfare training consists of air combat maneuver sorties accompanied by 20 mm air-to-air aircraft gunfire. Electronic combat training consists of the deployment of radio-frequency chaff and self-protection flares. Future training consists of additional air combat maneuver sorties conducted in connection with Carrier Strike Group air wing certification training in the Gulf of Mexico, and future training also includes the performance of air-to-air missile exercises. (FONSI signed January 2010).

Final EA: Construction of Joint Improvised Explosive Device Defeat Organization (JIEDDO) Battle Course at Camp Keller Range, Biloxi, Mississippi (DoN, 2009f). The Naval Construction Battalion (the Navy is the action proponent) in Gulfport, Mississippi (MS) utilizes approximately 2,500 acres of National Forest land under a Special Use Permit issued by the U.S. Forest Service for the National Forests in Mississippi. This facility is known as Camp Keller Small Arms Range and has been in continuous use since World War II. The main facility on Camp Keller is the outdoor firing range that is used to qualify personnel that are preparing for deployment overseas. This EA will assess the potential effects of a proposed JIEDDO Battle Course at Camp Keller. The proposed action is to construct and operate this counter-Improvised Explosive Devices (IEDs) awareness and reaction training system adjacent to the existing Camp Keller outdoor firing range. (FONSI signed September 2009).

Draft EA: The Establishment of the Meridian 2 Military Operations Area at Naval Air Station Meridian, Mississippi (DoN, 2009g): This EA analyzes the potential environmental effects associated with establishing and utilizing a proposed military operations area (MOA) proximate to Naval Air Station (NAS) Meridian in Mississippi. The proposed airspace would have a designated altitude of 8,000 feet above mean sea level (MSL) to 17,999 feet above MSL and would be divided into 2 sections: a northeastern block, referred to as Meridian 2 East, and a southwestern block, referred to as Meridian 2 West. The proposed MOA would be approximately 22 nautical miles (NM) southwest of NAS Meridian. The purpose of the proposed action is to establish a new MOA where naval aviators at NAS Meridian can complete their required readiness training operations and ensure that mission capabilities are sustained. The need for the proposed action is to support the increase in aircraft sorties that is required as a result of a recent change in the Navy's pilot training syllabus. This change will require the Training Air Wing One (TW-1) to increase the number of annual T-45C aircraft sorties from 32,000 to 37,000, which will saturate the existing Meridian 1 MOA. In addition, airspace areas where TW-1 currently conducts training are projected to see an increase in sorties from other military installations. TW-1 proposes to execute as many as 800 sorties per month in the Meridian 2 MOA. (FONSI is pending)

EIS: Establishment of the Mine Warfare Center of Excellence in the Corpus Christi Bay Area (DoN, 1995) with ROD signed in 1996. In this document, training and operating areas were established in the Gulf of Mexico. The EIS covered the following activities:

- Aviation Mine Counter Measures Sled Training Facility. Total of 64 launch and recoveries of MK-105s per quarter.
- Explosive Ordnance Disposal Facilities. One hundred detonations per year of a maximum 5-pound net explosive weight (NEW).
- Very Shallow Water/Littoral Training Area. Training tactics in 0 to 75 feet of water for 5 to 10 days per quarter. Approximately 40 practice mines would be placed in Areas 1 and 2, very few placed in Area 3. Detonations by EOD divers would occur approximately 25 times per year.
- Medium Water Depth Training and Operating Areas. Minesweeping practice by ships and helicopters would occur daily.
- Deep Water Training and Operating Area. Training activity would occur 35 to 40 days per year.
- Ordnance Detonation Operations Area. EOD personnel would detonate a maximum of 10 pounds of C-4 explosive up to 25 times a year.

EA: Replacement of T-34C aircraft with the Joint Primary Aircraft Training System (JPATS) Aircraft at Naval Air Station (NAS) Whiting Field, Florida (DoN, 2000). This EA evaluated the environmental impacts of the JPATS (T-6A) aircraft used in flight training operations at NAS Whiting Field and five Navy Outlying Landing Fields (NOLF) in Alabama and Florida. Airborne noise impacts were analyzed for the T-6A in addition to all other airfield operations and aircraft, including the TH-57 and TW-5 helicopter sorties. Short-term environmental impacts associated with construction projects and long-term, minor impacts to air quality and noise levels were identified for airfield operations.

EA: Implementation of an Integrated Natural Resources Management Plan (INRMP) at NAS Kingsville, Texas (DoN, 2001). This EA assessed the environmental impacts of implementing an INRMP for NAS Kingsville, Texas, which included: the Main Installation (3,229 acres of land) and is known as NAS Kingsville; a housing area to support assigned personnel known as Texas Terrace consists of 224 housing units and is situated on 30 acres of land; Naval Auxiliary Landing Field (NALF) Orange Grove, which occupies 1,373 acres of land; and a fourth parcel, which is a military bombing range and hunting preserve known as the McMullen County Range. This parcel consists of adjacent tracts, the "Dixie Target" and the Escondido Ranch. The Navy chose medium intensity management as the preferred alternative. This approach includes meeting all required management actions as well as implementing reasonable and achievable stewardship initiatives.

EIS: For the Purchase of Land in Hancock County, Mississippi for a Naval Special Operations Forces Training Range (DoN, 2004a). A Final EIS was prepared and a ROD was signed on October 6, 2004 for the acquisition of approximately 5,220 acres of privately owned property located in the northwestern acoustic buffer zone at Stennis Space Center (SSC). The land will be used as a unique, riverine and jungle training range for Naval Special Operations Forces (SOF). The land acquisition provided Naval SOF based at SSC with reliable and priority access to a local training range characterized by a permanent riverine and jungle environment where live combat using short-range training ammunition can be conducted.

OEA: To Establish a New Special Use Airspace Warning Area in the Gulf of Mexico (DoN, 2004b). The Navy prepared an overseas environmental assessment (OEA) to establish a new warning area (adjacent to W-92) to accommodate Air Combat Maneuver (ACM) activities. The new warning area has the same operating parameters as the current W-92 area: daily operations from 07:00-23:00, 0 to 40,000-feet altitude, supersonic check flights above 30,000 feet and 30 miles out to sea.

EA: Proposed Runway Extensions and Clear Zone Acquisition at NOLF Evergreen Airfield, Evergreen, Alabama (DoN, 2009b). This EA was prepared for NAS Whiting Field as the action proponent to evaluate environmental impacts associated with the construction and operation of the proposed extensions of Runways 1/19 and 10/28 at Navy Outlying Landing Field (NOLF) Evergreen, in Conecuh County, Alabama. NAS Whiting Field proposed to extend the current 4,000-foot runways at NOLF Evergreen by 1,000 feet to meet the minimum runway requirements of the T-6 training aircraft. As part of the proposed action, land would be purchased for the clear zones. Approximately 51 acres would be acquired in fee and an easement would be acquired on an additional 83 acres. Roughly 20 acres of the newly acquired land would need to be cleared of trees and shrubs. Based on the analysis presented in the EA, and coordination with the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Alabama Department of Environmental Management, and the Alabama Historical Commission, the Navy found that implementation of the proposed action will not significantly impact the quality of the human or natural environment or generate significant controversy. A FONSI was signed on 28 May 2009.

Programmatic OEA for High Speed Sea Trials in the Gulf of Mexico (DoN, 2009i): The U.S. Navy Program Executive Office for Ships proposed conducting high speed sea trials in the northern region of

the Gulf of Mexico over a period of five years. Examples of high speed-capable vessel classes included the Littoral Combat Ship (LCS) and the Joint High Speed Vessel (JHSV). The OEA addressed the tests performed during ship trials that have potential to affect the marine environment. The proposed high speed sea trials did not include testing of combat systems or the use of active sonar. The only testing with the potential to impact the marine environment were high speed endurance runs. Avoidance of impacts to marine and coastal resources, such as species protected by the Endangered Species Act and the Marine Mammal Protection Act, and conflicts with other activities occurring in the Gulf of Mexico influenced the selection of the proposed test site. In addition, protective measures were developed by the Navy and reviewed by National Marine Fisheries. Results from the analysis documented in the OEA concluded that implementation of the proposed action's preferred alternative would not result in significant harm to the resources of the global commons.

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CHAPTER 2 DESCRIPTION OF PROPOSED ACTIONS AND ALTERNATIVES

The Navy has identified the need to support and conduct current, emerging, and future training and RDT&E operations in the GOMEX Range Complex (see Chapter 1). This chapter provides detailed information on the proposed action and alternatives analyzed in the Final EIS/OEIS. Over a 10-year planning period, the Navy proposes to implement actions within the GOMEX Range Complex to meet this need by:

- Maintaining baseline training and RDT&E operations at current levels;
- Adjusting training and RDT&E operations from current levels as necessary to support the Fleet Response Training Plan (FRTP) in furtherance of Title 10 of the U.S.C., Section 5062 (10 U.S.C. 5062), which requires the Navy to be organized, trained, and equipped primarily for prompt and sustained combat incident to the operations at sea; and
- Implementing enhanced range complex capabilities.

Navy training is governed by the FRTP. The FRTP sets a deployment cycle for the Strike Groups that spans three periods: (1) basic, intermediate, and advanced pre-deployment training and certification; (2) deployment; and (3) post deployment sustainment training and maintenance. While several Strike Groups are always deployed to provide a global naval presence, Strike Groups at homebase must be ready to "surge" on short notice in response to directives from the National Command Authority. Surge refers to the capability to quickly deploy Navy assets, sometimes to multiple locations, in response to world events. For the Navy to be "surge-ready," it must be able to quickly modify its routine training schedule to allow for earlier certification of units before deploying them. One objective of the FRTP is to provide this surge capability. The FRTP calls for the ability to train and deploy six Carrier Strike Groups within 30 days following a deployment order and one additional group within 90 days. Planning also includes a surge capability for Surface Strike Groups and Expeditionary Strike Groups.

The proposed action does not indicate major changes to GOMEX Range Complex facilities, operations, training, or RDT&E capacities. Rather, the proposed action would result in relatively small-scale, but critical enhancements to the range complex that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission. The decision-maker will be asked to weigh any potential impacts resulting from this analysis to select the best alternative in order to sustain the Navy's mission.

This chapter is divided into two major subsections: Section 2.1 provides a detailed description of the GOMEX Range Complex. Section 2.2 describes the major elements of the proposed action and describes alternatives to the proposed action, including the No Action Alternative.

2.1 DESCRIPTION OF THE GOMEX RANGE COMPLEX EIS/OEIS STUDY AREA

The geographic scope of this Final EIS/OEIS (referred to from this point forward as the Study Area) includes all components of the GOMEX Range Complex and each OPAREA (as described in Table 1.4-1), including the area from the mean high tide line, up to and extending seaward to each OPAREA's boundary. Figure 1.5-1 depicts the Study Area for this Final EIS/OEIS. The offshore OPAREAs and associated SUA are shown in Figure 2.1-1 through Figure 2.1-3. Land ranges and targets and associated SUA are shown in Figure 2.1-4 (McMullen County Range) and Figure 2.1-5 (Noxubee County Range); and the NSA Panama City Demolition Training Pond is shown on Figure 2.1-6. These OPAREAs, SUA, and land ranges are further described in this section.

2.1.1 GOMEX Offshore OPAREAs

The GOMEX offshore OPAREAs are a set of operating and maneuvering areas with defined ocean surface and subsurface areas described in detail in Table 2.1-1.

TABLE 2.1-1
GOMEX OFFSHORE OPAREAS DESCRIPTIONS

COMPONENT	DESCRIPTION
Offshore Operating Areas – Surface and Subsurface Waters	The surface and subsurface OPAREAs associated with the GOMEX Range Complex cover a combined 17,440 nm^2 of ocean and include the following OPAREAs: - Panama City (Area = 3,084 nm^2 ; Depth = 33 to 984 feet [0 to 0.16 nm]) - Pensacola (Area = 4,882 nm^2 ; Depth = 33 to 6,890 feet [0 to 1.13 nm]) - New Orleans (Area = 2,607 nm^2 ; Depth = 262 to 7,546 feet [.04 to 1.24 nm]) - Corpus Christi (Area = 6,867 nm^2 ; Depth = 66 to 4,593 feet [.01 to 0.76 nm])
Sea Range Instrumentation	RDT&E operations typically occur in the Panama City and Pensacola OPAREAs. The inshore areas within the Panama City OPAREA include non-magnetic areas that have been divided into three sub-areas to provide for the testing of projects in a non-magnetic environment. More information about this instrumentation can be found in the Environmental Impact Statement / Overseas Environmental Impact Statement for NSWC PCD Mission Activities (http://nswcpc.navsea.navy.mil/Environment-Documents.htm).

2.1.2 Special Use Airspace

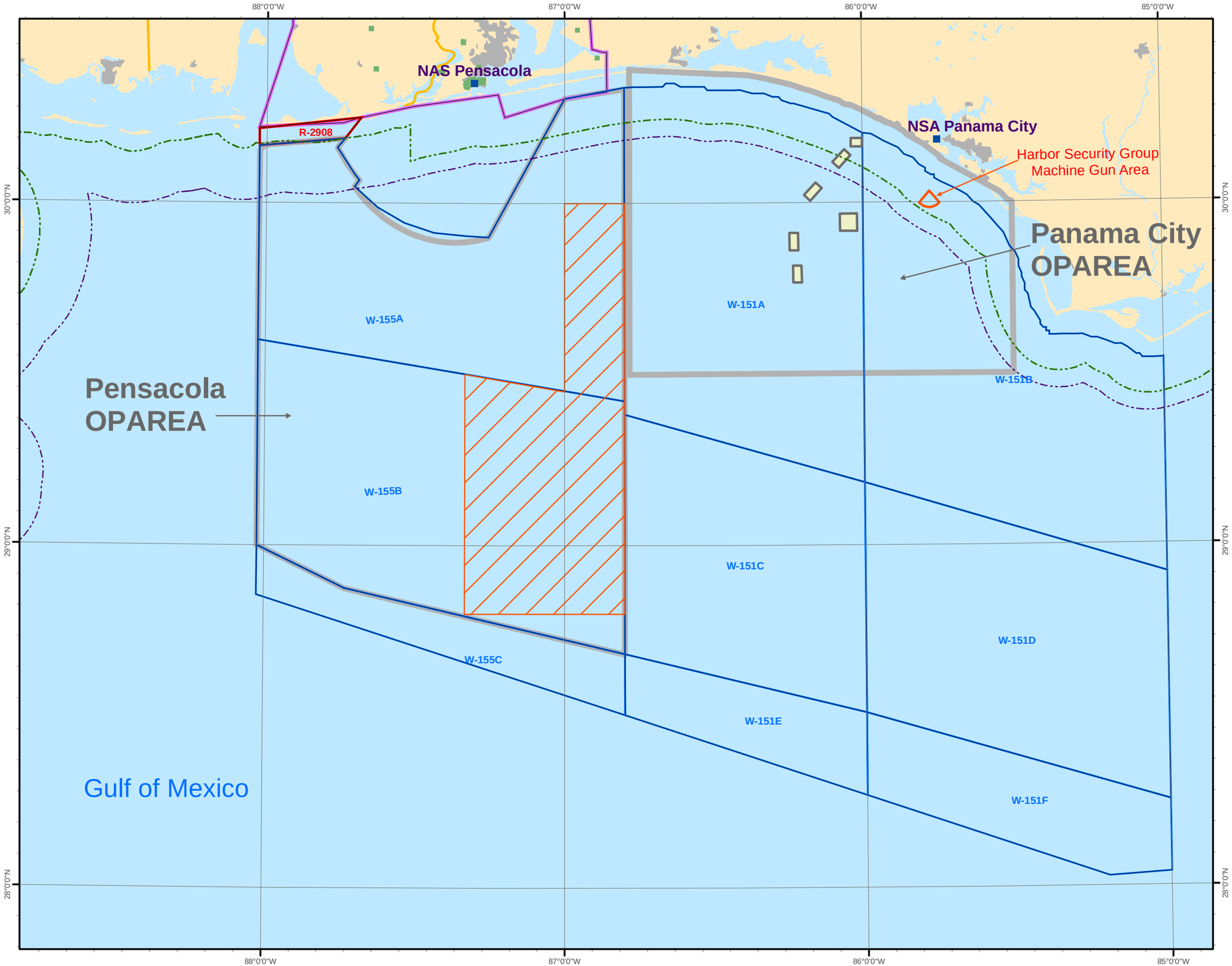
Restricted Airspace and Warning Areas are components of Special Use Airspace and are defined by the Federal Aviation Administration (FAA) as follows (FAA Order 7400.8):

Special Use Airspace: Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not part of those activities.

Restricted Airspace: The flight of aircraft, while not wholly prohibited, is subject to restriction. Restricted Airspace denotes the existence of unusual, often invisible hazards to aircraft (*e.g.*, release of ordnance). Restricted Airspace in the GOMEX Range Complex considered in this Final EIS/OEIS is designated R-4404, R-6312, and R2908. Table 2.1-2 provides further details of these areas.

Military Operating Areas: Military Operating Areas (MOA) are SUA regions typically below 18,000 feet used to separate or segregate certain non-hazardous military flight activities from Instrument Flight Rules traffic and to identify Visual Flight Rules traffic where these activities are conducted. MOAs in the GOMEX Range Complex considered in this Final EIS/OEIS are the Meridian MOAs, Pine Hill MOAs, Pensacola MOAs, Kingsville MOAs, and Brownwood MOAs. Table 2.1-2 provides further details of these areas.

Warning Areas: A warning area is airspace of defined dimensions, extending from 3 nm outward from the coast of the United States, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters, or both. Warning Areas in the GOMEX Range Complex considered in this Final EIS/OEIS are W-151, W-155, W-92, W-54, and W-228. Table 2.1-2 provides further details of these areas.



Panama City and Pensacola OPAREAs and Special Use Airspace

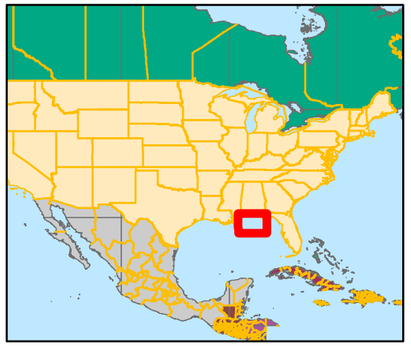
Figure 2.1-1

Legend

- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Eastern GOMEX BOMBEX HotBox
- Panama City Existing MINEX Boxes
  No Action Alternative

Special Use Airspace

- Military Operating Areas (MOA)
- Restricted Airspace (R-)
- Warning Areas (W)
- Operating Areas (OPAREA)



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1:1,189,843

10 5 0 10 20 Nautical Miles

20 10 0 20 40 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources:
National Geospatial Intelligence Agency (NGA) Database;
Special Use Airspace Document AP/1A;
COMLANTFLT 3120.26E Document.

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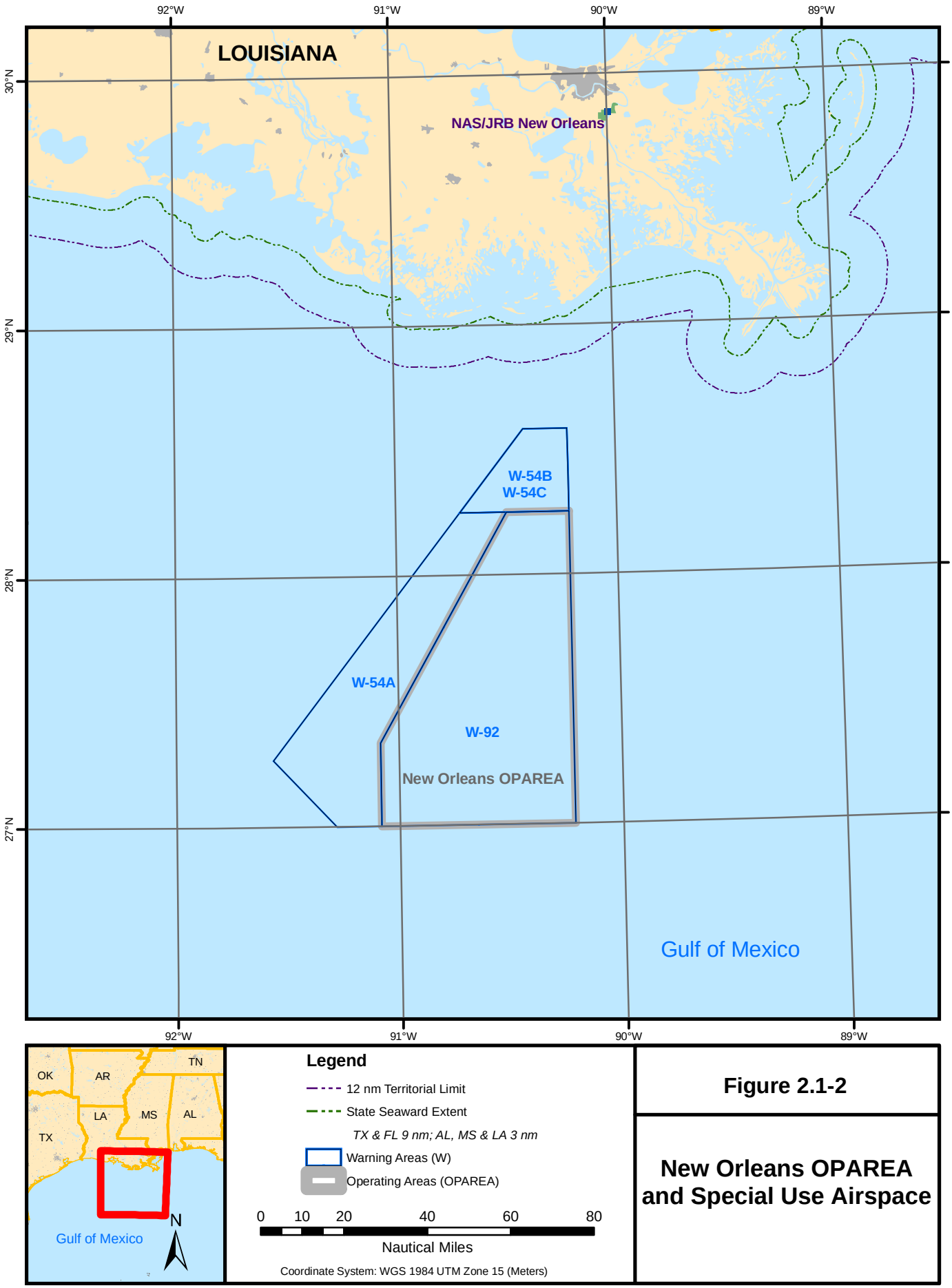
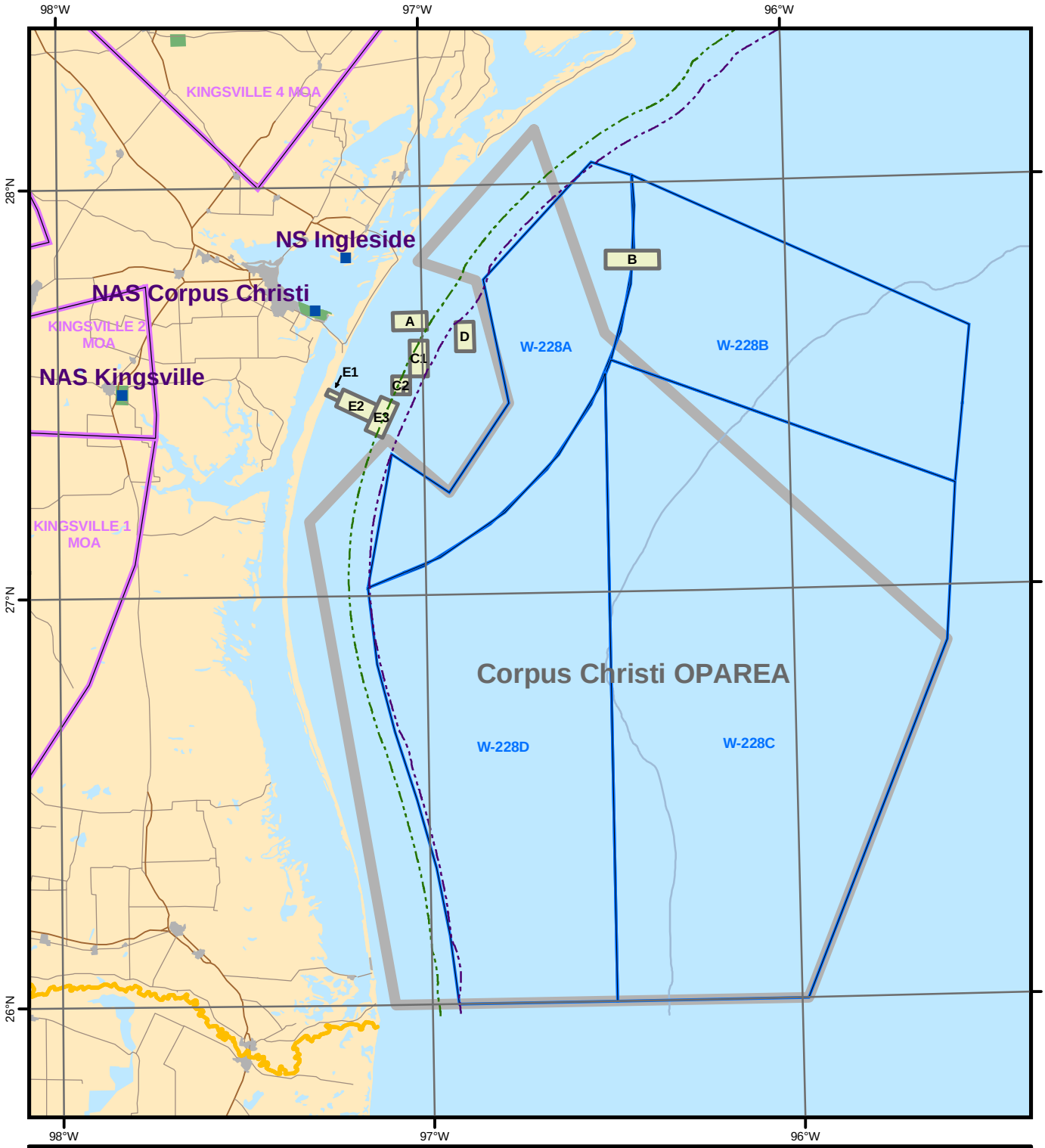


Figure 2.1-2

New Orleans OPAREA and Special Use Airspace



Legend

- Shelf Break
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Corpus Christi MINEX Boxes

Special Use Airspace

- Military Operating Areas (MOA)
- Warning Areas (W)
- Operating Areas (OPAREAs)

0 10 20 40 60
Nautical Miles

Coordinate System: WGS 1984 UTM Zone 14 (Meters)

Figure 2.1-3

Corpus Christi OPAREA and Special Use Airspace

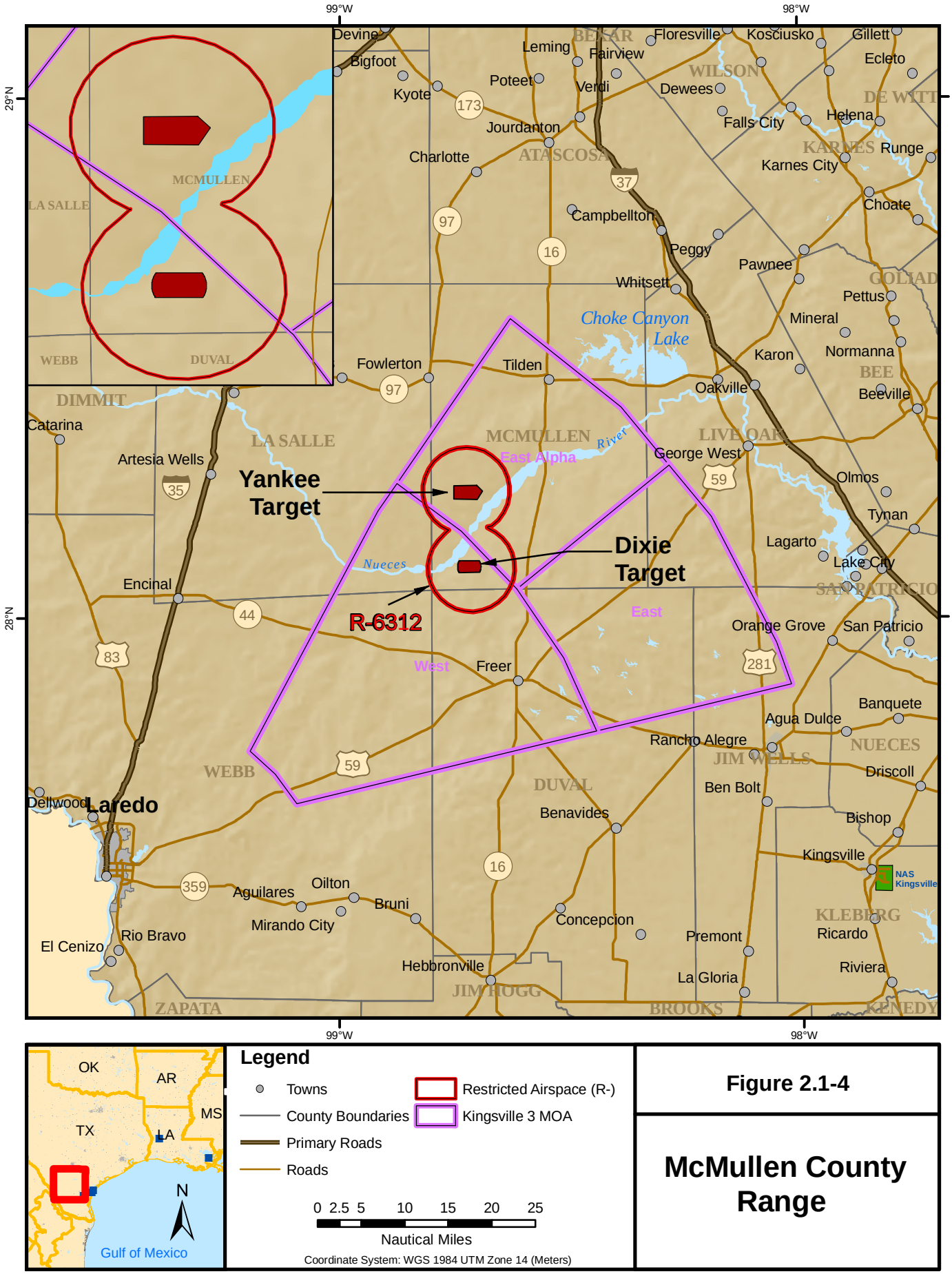
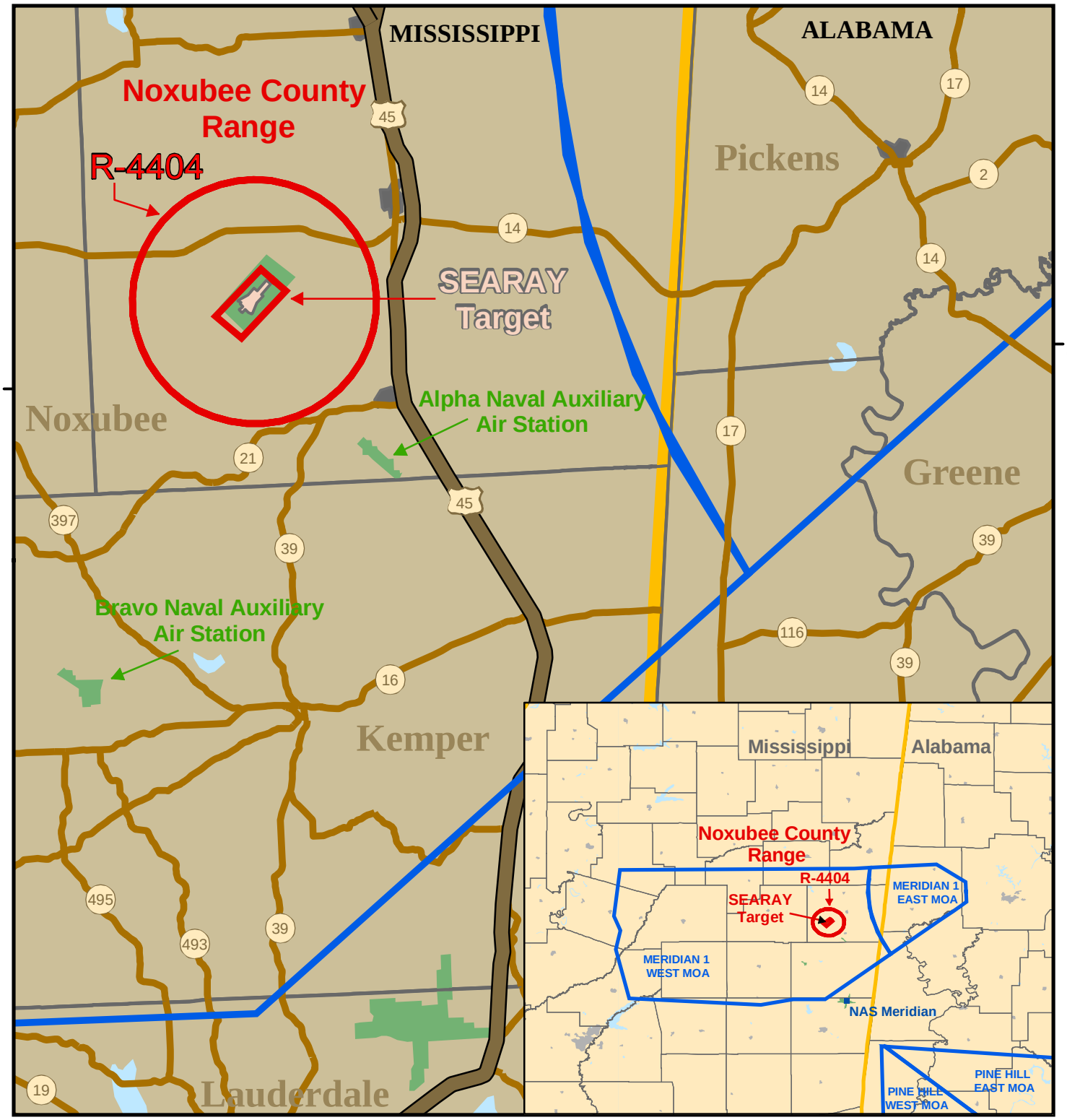


Figure 2.1-4

McMullen County Range



Legend

- Roads
- Primary Roads
- County Boundaries
- Cities
- Military Installations
- SEARAY Target Footprints

Special Use Airspace

- Military Operating Areas (MOAs)
- Restricted Airspace

0 2.5 5 10 15
Nautical Miles

Figure 2.1-5

Noxubee County Range

Coordinate System: WGS 1984 UTM Zone 15 (Meters)

Legend

- NSA Panama City Roads
- Panama City Demo Pond
- NSA Panama City

0 0.25 0.5 1

Nautical Miles

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Figure 2.1-6

NSA Panama City Demolition Pond Area

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TABLE 2.1-2
GOMEX RANGE COMPLEX SPECIAL USE AIRSPACE DESCRIPTIONS

COMPONENT	DESCRIPTION
Offshore Special Use Airspace (SUA) - Warning Areas	Warning Areas of the GOMEX Range Complex are large blocks of SUA generally overlaying particular OPAREAs. Operations conducted in these Warning Areas include all weather flight training, refueling, test flights, bombing, fleet training, independent unit training, ASW, aircraft carrier, ship and submarine operations, and surface gunnery. Conventional ordnance is permitted within designated SUA. The Warning Areas of the GOMEX Range Complex are: W-151A/B/C/D/E/F: Associated with the Panama City OPAREA (area: 2,557 nm^2) W-155A/B/C: Associated with the Pensacola OPAREA (area: 5,434 nm^2) W-92: Associated with the New Orleans OPAREA (area: 2,607 nm^2) W-54A/B/C: Associated with the New Orleans OPAREA (area: 2,237 nm^2) W-228A/B/C/D: Associated with the Corpus Christi OPAREA (area: 7,975 nm^2)
Overland Special Use Airspace	Other SUA within the GOMEX Range Complex, under Navy cognizance, not directly associated with OPAREAs or land areas include: ▪ Meridian 1 East and West MOAs, located 10 nm north of NAS Meridian. Activities conducted in these areas include student pilot training, undergraduate intermediate jet training, undergraduate advanced jet training, and combat search and rescue (CSAR). ▪ Pine Hill East and West MOAs, located 30 nm southeast of NAS Meridian. Activities conducted in these areas include student pilot training, undergraduate intermediate jet training, undergraduate advanced jet training, and CSARs. ▪ Pensacola North MOA, located north of NAS Whiting Field. Activities conducted in Pensacola North MOA include progressive spins, maintenance flights, and standardization flights for fixed-wing aircraft. ▪ Pensacola South MOA, located north of NAS Pensacola. Activities conducted in Pensacola South MOA include progressive spins, maintenance flights, and standardization flights for fixed-wing aircraft. ▪ R-2908, located 3 nm south of the Alabama and Florida shoreline. The Blue Angels Navy Flight Demonstration Squadron is the primary user of this airspace. ▪ The Brownwood MOAs, located 60 nm southwest of NAS JRB Fort Worth. Activities beyond Navy student pilot training include air combat maneuvers (ACM), air intercept control, aerial refueling, and reconnaissance training predominantly by USMC and USAF units based at JRB Ft Worth. ▪ There are five Kingsville MOAs in total. The Navy primarily uses Kingsville 1, 2, and 3 MOAs and occasionally uses Kingsville 4 MOA. The USAF is the primary user of Kingsville 5 MOA. The total area of the MOAs is approximately 12,000 nm^2. Activities conducted in the MOAs include student pilot training, undergraduate intermediate jet training, and undergraduate advanced jet training.

2.1.3 Inland Ranges

The GOMEX Range Complex includes three inland ranges: the McMullen County Range (Texas), Noxubee County Range (Mississippi), and the Western Maneuver Area at the Stennis Space Center (SSC) (Mississippi). The Navy also conducts training at Eglin AFB ranges, located in the Florida panhandle. These ranges provide important training resources for air-to-ground bombing and weapons delivery by naval aircrews, and SOF training. As discussed in Section 1.4, all but the Western

Maneuver Area at the SSC and Eglin AFB ranges will be analyzed in this Final EIS/OEIS. Details of the McMullen County Range and Noxubee County Range are presented in Table 2.1-3.

TABLE 2.1-3
GOMEX RANGE COMPLEX LAND RANGE DESCRIPTIONS

COMPONENT	DESCRIPTION
McMullen County Range	The McMullen County Range is located approximately 65 nm northwest of NAS Kingsville and encompasses an area of 10,625 acres. Most of the range is surrounded by ranch land. The range complex is a day and limited night visual flight rules (VFR) facility composed of two target impact areas (Yankee and Dixie Targets) approximately 15 miles apart. Yankee Target has a day and night VFR target to the north. Dixie Target has a day use only VFR target located to the south. • Yankee Target is located at 28° 15'N, 98° 43'W. It is leased by the Navy, but is maintained by the USAF (i.e., tower and target maintenance). Yankee Target has 19 practice bomb targets, including buses, tanks, convoys, and boxes; three strafe (i.e., for air-to-ground gunfire) targets; and four no-drop heat signature targets. Two mobile threat emitters and surface-to-air missile (SAM) sites are located at the Yankee Target. • The Navy-owned, Dixie Target is located at 28° 06'N, 98° 43'W. This facility consists of one bull's-eye target. NEPM up to 1,000-pound bombs and 2.75-inch rockets are permitted at the McMullen County Range. Airspace above the McMullen County Range is Restricted Airspace R- 6312. R-6312 is comprises two, 5-nm circles centered on Yankee and Dixie Targets. The McMullen County Range and R-6312 are located within the King 3 MOA. King 3 MOA is subdivided into three areas: YankeeTarget, located in King 3 East Alpha; DixieTarget located primarily in King 3 West; and King 3 East. The boundary of restricted areas is within a 5-nm radius about the two points of 28° 15'N, 98° 43'W and 28° 06'N, 98° 43'W.
Noxubee County Range	The Noxubee County Range, which includes the SEARAY Target is located approximately 30 nm northwest of NAS Meridian and encompasses an area of approximately 2,889 acres. This acreage includes a 654-acre impact area, and the Navy also holds easements on a buffer zone consisting of 2,335 acres. The range provides for air-to-ground (A-G) ordnance deliveries using only MK-76 (NEPM). A-G GUNEX is not conducted; however, simulated strafe runs can be performed. Restricted Airspace 4404 (R-4404) is the SUA associated with the SEARAY Target and is divided into three areas: A, B, and C. • R-4404A is located 45 nm north of NAS Meridian within R-4404B. • R-4404B is located 40 nm north of NAS Meridian. Its area is within a 5-nm radius centered on 33° 03' 11"N, 88° 41' 00"W. • R-4404C is located 40 nm north of NAS Meridian. Its area is within a 5-nm radius centered on 33° 03' 11"N, 88° 41' 00"W. Activities conducted in R-4404 include bombing practice, student pilot training, undergraduate intermediate jet training, undergraduate advanced jet training, and CSAR.

TABLE 2.1-3(Continued)
GOMEX RANGE COMPLEX LAND RANGE DESCRIPTIONS

COMPONENT	DESCRIPTION
Land Range Scoring Systems	The GOMEX Range Complex includes instrumentation systems to score weapons training events. Major systems are summarized below: McMullen County Range is the only Navy instrumented air-to-ground range within the GOMEX Range Complex. Weapons Impact Scoring System (WISS) and strafe scoring are available at Yankee Target within the McMullen County Range. At McMullen County Range, scoring is accomplished from two manned towers on each target site. Yankee target scores are given as miss distance in feet and clock position. Dixie target scores are given as miss distance (in feet or meters) and clock position. Scoring is provided for the following events: • Dive bomb/dive toss; • Rocket fire (2.75-inch only); • Low-angle low-drag; • Low-angle bomb; • Strafe (20mm target practice rounds only); and • Level bomb. Joint Advanced Weapon Scoring System (JAWS), including WISS and Improved Remote Strafe Scoring System (IRSSS), provides automatic scoring at Yankee Target. Scoring at Dixie Target is manual/visual only.

2.1.4 NSA Panama City Demolition Pond

The GOMEX Range Complex also includes an interior training area at NSA Panama City, referred to as the Demolition Pond Area. The Demolition Pond Area is a circular water body approximately 282 feet in diameter. The water depth is shallow (ranging from 0-11 feet). Training with small underwater explosive charges is conducted at the pond during daylight hours by a variety of groups, including EOD groups, salvage divers, and security forces. The maximum permitted charge size is 5 lbs net explosive weight (NEW). The Demolition Pond Area is depicted in Figure 2.1-6. The demolition pond current training and proposed operations are further described in Table 2.2-6.

2.2 PROPOSED ACTION AND ALTERNATIVES

National Environmental Policy Act (NEPA) implementing regulations (40 CFR §1502.14) and Navy procedures (32 CFR Part 775) provide guidance on the consideration of alternatives to a federal proposed action and require rigorous exploration and objective evaluation of all reasonable alternatives. Each alternative must be feasible and reasonable in accordance with CEQ regulations (40 CFR Parts 1500-1508) and Navy guidance (32 CFR Part 775). Reasonable alternatives must meet the stated purpose and need of the proposed action in this case and must be practical or feasible. Alternatives outside the scope of what Congress has approved or funded must still be evaluated because the EIS may serve as the basis for modifying the congressional approval or funding in light of NEPA's goals and policies.

2.2.1 Proposed Action

The proposed action is to support and conduct current and potential, emerging training and RDT&E operations in the GOMEX Range Complex. To achieve this, the Navy proposes to:

- Maintain training and RDT&E operations at current levels if the No Action Alternative is selected. Vessel movements related to training are part of the proposed action.

If either Alternative 1 or 2 is selected, then:

- Increase or modify training and RDT&E operations from current level as necessary in support of the FRTP.
- Implement enhanced range complex capabilities.

The decision-maker for this Final EIS/OEIS will decide both the level and mix of training and testing, and range capability enhancements, that best meet Navy requirements within the GOMEX Range Complex. The following sections discuss the alternatives with respect to the components that make up the proposed action.

2.2.2 Alternatives

Alternatives in this Final EIS/OEIS were evaluated to ensure they met the purpose and need, giving due consideration to range complex attributes such as the capability to support current and emerging Fleet tactical training and RDT&E requirements; the capability to support realistic, essential training at the level and frequency sufficient to support the FRTP and Tactical Training Theater Assessment and Planning (TAP) Program; and the capability to support training requirements while following Navy Personnel Tempo of Operations (PERSTEMPO) guidelines[4].

Three alternatives are analyzed in this Final EIS/OEIS and are summarized below:

1) The No Action Alternative – Under the No Action Alternative, training operations and major range events would continue at current levels. Evaluation of the No Action Alternative provides a credible baseline for assessing environmental impacts of Alternative 1 and Alternative 2 (Preferred Alternative);

2) Alternative 1 – No Action Alternative plus: elimination of Mine Warfare training; adjustments to training levels as shown in Tables 2.2-4 through 2.2-6; and implementation of enhancements, as necessary to meet the components of the proposed action. This alternative is composed of all operations currently conducted – the No Action Alternative – with modifications to current training or introduction of new training. Specifically, the training modifications would include:

   a) conducting new training associated with VFA-204 air-to-surface bomb training; and

   b) elimination of mine warfare training (mine countermeasures and mine neutralization) within the GOMEX Range Complex. The proposed range enhancements under Alternative 1 are to use more commercial aircraft to serve as oppositional forces rather than using Navy aircraft for Air Intercept Control Exercises; and

3) Alternative 2 (Preferred Alternative) – Alternative 1 plus: implementation of additional enhancements to enable the Range Complex to meet foreseeable needs, including implementation of the Joint National Training Capability (JNTC) within the GOMEX Range Complex. Unlike Alternative 1, under Alternative 2, the Navy proposes to eliminate the use of High Explosive (HE) bombs during major exercise air-to-surface bombing events. Non-explosive Practice Munition (NEPM) bombs would continue to be used during major exercises, and four HE bombs are proposed to be dropped during unit level training under Alternative 2.

[4] PERSTEMPO is defined by the Navy as time away from homeport, as tracked at the unit level.

2.2.3 No Action Alternative – Description of Current Training Operations within the GOMEX Range Complex

2.2.3.1 Baseline[5] Training Operations

Training operations in the GOMEX Range Complex span from unit level exercises to integrated major range training events. The scope of operations can consist of basic flight instruction or ordnance delivery at land and water targets by a single aircraft, to Joint Task Force Exercises (JTFEX), which may involve thousands of participants over a period of two weeks.

A description of the training operations typically conducted on the GOMEX Range Complex is shown in Table 2.2-1. Each military operation described in this Final EIS/OEIS meets a requirement established by the FRTP. RDT&E events similar to training activities conducted in the GOMEX Range Complex are accounted for in the total events for each warfare area. Training or range enhancements discussed in the GOMEX Range Complex Management Plan (RCMP) (DoN, 2006a) that do not involve environmental resources are not included in the analysis of this Final EIS/OEIS (e.g., range complex staffing plans, range scheduling and data collection systems). Table 2.2-4 provides specific operational data for each range operation listed in Table 2.2-1, including: types of vessel/aircraft (platform) used; numbers of annual events; types and quantities of ordnance used; and training areas where the operation would take place. A more detailed summary of each of the training operations, including vessels, aircraft and weapons systems involved in each event type, and ordnance expended and duration of each event type, is provided in Appendix D.

The level of operations described are derived from data collected during the development of the GOMEX RCMP (DoN, 2006a) as documented in the Operations Data Book (DoN, 2006b), data from the Navy's Target and Range Information Management System, personal interviews with naval operators and subject matter experts, and other operations data logs. The data in Table 2.2-4 are considered to be an accurate representation of the training activities normally conducted within the GOMEX Range Complex and provide the basis for comparing alternatives and potential environmental impacts.

Table 2.2-2 summarizes the portion of major exercises performed in the GOMEX Range Complex. Training events during a Carrier Strike Group (CSG) and Expeditionary Strike Group (ESG) for Composite Training Unit Exercise (COMPTUEX) include many of the same events listed individually in Table 2.2-4, but are conducted together with multiple ships, submarines and/or aircraft versus individually as with ULT. The number of events occurring in the major exercises is accounted for under their corresponding descriptions in Table 2.2-4. Many major warfare area events are performed in major exercises within the GOMEX Range Complex; however, ASW and MIW training using active sonar platforms were analyzed in the Final AFAST EIS/OEIS and summarized in Section 3.20 of this document.

[5] Baseline training refers to typical training that currently occurs in the Range Complex. The numbers of operations in the most recent years were made available through the USFF Live Training Branch.

TABLE 2.2-1
GOMEX RANGE COMPLEX TYPICAL OPERATIONS

Range Operation	Description	Area
MINE WARFARE		
Mine Countermeasures – Airborne	Helicopters, surface and subsurface units detect, identify, classify, mark, disable and/or destroy sea mines using a variety of methods.	Panama City and Corpus Christi OPAREAs
Mine Countermeasures – Surface		
Mine Neutralization – Remotely Operated Vehicle	Helicopters, surface and subsurface units, and EOD personnel identify, evaluate, localize and destroy or render safe sea mines that constitute a threat to ships, landing craft or personnel.	Panama City and Corpus Christi OPAREAs
Mine Neutralization – Explosive Ordnance Disposal		
SURFACE WARFARE		
Bombing Exercise (BOMBEX) Air-to-Surface (A-S)	Fixed wing aircraft deliver bombs against maritime targets.	W-151A/C; W-155B for NEPM bombs; and Pensacola OPAREA Hotbox for HE bombs
Gunnery Exercise (GUNEX) Air-to-Surface	Fixed wing aircraft deliver gunfire against maritime targets.	Pensacola OPAREA Hotbox
GUNEX [Surface-to-Surface (S-S)] – Ship	Surface ships fire main battery guns and crew-served weapons against maritime targets.	W-151A/B; W-155A
GUNEX [Surface-to-Surface (S-S)] – Boat	Small boat gun crews train by firing small arms against surface targets at sea.	Panama City OPAREA and Corpus Christi UNDET BOX E3
Maritime Security (MS) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship; anti-piracy operations; and special operations forces	VBSS/MIO: Crews from Navy surface ships identify, track, intercept, board and inspect foreign merchant vessels suspected of not complying with United Nations/allied sanctions and/or conflict rules of engagement. The boarding party will be delivered from a surface ship via Rubber-hull Inflatable Boat (RHIB) or similar small craft if the target vessel is non-hostile, or via helicopter if hostile. This training event is non-firing. See Appendix D for more descriptions.	W-151; W-155
MS to include VBSS/MIO-Helicopter	Non-firing ULT & major exercise events. Each event involves three helicopters (two at low altitude and one at high altitude) and a target vessel, Navy Special Warfare personnel fast-rope from one helicopter to the target vessel.	W-151; W-155
Small Arms Training-Explosive Hand Grenades	Training with anti-swimmer grenades (MK3A2, 8 oz HE). Not all events use explosive rounds in the exercise.	UNDET Area E3

TABLE 2.2-1 (Continued)
GOMEX RANGE COMPLEX TYPICAL OPERATIONS

Range Operation	Description	Area
AIR WARFARE		
Air Intercept Control	Surface ships vector friendly aircraft to intercept and destroy adversary aircraft.	W-151; W-155
STRIKE WARFARE		
BOMBEX (Air-to-Ground)	Fixed wing aircraft deliver bombs against land targets.	SEARAY Target; Yankee Target; Dixie Target
GUNEX (Air-to-Ground)	Fixed wing aircraft deliver gunfire against land targets.	Yankee Target
AMPHIBIOUS WARFARE		
Firing Exercises (FIREX) –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Surface ships fire main battery guns against land targets in support of military operations ashore. This training is conducted at-sea using a computer simulated land target and a series of buoys that can acoustically score the training event.	W-151A/B; W-155A
ELECTRONIC COMBAT		
Chaff Exercise-Ship Deployed Chaff	Ships deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack.	W-151A/B; W-155A
Chaff Exercise-Aircraft Deployed Chaff	Aircraft deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack.	W-151A/B; Brownwood MOAs
Flare Exercise	Aircraft deploy flares to disrupt infrared guidance systems of threat missiles.	W-151A/B; Brownwood MOAs
MISSION AREA AND UNDERWATER DETONATION TRAINING		
Basic Flight Instruction	Student pilots engage in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No HE weapons are expended during the training.	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312
Salvage Diver Training	Salvage divers train in the use of small underwater charges.	NSA Panama City Demolition Pond
EOD Tech Training	Explosive Ordnance Disposal technicians train in the use of small underwater charges.	NSA Panama City Demolition Pond
Security Force Training	Security Forces train in the detonation of small underwater charges.	NSA Panama City Demolition Pond
Diver Training	Divers train in the use of small underwater charges.	NSA Panama City Demolition Pond

TABLE 2.2-2
MAJOR EXERCISES IN THE GOMEX RANGE COMPLEX

Operation	Warfare Area	Description	Area
Carrier Strike Group (CSG) Composite Training Unit Exercise (COMPTUEX)	Portions of Several Warfare Areas	The CSG COMPTUEX is a major at-sea training event that represents the first time before deployment that an aircraft carrier and its carrier air wing integrate operations with surface and submarine units in an at-sea environment. Training events during a CSG COMPTUEX include many of the same events listed individually in Table 2.2-1, but are conducted together with multiple ships, submarines and/or aircraft versus individually as with Unit Level Training. During a CSG COMPTUEX participants are presented with event-driven mini-battle problems and an event-driven Final Battle Problem. A CSG COMPTUEX typically lasts 21 days, with training events conducted at multiple range complexes and inland ranges; therefore, only a portion of a CSG COMPTUEX would occur in a given range complex. Anti-submarine warfare (ASW) training involving the use of active sonar is analyzed separately in the AFAST EIS/OEIS.	GOMEX OPAREAs and inland ranges
Joint Task Force Exercise (JTFEX)	Portions of Several Warfare Areas	A JTFEX would be scheduled after a CSG COMPTUEX and is an advanced training event that often includes other DoD services and/or Allied forces. Like the CSG COMPTUEX, the JTFEX includes many of the same events listed individually in Table 2.2-1, but are conducted together with multiple ships, submarines and/or aircraft versus individually as with Unit Level Training. Training events in a JTFEX are non-scripted, scenario-driven battle problems that focus on mission planning and strategy, and on the orchestration of integrated maneuvers, communication, and coordination. The Strike Group is presented with a threat-driven scenario involving multiple threats that require advanced target-identification and rules of engagement. A JTFEX typically lasts 10 days, with training events conducted at multiple range complexes and inland ranges; therefore, only a portion of a JTFEX would occur in a given range complex. Like the CSG COMPTUEX, JTFEX events in the GOMEX Range Complex are limited. ASW training involving the use of active sonar is analyzed separately in the AFAST EIS/OEIS.	GOMEX OPAREAs and inland ranges

Under the No-Action Alternative, training operations and major range events would continue at current levels. Under this alternative, the GOMEX Range Complex would not accommodate training level adjustments, and would not implement enhancements identified in the GOMEX RCMP (DoN, 2006a). Evaluation of the No-Action Alternative in this Final EIS/OEIS provides a credible baseline for assessing environmental impacts of Alternative 1 and Alternative 2 (Preferred Alternative).

2.2.4 Alternative 1 – Modify Operational Training and Enhance Range Complex Capabilities

Alternative 1 is a proposal designed to meet Navy and DoD current and near-term operational training and RDT&E requirements. If Alternative 1 were to be selected, in addition to accommodating training operations currently conducted (i.e., those described in the No Action Alternative), training and RDT&E numbers would be adjusted (as shown in Tables 2.2-4 through 2.2-6) and Range Complex capabilities would be enhanced as necessary to meet the components of the proposed action.

2.2.4.1 Proposed Modifications in Training Operations

In addition to maintaining most current levels of operations (the baseline), the Navy proposes to modify certain training events or training support in the GOMEX Range Complex. These include:

Mine Warfare Training Events. Under Alternative 1, mine warfare training events would not occur in the GOMEX Range Complex. Current training events to be eliminated would include airborne mine countermeasures and various types of mine neutralization training events.

Unit Level Air-to-Surface Bombing and Air-to-Surface Gunnery. The Navy proposes to increase certain Bombing Exercises (BOMBEX) (Air-to-Surface) and Gunnery Exercise (GUNEX) (Air-to-Surface) training events conducted in the GOMEX Range Complex. The proposed increase in BOMBEX (A-S) and GUNEX (A-S) training stems from the F/A-18 squadron (VFA-204) requirement for unit level BOMBEX and GUNEX training. The proposed increase in unit level BOMBEX (A-S) by VFA-204 would be in addition to the current BOMBEX (A-S) training already conducted in the GOMEX Range Complex during major training exercises. The proposed increase in unit level training would take place across any season and would involve three types of High Explosive (HE) ordnance. The numbers of events/sorties and the numbers and sizes of the bombs and 20 mm cannon rounds proposed are set forth in Table 2.2-4. The specific location for the proposed increase in unit level BOMBEX (A-S) and GUNEX (A-S) training would be the BOMBEX "Hotbox" located within the Pensacola OPAREA.

Underwater Demolition Training at NSA Panama City Demolition Pond Area. Under Alternative 1, the Navy proposes no increase in training days utilized at the Demolition Pond (See Table 2.2-6). The four groups currently using the Demolition Pond (i.e., divers, explosive ordnance disposal technicians, security forces, and salvage divers) would continue using the Demolition Pond 90 days out of the year. However, these groups train with nearly four dozen different types of charges ranging in size from less than an ounce to five pounds (Note: in no case, would a single charge used be greater than 5 lbs net explosive weight [NEW]). Under Alternative 1, the mix and weights of the charges would change from the current mix and weight, but the overall weight (on a yearly basis) of explosives is expected to remain similar to or decrease slightly from current levels. Appendix D contains the details of all the charges used at the Demolition Pond, including: name, Navy Ammunition Logistic Code (NALC), description, and NEW.

Conduct Maritime Security (MS) Surge Surface Strike Group (SSG) (Independent Deployment) Training. Maritime Security Surge operations are addressed in the FRP, and are in turn discussed in this document to ensure that our ability to respond to emergent requirements, such as the rise in piracy and the global war on terrorism, is maintained. The Navy proposes to use GOMEX Range Complex for preparing surface ships and embarked air, special forces and Marine Corps units for deployment as MS SSGs. The Global War on Terror brought increased requests from US combatant commanders for rapid short-term Navy support for contingencies such as maritime security, maritime interception, homeland defense, information operations and special operations. Quite often, groups smaller than CSGs or ESGs can adequately respond to these contingencies if properly configured and trained.

Each fleet maintains a number of ships ready to deploy on short notice. After receiving a request, it can tailor a one to three ship MS SSG, also referred to as Independent Deployers, from among these 'surge-capable units' that can best accomplish the mission. Preparing these Independent Deployers includes a mix of classroom, synthetic and live training events. Live training ensures proficiency in multi-unit procedures and autonomous operations by means of anticipated region-specific scenarios. It should be noted that the description of MS SSG training is anticipated, but the Navy does not expect MS SSG training to significantly alter the overall type and quantity of operations currently conducted in the GOMEX Range Complex.

2.2.4.2 Proposed Enhancement to Range Complex Capabilities

Commercial Air Services Support for Fleet Opposition Force & Electronic Warfare (EW) Threat Training. The Navy proposes to increase the number, type and operation of Commercial Air Services within the GOMEX Range Complex. These contractor-owned and operated supersonic and subsonic aircraft carry a variety of electronic threat emitters, perform aircraft maneuvers and flight profiles that mimic enemy aircraft, and provide air-to-air refueling capabilities. Their use enhances the following range capabilities:

1) Opposition Force (OPFOR) aircraft against naval aircraft and ships in air defense events (Air Intercept Control [AIC]), and sometimes intercept aircraft for AIC events;
2) Threat missile and aircraft profiles against naval aircraft and ships in electronic combat events;
3) Refueling tanker support during major exercises.

Increased use of Commercial Air Services to support fleet training would not increase aircraft numbers, emissions, time spent in the warning areas, or alter current airspace usage. Rather, Commercial Air Services would displace fleet assets now used to support fleet training events listed in Table 2.2-3, and greatly increase the overall quality of fleet training by making it a dedicated mission in specially equipped aircraft for the Commercial Air Services aircrew.

TABLE 2.2-3
TRAINING ELEMENTS SUPPORTED BY COMMERCIAL AIR SERVICES

Training Event	No Action Alternative Sorties/Events	Alternative 1 Proposed Sorties/Events	Alternative 2 Proposed Sorties/Events
Chaff Exercise	368	368	368
Air Intercept Control	40	40	40

2.2.5 Alternative 2 – Modify Operational Training and Implement Additional Enhancements (Preferred Alternative)

Alternative 2, the Preferred Alternative, includes implementation of many of the elements of Alternative 1, and an increase in post-BRAC Gulf-based (F-18 and E-2) operations and transient Navy participation in Navy or joint training opportunities afforded by proximity to the Army's Joint Readiness Training Center (JRTC) and its Joint National Training Capability (JNTC) infrastructure. As with Alternative 1, training events would be adjusted as shown in Tables 2.2-4 through 2.2-6. Moreover, like Alternative 1, Alternative 2 includes the commercial air services range training enhancement. Furthermore, Alternative 2 includes the elimination of High Explosive (HE) bombs used during major exercise BOMBEX (A-S) training.

The Army's Joint Readiness Training Center (JRTC) in the southeast U.S. is located on their 198,000 acre installation at Ft Polk, Louisiana. The JRTC is one of the three centers that conduct tough, realistic, multi-echelon, joint and combined arms training to train leaders to deal with complex situations and develop highly proficient, cohesive units capable of conducting operations across the full spectrum of conflict. Combat battalions and their command staffs' obtain their most sophisticated and realistic training at the JRTC prior to deployment to combat zones overseas.

Networking the JRTC at Ft Polk with military activities throughout the Gulf region, and nationally, the JNTC provides units with the capability to train as a part of a large, multi-platform group while saving time, manpower, and additional costs. It constructs the battle problem with a mix of live (real personnel and equipment participating), virtual (*e.g.*, aircrew in full motion simulators at a training facility), and constructive elements ('scripted' items introduced into the battle problem by the training staff). For example, a convoy commander in a live battle problem at Ft Polk can, via the JRTC, call for supporting

fire from an Air Force gunship, the crew of which 'seeing' the same tactical situation, but actually in a mission trainer cab on the ground at Hurlburt Field in Florida. The soldiers in Ft Polk will have an honest simulation of the effectiveness of their employment of the gunship, the gunship crew will have a valuable training experience working with an Army unit 'engaging' the enemy.

The Navy is a participant in the JNTC through its Joint Training and Experimentation Network (JTEN). Navy E-2s and F-18s from NAS JRB New Orleans can participate in the battle problems underway at Fort Polk while over the Gulf of Mexico. The locations of Fort Polk and the Western Maneuver Area at the Stennis Space Center are shown on Figure 1.1-1.

As mentioned earlier, one of the chief differences between Alternative 1 and Alternative 2 is the reduction in HE bombs used during BOMBEX (A-S) training under Alternative 2. Under the proposed Alternative 2, no HE bombs would be used during BOMBEX (A-S) training during major exercise events. Under Alternative 2, VFA-204 would still conduct one BOMBEX (A-S) unit level training event per year with HE bombs within the proposed Hotbox. BOMBEX (A-S) training would still occur under Alternative 2, but most of the ordnance used would be non-explosive practice munitions (NEPM). The total number of bombs proposed to be dropped at sea under Alternative 2 would increase over baseline levels, but the total number of HE bombs would decrease in comparison to baseline levels. The details of the differences in BOMBEX (A-S) training are set forth in Table 2.2-4. The targets for the proposed BOMBEX (A-S) training are MK-58 marine markers. The proposed location for the BOMBEX (A-S) training is the hotbox identified in Figure 2.1-1.

If the Preferred Alternative were to be selected, all components of the proposed action (*i.e.*, increase in training and RDT&E operations, and implementation of enhancement recommendations) would be achieved based on the goal of meeting the purpose and need of the proposed action to the maximum extent possible by optimizing training throughput to support future contingencies.

2.2.6 Summary of Operational Parameters for all Alternatives

The Navy's proposed training operations data for the No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) are presented in Table 2.2-4 (Primary Warfare Area Training Events), Table 2.2-5 (Basic Flight Instruction and Mission Area Training), and Table 2.2-6 (Demolition Pond). The No Action Alternative data are based on numbers of events and sorties currently performed on a yearly basis with the incorporation of data to allow for the surging of operations in time of need.

A brief description of each range operation, along with general information regarding location of the operations was provided in Table 2.2-1. Table 2.2-4 summarizes additional details for each operation, including vessel/aircraft (platform); types and annual quantities of ordnance used; and the location where the operation would take place.

Refer to Figure 1.1-1 for the graphical depiction of the SUA locations. Table 2.2-5 summarizes the existing and proposed basic flight training and mission area flight training conducted in GOMEX Range Complex SUA. As shown in the table, no increase in flight training is proposed under any alternative.

Table 2.2-6 summarizes the annual activity at the Demolition Pond. As illustrated in the table, the salvage diver training is conducted 60 days/year, EOD technician training is conducted 12 days/year, security forces training is conducted eight days/year, and diver training is conducted eight days/year. A variety of small charges are used in the training. These are further described in Appendix D. Refer to Figure 2.1-6 for the graphical depiction of the Demolition Pond.

Tables 2.2-7, 2.2-8, and 2.2-9 summarize data from Table 2.2-4 for purposes of the environmental analysis presented in Chapter 3. Table 2.2-7 summarizes the Navy operations that may be considered potential stressors to the marine and terrestrial environment and compares the levels of these operations

for each of the three proposed alternatives based on data presented in Tables 2.2-4 through Table 2.2-6. Table 2.2-8 summarizes the various ordnance types for each training area within the Study Area. The table compares numbers of rounds for the three alternatives. Table 2.2-9 lists the in-water explosive ordnance proposed for each alternative by training area per year (NOTE: The ordnance used at the NSA Panama City Demolition Pond is set forth in its own table in Appendix D).

2.2.7 Alternatives Considered but Eliminated from Further Analysis

The following alternatives were considered, but do not meet the purpose and need.

2.2.7.1 No Training Alternative

If the Navy did not conduct training exercises in the GOMEX Range Complex, it would not be able to meet its obligations, as identified in Title 10 United States Code, Section 5062, which requires the Navy to be "organized, trained, and equipped primarily for the prompt and sustained combat incident to operations at sea." Without proper training, U.S. combat forces would not be capable of deploying at a level of readiness necessary to respond to "real world" contingency situations as have recently occurred in the eastern Mediterranean and the Arabian Sea, or potential future threat situations in the China Sea and Sea of Japan. Additionally, RDT&E supports the Title 10 mandate because it provides the Navy the capability of developing weapon systems and ensuring their safe and effective implementation for the Atlantic Fleet. For these reasons, an alternative that would decrease military training from current levels or eliminate training altogether would not meet the purpose and need of the proposed action. Therefore, in accordance with CEQ guidance, the No Action Alternative as used in this Final EIS/OEIS refers to no change from current levels of training and testing. An alternative whereby the Navy would not conduct training exercises along the East Coast has been eliminated from further consideration in this Final EIS/OEIS.

2.2.7.2 Alternative Range Complex Locations

No single range complex can accommodate the entire spectrum of Navy and Marine Corps training and testing. To maintain a high level of combat readiness for naval forces at best value to the U.S. taxpayer, the Navy and Marine Corps homeported their forces in multiple concentration areas rather than a single area, in part to ensure the surrounding training and testing areas could support their specific needs. The result is a system of range complexes, each optimized to support the limited set of warfare areas that predominate in that locale. Taken as a whole, this system of ranges provides a robust training and testing capability for all naval warfare missions, but no one range complex can cover them alone.

As discussed in Paragraph 1.2.1.2, naval forces need to train for a wide variety of operations conducted on and below the ocean surface, on land and in the air. Beyond these broad categories, the Navy needs access to training areas with some very specific attributes. For example, the wide variety of Navy and Marine Corps mission areas calls for an equally wide variety of very different land ranges. Amphibious training requires a military beach that opens directly to maneuver areas and live fire ranges. Aircraft strike training requires an array of air-to-ground bombing ranges, each overlaid with special use airspace that separates military aircraft and ordnance from civil aircraft. Small boat riverine operations need a stretch of inland water adjacent to land targets suitable for live fire. Again, no single range complex on the east coast or in the Gulf has all the geographic attributes required to support the entire spectrum of Navy and Marine Corps training and testing.

A second consideration is that there are two broad levels of training that differ in complexity and requirements: Unit Level Training and Major Exercises. Generally, these two levels of training differ in their requirements for the size of the training area and sophistication of range support.

Unit Level Training (ULT). As discussed in Paragraph 1.2.1.3, high volume, short duration training exercises by individual ships and aircraft characterize ULT. The size of the training area is relatively smaller and range support requirements not as great as with large scale major exercises. In fleet concentration areas, backyard ranges best meet these needs. Backyard ranges are training or testing areas close enough to base that an aircraft can launch from its home airfield, conduct its mission, and return to base during a single sortie. For a surface ship or submarine, the backyard range is the ocean operating area just outside its homeport where it can conduct an array of ULT events on a one or two-day underway period. To displace training and testing areas for ULT events beyond the geographic reach of a backyard range would require thousands of sailors and marines to deploy for even the simplest training, incurring an inordinate expense, both in cost and time away from home, and would quickly degrade the combat readiness of the entire fleet.

Major Exercises. USFF conducts six to eight large scale major exercises (JTFEX/COMPTUEX) every year. Each involves thousands of participants, multiple ships and aircraft, and elaborate range support requirements over a period of one to four weeks. Ideally, the venue for a major exercise would not require more than a couple days transit time for most participants. Of greater importance is access to large, relatively unencumbered ocean operating areas, multiple strike targets, and specialized range attributes to support the battle scenario such as a large military beach, opposition forces, and/or electronic combat simulators. No single range complex offers the whole package of range attributes to adequately support all major exercises from start to finish.

The GOMEX Range Complex possesses a number of features that make it an indispensable component of the Navy's system of ranges.

- Favorable national airspace allocations have encouraged CNATRA to train its pilots within the GOMEX Range Complex SUA. A training aircraft taking off from NAS Kingsville, NAS Meridian, or NAS Whiting Field can easily access on-shore or offshore training special use airspace without traversing or interrupting the extremely busy commercial jetways.
- Similarly, easy access to offshore special use airspace, sea surface, and subsurface space, and proximity to NSA Panama City has resulted in the Navy RDT&E community to concentrate its gulf coast testing in the northeastern portion of the GOMEX Range Complex.
- Fair weather in the winter months and large conventional ordnance training ranges at Eglin Air Force Base offer alternatives for East Coast Carrier Strike Group and Expeditionary Strike Group training.

Over the years, a commercial/industrial/government support base and regulatory framework developed alongside these investments that are now mutually supporting. Also, the Navy negotiated important agreements and established standard operating procedures (SOP) and safety processes. Examples include Memorandums of Agreement between the Navy and the FAA regarding safe control and routing of aircraft, as well as lease agreements between the Navy and states/Non-Governmental Organizations regarding the use of land for military training purposes. In today's fiscal and regulatory environment, replicating these capabilities in a different location is not realistic.

In summary, the GOMEX Range Complex is a vital component of the Atlantic Fleet system of range complexes, necessary and critical to ensure that naval forces are prepared and certified ready for overseas deployment and combat operations. Other locations do not provide comparable features (*e.g.*, proximity to the Army's Joint Regional Training Center) and, as a result, were eliminated from further consideration.

2.2.7.3 Conduct Simulated Training Only

Under this alternative, only simulated training would be conducted using computer models and classroom training. While computer simulation and classroom training are extensively used by the Navy and are effective training tools, they cannot exclusively replace live training because they do not replicate the atmosphere or experience that live training provides. The experience of live training provided by actually flying an aircraft, operating a combat system such as a shipboard gun, or handling explosive ammunition, simply cannot be replicated through simulation, particularly as it relates to the physiological (physical and emotional) reaction invoked by the power, noise, and visual effects associated with these systems. Crews need live training aboard their own ships and aircraft to have full confidence in the actual systems they maintain and with which they will be going into combat. Live training reduces future accidents which may result from the lack of live training experience. The live training environment provides the necessary opportunity to operate with multiple external variables.

Additionally, simulation cannot replicate the environment provided during coordinated training and major exercises, where multiple ships, submarines and aircraft, and hundreds or thousands of men and women are participating in training activities in a coordinated fashion to accomplish a common military objective. Strike Groups must be able to practice and hone their skills in communication, maneuvering, operating systems, repairing equipment, and firing weapons in an environment that is as realistic, and replicates the high energy and stress of what they would encounter in an actual combat situation. Because of the need to "train as we fight," this alternative would fail to meet the purpose and need of the proposed action in that it would not sufficiently prepare naval forces for combat. Therefore, this alternative is not evaluated in this Final EIS/OEIS.

2.2.7.4 Non-Explosive, Practice Munitions Use

An alternative that would rely entirely on non-explosive practice munitions (NEPM) use within the GOMEX Range Complex would not achieve the necessary levels of proficiency in firing weapons in a high stress and realistic environment. NEPM is utilized throughout the GOMEX Range Complex, and provides opportunity to implement a successful, integrated training program while reducing the risk and expense typically associated with live ammunition. As such, NEPM is already utilized extensively to enhance combat performance in the Navy's training program. However, while it is an essential component of training, NEPM cannot be used exclusively to train safely for an inherently unsafe combat environment. Consequently, this alternative fails to meet the purpose and need of the proposed action. Therefore, this alternative was not carried forward for analysis.

TABLE 2.2-4
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance[6]	No Action Alternative	Alternative 1	Alternative 2	Training Area
Mine Warfare						
Mine Countermeasures – Airborne (AMCM)	MH-53	MK-103 mechanical sweep MD54 NEW (.002 lb/shot)	10 sorties	0 sorties	0 sorties	Corpus Christi OPA REA Figure 2.1-3
	MH-53		10 sorties	0 sorties	0 sorties	Panama City OPA REA Figure 2.1-1
Mine Countermeasures – Surface (SMCMEX)	MCM	AN/SLQ-38 Mechanical Sweep MD54 NEW (.00514 lb/shot)	12 events	0 events	0 events	Corpus Christi OPA REA Figure 2.1-3
	MCM		12 events	0 events	0 events	Panama City OPA REA Figure 2.1-1
Mine Neutralization – Surface – Remotely Operated Vehicle (ROV)	MCM	AN/SLQ-48 (MP1) MD54 NEW (.00514 lb/shot)	14 events	0 events	0 events	Corpus Christi OPA REA Figure 2.1-3
	MCM		14 events	0 events	0 events	Panama City OPA REA Figure 2.1-1
	MCM	AN/SLQ-48 (MP2) (20 lb charges)	8 events	0 events	0 events	Corpus Christi OPA REA Figure 2.1-3
	MCM		8 events	0 events	0 events	Panama City OPA REA Figure 2.1-1

[6] Shaded cells indicate explosive ordnance.

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Training Area
Mine Neutralization – Surface – Remotely Operated Vehicle (ROV) (Cont)	MCM	AN/SLQ-48 (MP3) (20 lb charges)	8 events	0 events	0 events	Corpus Christi OPA REA Figure 2.1-3
	MCM		8 events	0 events	0 events	Panama City OPA REA Figure 2.1-1
Mine Neutralization (EOD)	EOD	5 lb charges 10 lb charges 20 lb charges	13 events (5 lb) 3 events (10 lb) 2 events (20 lb)	0 events	0 events	Panama City OPA REA Figure 2.1-1
	EOD		14 events (5 lb) 31 events (10lb) 2 events (20 lb)	0 events	0 events	Corpus Christi OPA REA Figure 2.1-3
Surface Warfare						
Bombing Exercise (BOMBEX) (Air-to-Surface)[7]	F/A-18 during major exercises	MK-82/GBU-30/38 (500 lb HE bomb)[8]	5 events (20 bombs)	5 events (20 bombs)	0	W-155 Hotbox Pensacola OPA REA
		MK-83/GBU-32 (1,000 lb HE bomb)[7]	4 events (16 bombs)	4 events (16 bombs)	0	
		MK-82(I), BDU-45 (500 lb NEPM)[7]	6 events (24 bombs)	6 events (24 bombs)	11 events (44 bombs)	W-151 A/C; W-155B
		MK-76 (I) (25 lb NEPM)[9]	14 events (140 bombs)	14 events (140 bombs)	14 events (140 bombs)	
		MK-83 (I) (1,000 lb NEPM)[7]	0	0	4 events (16 bombs)	

[7] Targets are typically smoke floats. An event consists of one or more aircraft dropping one or more bombs on a target in closely timed intervals.
[8] Event = a flight of 2 F/A-18s, each dropping 2 bombs
[9] Event = a flight of 2 F/A-18s, each dropping 5 bombs

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Training Area
Bombing Exercise (BOMBEX) (Air-to-Surface)[10]	F/A-18 with Laser Targeting	MK-82 (500 lb HE bomb)[7]	2 events (8 bombs)	2 events (8 bombs)	0	W-155 Hotbox Pensacola OPAREA
		MK-83 (1,000 lb HE bomb)[7]	2 events (8 bombs)	2 events (8 bombs)	0	
		MK-82(I), BDU-45 (500 lb NEPM)[7]	4 events (16 bombs)	4 events (16 bombs)	6 events (24 bombs)	W-151 A/C; W-155B
		MK-83(I) (1,000 lb NEPM)[7]	0	0	2 events (8 bombs)	
	F/A-18 VFA-204 unit level training	MK-82 (500 lb HE bomb)[7]	0	20 events (80 bombs)	0	W-155 Hotbox Pensacola OPAREA
		MK-83 (1,000 lb HE bomb)[7]	0	5 events (20 bombs)	1 event (4 bombs)	
		MK-84/GBU-31 (2,000 lb HE bomb)[11]	0	3 events (3 bombs)	0	
		MK-82(I), BDU-45 (500 lb NEPM)[7]	0	0	20 events (80 bombs)	W-155B
		MK-83(I) (1,000 lb NEPM)[7]	0	0	5 events (20 bombs)	
		MK-84(I) (2,000 lb NEPM)[9]	0	0	3 events (3 bombs)	

[10] Targets are typically smoke floats. An event consists of one or more aircraft dropping one or more bombs on a target in closely timed intervals.
[11] Event = a flight of 1 F/A-18, dropping 4 bomb

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance[12]	No Action Alternative	Alternative 1	Alternative 2	Training Area
GUNEX (Air-to-Surface)	F/A-18	20 mm cannon	0	40 sorties (24,000 rounds)	40 sorties (24,000 rounds)	W-155 Hotbox Pensacola OPAREA
GUNEX (Surface-to-Surface) (Ship)	CG, DDG[13]	5- inch gun	8 events (400 rounds)	8 events (400 rounds)	8 events (400 rounds)	W-151 A/B W-155A Figure 2.1-1
	FFG[14]	76 mm gun	8 events (40 rounds)	8 events (40 rounds)	8 events (40 rounds)	
	CG, DDG, FFG[15]	Crew-served weapon (CSW) machine gun (.50 cal); M16 (5.56 mm)	8 events (2,400 rounds)	8 events (2,400 rounds)	8 events (2,400 rounds)	
		CIWS (BLK 1B) 20 mm	8 events (6,400 rounds)	8 events (6,400 rounds)	8 events (6,400 rounds)	
		25 mm machine gun	8 events (1,600 rounds)	8 events (1,600 rounds)	8 events (1,600 rounds)	
GUNEX (Surface-to-Surface) (Boat)	Vessels such as, combat rubber raiding craft, rigid hull inflatable boats, and patrol craft	7.62 mm machine gun	2 events (16,000 rounds)	2 events (16,000 rounds)	2 events (16,000 rounds)	Panama City OPAREA
		7.62 mm machine gun (A131)	4 events (11,200 rounds)	4 events (11,200 rounds)	4 events (11,200 rounds)	Corpus Christi UNDET Box E3

[12] Shaded cells indicate explosive ordnance.
[13] Targets: High Speed Maneuvering Surface Target, MK-33 SEPTAR, trimaran or radar reflective surface balloon (killer tomato)
[14] High Speed Maneuvering Surface Target or radar reflective surface balloon (killer tomato)
[15] Targets: 55-gallon drum, balloon (weather, Mylar, or target) or FAST

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance[16]	No Action Alternative	Alternative 1	Alternative 2	Training Area
GUNEX (Surface-to-Surface) (Boat) (Cont)		.50 cal gun (A555)	4 events (10,000 rounds)	4 events (10,000 rounds)	4 events (10,000 rounds)	
		40 mm gun (B576)	4 events (2,880 rounds)	4 events (2,880 rounds)	4 events (2,880 rounds)	
Small Arms Training – Explosive Hand Grenades	Maritime Expeditionary Support Group (Various Small Boats)	MK3A2 grenades[17]	6 events (20 grenades)	6 events (20 grenades)	6 events (20 grenades)	UNDET Area E3
Maritime Security Operations to include VBSS/MIO- Ship	Rigid Hull Inflatable Boat (RHIB) or smaller boat and CG, DDG, FFG, LPD, or LSD	No ordnance used	36 events	36 events	36 events	W-151, W-155
Maritime Security Operations to include VBSS/MIO- Helicopter	MH-60 and CG, DDG, FFG, LPD, or LSD	No ordnance used	18 events	18 events	18 events	W-151, W-155

[16] Shaded rows include explosive ordnance proposed.
[17] An individual event can include detonation of up to 10 live grenades, but no more than 20 live grenades will be used per year.

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance[18]	No Action Alternative	Alternative 1	Alternative 2	Training Area
Air Warfare						
Air Intercept Control[19]	F/A-18; E2-C	N/A	40 sorties	40 sorties	40 sorties	W-151; W-155 Figure 2.1-1
Strike Warfare						
BOMBEX (Air-to-Ground)	T-45	MK-76 (25 lb NEPM bomb) and BDU-33 NEPM bomb	12,800 sorties (17,640 MK-76 bombs and 3,405 BDU-33 bombs)	12,800 sorties (17,640 MK-76 bombs and 3,405 BDU-33 bombs)	12,800 sorties (17,640 MK-76 bombs and 3,405 BDU-33 bombs)	SEARAY Target Figure 2.1-5
	T45, F-16	MK-76 (25 lb NEPM bomb)	306 sorties (1,433 bombs)	306 sorties (1,433 bombs)	306 sorties (1,433 bombs)	Dixie Target Figure 2.1-4
BOMBEX (Air-to-Ground) (cont)	F-16, F-15, T-38, T-45	BDU-33 (NEPM bomb) and MK-82 (500 lb NEPM bomb)	489 sorties (2,400 BDU-33 bombs) and (236 MK-82 bombs)	489 sorties (2,400 BDU-33 bombs) and (236 MK-82 bombs)	489 sorties (2,400 BDU-33 bombs) and (236 MK-82 bombs)	Yankee Target Figure 2.1-4
Gunnery Exercise (Air-to-Ground)	F-16, F-15	20 mm cannon	163 sorties (25,000 rounds)	163 sorties (25,000 rounds)	163 sorties (25,000 rounds)	Yankee Target Figure 2.1-4

[18] Shaded rows include explosive ordnance proposed.
[19] AIC can have 2-6 aircraft per intercept; for purposes of analysis, used 4 aircraft per intercept

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance[20]	No Action Alternative	Alternative 1	Alternative 2	Training Area
Amphibious Warfare						
Firing Exercise (FIREX) with IMPASS	CG, DDG	5-inch gun (IMPASS)	8 events (800 NEPM rounds)[21]	8 events (800 NEPM rounds)	8 events (800 NEPM rounds)	W-151A/B W-155A Figure 2.1-1
Electronic Combat						
Chaff Exercise	F/A-18	RR-144A/AL; RR-129A/L	368 sorties (3,680 cartridges)[22]	368 sorties (3,680 cartridges)	368 sorties (3,680 cartridges)	W-151 A/B; Figure 2.1-1
	F-18 (USMC), F-16 (USAF)	R-188	980 sorties[23] 5,000 cartridges	980 sorties 5,000 cartridges	980 sorties 5,000 cartridges	Brownwood MOAs
	CG, DDG, FFG	MK-214 (seduction chaff)	10 events (60 cartridges)[24]	10 events (60 cartridges)	10 events (60 cartridges)	W-151 A/B; W-155A Figure 2.1-1
	CG, DDG, FFG	MK-216 (distraction chaff)	4 events (24 cartridges)[25]	4 events (24 cartridges)	4 events (24 cartridges)	W-151 A/B; W-155A Figure 2.1-1

[20] Shaded rows include explosive ordnance proposed.
[21] 100 rounds per event
[22] 10 cartridges per sortie
[23] The sorties number is a total of all Navy, Air Force and Marine Corps sorties and is the same as that listed in Table 2.2-5 for the Brownwood MOAs. Not all of these sorties involve chaff expenditure. Chaff expenditure is by USAF and USMC only in the Brownwood MOAs.
[24] 6 cartridges per event
[25] 6 cartridges per event

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE GOMEX RANGE COMPLEX STUDY AREA

Range Operation	Platform	System or Ordnance[26]	No Action Alternative	Alternative 1	Alternative 2	Training Area
Flare Exercise	F/A-18	MJU-8A/B; MJU-27 A/B; MJU-32B; MJU-53B; SM-875/ALE	368 sorties (1,840 flares)[27]	368 sorties (1,840 flares)	368 sorties (1,840 flares)	W-151 A/B Figure 2.1-1
	F-18 (USMC), F-16 (USAF)	M-206, MJU-7	980 sorties[28] 11,930 canisters	980 sorties 11,930 canisters	980 sorties 11,930 canisters	Brownwood MOAs

[26] Shaded rows include explosive ordnance proposed.
[27] 5 flares per sortie
[28] The sorties number is a total of all Navy, Air Force and Marine Corps sorties and is the same as that listed in Table 2.2-5 for the Brownwood MOAs. Not all of these sorties involve flare expenditure. Flare expenditure is by USAF and USMC only in the Brownwood MOAs.

TABLE 2.2-5
CURRENT AND PROPOSED BASIC FLIGHT INSTRUCTION AND MISSION AREA TRAINING

		Annual Sortie Numbers			
Range Operation	**Platform**	**No Action**	**ALT 1**	**ALT 2**	**Location**
Mission Area Training	F-15/16/18, E-2/3, (K)C-5/130/135, P3	328	328	328	W-92/W-54
Basic Flight Instruction	T-34, T-6, T-45, T-39	3,865	3,865	3,865	W-228
	T-6, T-45, T-39	1,737	1,737	1,737	R-4404
	T-34, T-6, T-45, T-39	5,498	5,498	5,498	Meridian 1 East MOA
	T-6, T-45, T-39	3,783	3,783	3,783	Meridian 1 West MOA
	T-6, T-45, T-39	3,092	3,092	3,092	Pine Hill East MOA
	T-6, T-45, T-39	3,091	3,091	3,091	Pine Hill West MOA
	T-34, T-6, T-39	243	243	243	Pensacola North MOA
	T-34, T-6, T-45, T-39	2,580	2,580	2,580	Pensacola South MOA
	T-34, T-6, T-45, T-39	180	180	180	R-2908
	T-34, T-6, T-45, T-44, TC-12 AF: F-16, T-1	20,684	20,684	20,684	Kingsville MOA 1-5
	T-34, T-6, T-45, T-44, TC-12 AF: F-16, T-1	1,008	1,008	1,008	R-6312
Mission Area Training	KC-135, F-18/16, B-1/52, C-12/130, E-2, T-1/6/45, G200	329	329	329	Brownwood 1 MOA
	KC-135, F-18/16, B-1/52, C-12/130, E-2, T-1/6/45, G200	325	325	325	Brownwood 2 MOA
	KC-135, F-18/16, B-1/52, C-12/130, E-2, T-1/6/45, G200	326	326	326	Brownwood 3/4 MOA
TOTAL		**47,069**	**47,069**	**47,069**	

Source: USFF N731C/CSFTL 2008 compilation from the following: ACC Patton, Lito SUA Report, Martin SUA, TW-6, LT Hauser, and JRB Fort Worth SUA Report.

TABLE 2.2-6
CURRENT AND PROPOSED OPERATIONS AT THE NSA PANAMA CITY DEMOLITION POND

		ANNUAL TRAINING DAYS		
Range Operation	**System or Ordnance (Nomenclature)**	**No Action (days)**	**ALT 1 (days)**	**ALT 2 (days)**
Salvage Diver Training	Various small underwater charges[29] (less than 5 lb each)	60	60	60
EOD Tech Training	Various small underwater charges (less than 5 lb each)	12	12	12
Security Force Training	Various small underwater charges (less than 5 lb each)	10	10	10
Diver Training	Various small underwater charges (less than 5 lb each)	8	8	8
Total		**90 days**	**90 days**	**90 days**

TABLE 2.2-7
SUMMARY OF PROPOSED CHANGES IN OPERATIONAL PARAMETERS IN THE GOMEX STUDY AREA

Potential Stressor and Operational Parameter	**No Action**	**Alternative 1**		**Alternative 2**	
	(#/yr)	**(#/yr)**	**(Change From No Action)**	**(#/yr)**	**(Change From No Action)**
Vessel Movements					
Steaming days/yr[30]	180	180	0%	180	0%
Aircraft Overflights					
Fixed-wing aircraft sorties/yr	61,657	61,770	0.002%	61,772	0.002%
Helicopters sorties/yr [31]	38	18	-53%	18	-53%
Mine Warfare Devices Towed Through Water by Helicopters					
Sorties/yr	20	0	-100 %[32]	0	-100%
Fixed Mine Shapes (non-explosive)					
Mine shapes deployed/yr	169	0	-100 %	0	-100%
Munitions Use/Non-explosive Practice Munitions (NEPM)					
Bombs/yr	25,294	25,294	0%	25,449	1%
Cannon shells/yr (20 – 40 mm)	35,880	59,880	67 %	59,880	67%
Naval gunshells/yr (5-inch, 76 mm)	1,240	1,240	0%	1,240	0%
Small caliber/yr (.50 cal -7.62 mm)	39,600	39,600	0%	39,600	0%

[29] Details of each charge type, size, and quantity used per year are set forth in Appendix D.
[30] Based on the number of non-sonar events plus 2 days for travel to and from the range area.
[31] The Draft EIS/OEIS listed the number of helicopter sorties as 20 for the No Action Alternative and zero for each of the action alternatives, however these numbers were incorrect as reflected in Table 2.2-4. The sortie numbers have been corrected to reflect the total number of helicopter sorties listed in Table 2.2-4 for each alternative.
[32] Negative 100% means that under the alternative, all such operational parameters are eliminated.

TABLE 2.2-7 (Continued)
SUMMARY OF PROPOSED CHANGES IN OPERATIONAL PARAMETERS IN THE GOMEX STUDY AREA

Potential Stressor and Operational Parameter	No Action	Alternative 1		Alternative 2	
	(#/yr)	(#/yr)	(Change From No Action)	(#/yr)	(Change From No Action)
Underwater Explosions / High Explosive (HE) Use					
Bombs					
MK-82/yr	28	108	286%	0	-100%
MK-83/yr	24	44	83%	4	-84%
MK-84/yr	0	3	N/A[33]	0	0%
Underwater detonations					
8 oz Anti-swimmer grenades	20	20	0%	20	0%
5 lb NEW charges/yr	27	0	-100%	0	-100%
10 lb NEW charges/yr	34	0	-100%	0	-100%
20 lb NEW charges/yr	36	0	-100%	0	-100%
Expended Materials					
Ordnance related materials (NEPM)[34]	see footnote	see footnote	see footnote	see footnote	see footnote
Targets/yr[35]	approximately 85	approximately 113	33%	approximately 114	34%
Chaff/yr (RR-144)	3,680	3,680	0%	3,680	0%
Chaff/yr (R-188)	5,000	5,000	0%	5,000	0%
Chaff/yr (MK-214 or MK-216)	84	84	0%	84	0%
Flares/yr (M-206, MJU-7)	11,930	11,930	0%	11,930	0%
Flares/yr (MJU-8A/B; MJU-27 A/B; MJU-32B; MJU-53B; SM-875/ALE)	1,840	1,840	0%	1,840	0%
Various small charges (less than or equal to 1.25 lbs each)	See Apprendix D	See Apprendix D	NA	See Apprendix D	NA

[33] Not Applicable (N/A) is used when % increase is not calculable because such operational parameter did not exist in the baseline condition.
[34] Values are the same as those presented for weapons firing and ordnance use.
[35] The number of targets and target types varies depending on availability. It can be assumed that approximately 1 target is used per BOMBEX (A-S) and GUNEX (S-S) events. See Appendix E for potential target types.

TABLE 2.2-8
ORDNANCE USE BY TRAINING AREA IN THE GOMEX STUDY AREA

Training Area and Ordnance Type	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
W-151 / Panama City OPAREA			
7.62 mm (A131) machine gun rounds	16,000	16,000	16,000
5 lb NEW charges	13	0	0
10 lb NEW charges	3	0	0
20 lb NEW charges	18	0	0
New Orleans OPAREA			
No ordnance	0	0	0
Corpus Christi OPAREA			
7.62 mm (A131) machine gun rounds	11,200	11,200	11,200
.50 cal (A555) rounds	10,000	10,000	10,000
40 mm linked inert (B576) rounds	2,880	2,880	2,880
Grenades (MK3A2)	20	20	20
5 lb NEW charges	14	0	0
10 lb NEW charges	31	0	0
20 lb NEW charges	2	0	0
60 lb NEW charges	16	0	0
W-155 A/B / Pensacola OPAREA Hotbox			
20 mm cannon rounds	0	24,000	24,000
MK-82 HE bombs	28	108	0
MK-83 HE bombs	24	44	4
MK-84 HE bombs	0	3	0
MK-82 NEPM bombs	0	0	80
MK-83 NEPM bombs	0	0	20
MK-84 NEPM bombs	0	0	3
W-151A/B/C or W-155A / Pensacola and Panama City OPAREAs			
MK-76 NEPM bombs	140	140	140
MK-82 NEPM bombs	40	40	68
MK-83 NEPM bombs	0	0	24
MK-84 NEPM bombs	0	0	3
5 inch naval gun rounds (NEPM)	1,200	1,200	1,200
76 mm gun shells	40	40	40
CIWS BLK 1B (20 mm)	6,400	6,400	6,400
25 mm rounds	1,600	1,600	1,600
Small caliber (.50 cal- 7.62 mm)	2,400	2,400	2,400
Chaff (RR-144/RR-129)	3,680	3,680	3,680
Chaff (MK-214)	60	60	60
Chaff (MK-216)	24	24	24
Defensive Flares	1,840	1,840	1,840

TABLE 2.2-8 (Continued)
ORDNANCE USE BY TRAINING AREA IN THE GOMEX FINAL EIS/OEIS STUDY AREA

Training Area and Ordnance Type	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
McMullen County Range / Yankee Target			
Bombs (NEPMs)	2,636	2,636	2,636
20 mm cannon rounds	25,000	25,000	25,000
McMullen County Range / Dixie Target			
Bombs (NEPMs)	1,433	1,433	1,433
Noxubee County Range / SEARAY Target			
Bombs (NEPMs)	21,045	21,045	21,045
Brownwood MOAs			
Chaff (R-188)	5,000	5,000	5,000
Flares (M-206, MJU-7)	11,930	11,930	11,930

TABLE 2.2-9
SUMMARY OF EXPLOSIONS IN THE WATER AND THEIR NET EXPLOSIVE WEIGHTS BY TRAINING AREA IN THE GOMEX RANGE COMPLEX STUDY AREA

Training Area and Ordnance Type	Number of Explosions Per Year		
	No Action	Alternative 1	Alternative 2
W-155A/B (Pensacola OPAREA Hotbox)			
Bombs: MK-82 (192.2 lb NEW)	28	108	0
Bombs: MK-83 (415.8 lb NEW)	24	44	4
Bombs: MK-84 (945 lb NEW)	0	3	0
Panama City OPAREA UNDET boxes			
5 lb NEW charges	13	0	0
10 lb NEW charges	3	0	0
20 lb NEW charges	2	0	0
60 lb NEW charges	16	0	0
Corpus Christi OPAREA UNDET boxes			
8 oz MK3A2 Anti-swimmer grenades	20	20	20
5 lb NEW charges	14	0	0
10 lb NEW charges	31	0	0
20 lb NEW charges	2	0	0
60 lb NEW charges	16	0	0
Subtotal of Explosions for Study Area =	**169**	**175**	**24**
NSA Panama City Demolition Pond			
Various small charges (less than or equal to 1.25 lbs each)	See App D	See App D	See App D

2.2.8 Comparison of Alternatives and Effects

The comparison of alternatives presented in Table 2.2-10 is based on the information and analyses presented in Chapter 3 (Affected Environment and Environmental Consequences). The environmental stressors associated with each warfare area and operations were evaluated for each resource or issue in assessing potential environmental impacts under each alternative. There were no recordable differences in potential impacts between the alternatives for the following resources and issues:

- Hazardous Materials and Hazardous Waste;
- Water Resources;
- Air Quality;
- Airborne Noise;
- Land Use;
- Cultural Resources;
- Transportation;
- Demographics;
- Regional Economy;
- Recreation;
- Environmental Justice; or
- Public Health and Safety

The potential impacts would generally be temporary, short-term, minor, and/or localized changes to these resources or issues. As defined under NEPA, no significant impacts in U.S. Territorial Seas and no significant harm in Non-Territorial Waters to resources or issues were identified considering implementation of mitigation measures described in Chapter 5. In addition, resources were evaluated in accordance with Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (Eagle Act), Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), and the National Historic Preservation Act (NHPA). As a result of reduction of high explosive BOMBEXs by 92 percent in Alternative 2 and the cessation of Mine Warfare training, there is a substantial decrease in the number of marine mammals and sea turtles potentially impacted compared to the No Action Alternative. The potential impacts presented in Table 2.2-10 form the basis for providing choices to the decision maker.

The Atlantic Fleet Active Sonar Training (AFAST) Final EIS/OEIS is incorporated by reference in this Final EIS/OEIS for active sonar and Anti-Submarine Warfare associated activities as they pertain to the GOMEX Range Complex. The reader should refer to the AFAST Final EIS/OEIS (available at http://afasteis.gcsaic.com) for the full description and analysis of active sonar activities along the East Coast and within the Gulf of Mexico. The AFAST Final EIS/OEIS Record of Decision (74 FR 5650) was signed on January 23, 2009. A summary of the environmental consequences due to sonar activities in the GOMEX Range Complex is provided by resource area in Section 3.20.

TABLE 2.2-10
COMPARISON OF ALTERNATIVES AND EFFECTS

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Bathymetry, sediments, and soil	Localized disturbance of soft bottom benthic habitats from underwater detonations. Long-term minor impacts to benthic habitats from strikes and accumulation of Non-explosive Practice Munitions (NEPM) (Section 3.1.3.1).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. Slight increase in potential impacts to benthic habitats from strikes and accumulation of NEPM (Section 3.1.3.2).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. An increase in potential impacts to benthic habitat from strikes and accumulation of NEPM (Section 3.1.3.3).

TABLE 2.2-10 (Continued)
COMPARISON OF ALTERNATIVES AND EFFECTS

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Marine Communities	Localized disturbance of soft bottom benthic habitats from underwater detonations. Long-term minor impacts to benthic habitats from strikes and accumulation of Non-explosive Practice Munitions (NEPM) (Section 3.6.3.1).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. Slight increase in potential impacts to benthic habitats from strikes and accumulation of NEPM (Section 3.6.3.2).	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. An increase in potential impacts to benthic habitat from strikes and accumulation of NEPM (Section 3.6.3.3).
Marine Mammals	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 760 non-injurious potential exposures, and 31 injurious exposures. Under ESA, proposed activities may affect listed whale species and the West Indian manatee (Section 3.7.3.3).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 2,103 non-injurious potential exposures, and 70 injurious potential exposures. Under ESA, proposed activities may affect listed whale species and the West Indian manatee (Section 3.7.3.4).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposure, 92 non-injurious potential exposures, and 2 injurious potential exposures. Under ESA, proposed activities may affect listed whale species and the West Indian manatee. The Navy submitted to NMFS a Request for a Letter of Authorization under MMPA. NMFS concluded ESA Section 7 formal consultation with Navy (Appendix C) for listed and proposed whales. The Navy completed consultation with USFWS for the West Indian manatee (Section 3.7.3.5).
Sea Turtles	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 16 non-injurious exposures, and 0 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.2).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 39 non-injurious exposures, and 2 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.3).	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, no non-injurious exposures, and 0 injurious exposures. Under ESA, proposed activities may affect listed species. NMFS concluded ESA Section 7 formal consultation with Navy (Appendix C) for listed and proposed sea turtles. (Section 3.8.3.4). The Navy completed consultation with USFWS.

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Fish	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level effects. Under ESA, proposed activities may affect listed species Section (3.9.3.1).	Fish would no longer be affected by Mine Neutralization underwater detonations because these exercises would no longer occur. Fish affected by HE BOMBEX would increase because the number of HE bombs dropped would increase. No population-level effects. Under ESA, proposed activities may affect listed species Section (3.9.3.2).	Fish would no longer be affected by Mine Neutralization underwater detonations because these exercises would no longer occur. The number of fish affected by HE BOMBEX would decrease because the number of HE bombs dropped would decrease. No population-level effects. Under ESA, proposed activities may affect listed species Section (3.9.3.1). NMFS concluded ESA Section 7 formal consultation with Navy (Appendix C) for listed and proposed fish (Section 3.9.3.3)
Essential Fish Habitat (EFH)	No adverse affect to EFH. Any impacts associated with NEPM strikes would be minimal based on the small area affected. Other impacts would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Therefore, EFH consultation with NMFS is not required. (Section 3.9.3.1)	No adverse affect to EFH. Any impacts associated with NEPM strikes would be minimal based on the small area affected. Other impacts would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Therefore, EFH consultation with NMFS is not required. (Section 3.9.3.2)	No adverse affect to EFH. The area of benthic EFH potentially affected by NEPM strikes would increase, but the impacts would be minimal based on the small area affected. Other impacts would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Therefore, EFH consultation with NMFS is not required. (Section 3.9.3.3)

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Seabirds and Migratory Birds	Under ESA, vessel movements, aircraft overflights, and underwater detonations may affect brown pelicans. Under MBTA, no long-term population-level effect would occur to migratory bird populations (Section 3.10.3.1).	Under ESA, vessel movements, aircraft overflights, and underwater detonations may affect brown pelicans. Under MBTA, no long-term population-level effect would occur to migratory bird populations (Section 3.10.3.2).	Under ESA, vessel movements, aircraft overflights, and underwater detonations may affect brown pelicans. Under MBTA, no long-term population-level effect would occur to migratory bird populations. Substantial decrease in potential impacts compared to No Action and Alternative 1 due to decrease in HE bomb use in non-territorial waters. The Navy completed consultation with the USFWS regarding its determination of effect for Alternative 2 and the brown pelican (Section 3.10.3.3).
Terrestrial Biological Resources	Under ESA, proposed activities may affect listed species. Under MBTA, no long-term population-level effect would occur to migratory bird populations. No significant impact on vegetation or wetlands would be expected. (Section 3.11.3.1)	Under ESA, proposed activities may affect listed species. Under MBTA, no long-term population-level effect would occur to migratory bird populations. No significant impact on vegetation or wetlands would be expected. (Section 3.11.3.2)	Under ESA, proposed activities may affect listed species. Under MBTA, no long-term population-level effect would occur to migratory bird populations. No significant impact on vegetation or wetlands would be expected.
Terrestrial Biological Resources (Cont)			The Navy completed consultation with the USFWS regarding its determinations of effect for Alternative 2 and terrestrial species. (Section 3.11.3.3)
Atlantic Fleet Active Sonar Training (AFAST)	Potential impacts to resources or issues from AFAST and the proposed action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the proposed action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the proposed action combined are less than significant. (Section 3.20)

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CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes existing environmental conditions for resources and issues of concern potentially affected by the Alternatives described in Chapter 2. This chapter also identifies and assesses the environmental consequences of the Alternatives. The affected environment and environmental consequences are described and analyzed according to categories of resources and issues. The categories of resources addressed in this Final EIS/OEIS are:

Resource	Section	Resource	Section
Bathymetry, Sediments and Soil	3.1	Hazardous Materials and Hazardous Waste	3.2
Water Resources	3.3	Air Quality	3.4
Airborne Noise	3.5	Marine Communities	3.6
Marine Mammals	3.7	Sea Turtles	3.8
Fish and Essential Fish Habitat	3.9	Seabirds and Migratory Birds	3.10
Terrestrial and Freshwater Biological Resources	3.11	Land Use	3.12
Cultural Resources	3.13	Transportation	3.14
Demographics	3.15	Regional Economy	3.16
Recreation	3.17	Environmental Justice	3.18
Public Health and Safety	3.19	Summary of AFAST Sonar Operations	3.20

3.1 BATHYMETRY, SEDIMENTS, AND SOIL

3.1.1 Introduction and Methods

Water depth, bathymetry, bottom topography, and the sediment composition of the bottom, are features which define the ocean's physical environment. Sediments include rock. For this analysis, sediments refer to the soil, sand, organic matter, and minerals that accumulate at the bottom of a body of water within the Study Area. Terrestrial surface materials include soil, so the areas analyzed for impacts to soil are the McMullen and Noxubee County Ranges. The other analysis focuses on sediments, as the affected environment is offshore, coastlines, or in the Naval Support Activity (NSA) Panama City Demolition Pond. Activities impacting bathymetry, sediments, and soil would be implemented in accordance with applicable federal laws and regulations and with state and local laws, regulations, programs, plans, and policies as applicable. Appendix K addresses the federal, state, and local environmental review programs that do, or may, apply to the No Action Alternative, Alternative 1, and Alternative 2.

The GOMEX Study Area for bathymetry and sediments encompasses parts of the northern waters of the Gulf of Mexico. The Study Area occupies waters offshore all five U.S. Gulf coast states: Texas, Louisiana, Mississippi, Alabama, and Florida and extends seaward up to 125 nm (Figure 1.5-1). Covering 17,520 nm^2 of the marine environment, the Study Area spans coastal to deepwater habitats and encompasses shallow waters to waters greater in depth than 6,000 feet. The NSA Panama City Demolition Training Pond shown in Figure 2.1-6 is included in the Study Area for bathymetry and sediments. The Study Area for the analysis of soil is shown in Figure 2.1-4 and Figure 2.1-5 and includes the McMullen and Noxubee County Ranges.

3.1.1.1 Assessment Methods and Data Used

This section was prepared primarily through consideration of the proposed activities under each Alternative and determining their effects on bottom sediments by reviewing the accumulation of military expended material on the ocean bottom. The geographic dispersion of the proposed activities, and the resulting density of the military expended material, was the primary factor analyzed to determine potential impacts to bathymetry, sediments and soil. A further consideration was the effect of decomposing military expended material on the ocean bottom sediments.

Data used for assessing the existing conditions for bathymetry and sediments come from the Gulf of Mexico Navy Marine Resource Assessment (MRA) (DoN, 2007a) as well as internet keyword searches to obtain information that may not have been captured in the MRA. The goal of the MRA program is to describe and document the marine resources present in the Navy's OPAREAs. These MRAs represent a compilation and synthesis of available scientific literature (for example, journals, periodicals, theses, dissertations, project reports, and other technical reports published by government agencies, private businesses, or consulting firms), and National Marine Fisheries Service (NMFS) reports, including stock assessment reports, recovery plans, and survey reports. The MRAs provide a summary of the physical environment (*e.g.*, marine geology, circulation and currents, hydrography, and plankton and primary productivity) for each Study Area. The Navy also conducted Google and Yahoo keyword searches to obtain information on bathymetry and sediment baseline information for this Final EIS/OEIS The searches produced a number of websites that the author evaluated for credibility of the source, quality of the information, and relevance of the content, with only the best available information included in this document. Unless otherwise indicated, the existing conditions information provided in this chapter was taken from the MRA for the Gulf of Mexico and the Integrated Natural Resources Management Plans for NAS Kingsville, Panama City, McMullen Bombing and Gunnery Range, and NS Meridian (DoN, 2006b).

3.1.1.2 Warfare Areas and Associated Bathymetry and Sediment Environmental Stressors

Aspects of the proposed actions likely to act as stressors to bathymetry and sediments were identified by conducting a detailed analysis of the warfare areas, training activities, and specific activities included in the Alternatives and are shown in Table 3.1-1. After reviewing the Alternatives, the potential stressors were identified as the training activities that introduced expended material and chemical contaminant items into the water. Table 3.1-1 shows the possible stressors that potentially affect bathymetry, sediments, and soil.

TABLE 3.1-1
SUMMARY OF POTENTIAL STRESSORS TO BATHYMETRY AND SEDIMENTS

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Non-Explosive Practice Munitions**	**High Explosives**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Mine Warfare (MIW)					
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA		✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA		✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA		✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B		✓	✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox				
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Panama City OPAREA	✓	✓	✓	

TABLE 3.1-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO BATHYMETRY AND SEDIMENTS

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Non-Explosive Practice Munitions**	**High Explosives**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Corpus Christi OPAREA UNDET BOX E3	✓		✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155				
MSO to include VBSS/MIO- Helo	W-151/W-155				
Small Arms Training – Explosive Hand Grenades	UNDET Area E3		✓	✓	
Air Warfare (AW)					
Air Intercept Control (AIC)	W-151; W-155				
Strike Warfare (STW)					
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target	✓		✓	
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target	✓		✓	
Amphibious Warfare (AMW)					
Firing Exercise (FIREX) with IMPASS	W-151A/B; W-155A	✓		✓	
Electronic Combat (EC)					
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓		✓	
Chaff Exercises (CHAFFEX)	Brownwood MOAs	✓		✓	
Flare Exercises (FLAREX)	W-155A/B	✓		✓	
Flare Exercises (FLAREX)	Brownwood MOAs	✓		✓	

TABLE 3.1-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO BATHYMETRY AND SEDIMENTS

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Non-Explosive Practice Munitions**	**High Explosives**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Mission Area Training [36]					
Mission Area Flight Training	W-92; W-54; Brownwood MOAs				
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312				
Salvage Diver Training	NSA Panama City Demolition Pond		✓	✓	
EOD Tech Training	NSA Panama City Demolition Pond		✓	✓	
Security Force Training	NSA Panama City Demolition Pond		✓	✓	
Diver Training	NSA Panama City Demolition Pond		✓	✓	

For each of the events that expend materials, the types of materials and locations were detailed in Tables 2.2-6 and 2.2-7. Tables depicting expenditures of materials in the OPAREA (Tables 2.2-6 and 2.2-7) and Section 3.2, Hazardous Materials and Hazardous Waste, combined with information provided in Chapters 1 and 2 of this EIS/OEIS provided the operations and military expended materials data used in the analysis of the potential stressors to bathymetry, sediments, and soil.

3.1.2 Affected Environment

The general bottom features in the GOMEX offshore Range Complex are shown in Figure 3.1-1, Figure 3.1-2, and Figure 3.1-3; bottom sediments are shown in Figure 3.1-4.

Panama City, Pensacola, New Orleans and Corpus Christi OPAREAs

The Gulf of Mexico is the ninth largest body of water in the world with a surface area of 448,400 nm^2. The GOMEX is distinguished by an enormous river delta, limestone islands, expansive and relatively flat continental-shelf areas, submarine canyons, steep escarpments, sea fans, and a central deep, flat basin where water depths reach over 10,000 feet. The GOMEX is a relatively small, deep sedimentary or Mediterranean type of ocean basin characterized by thick accumulations of sediments, areas of

[36] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

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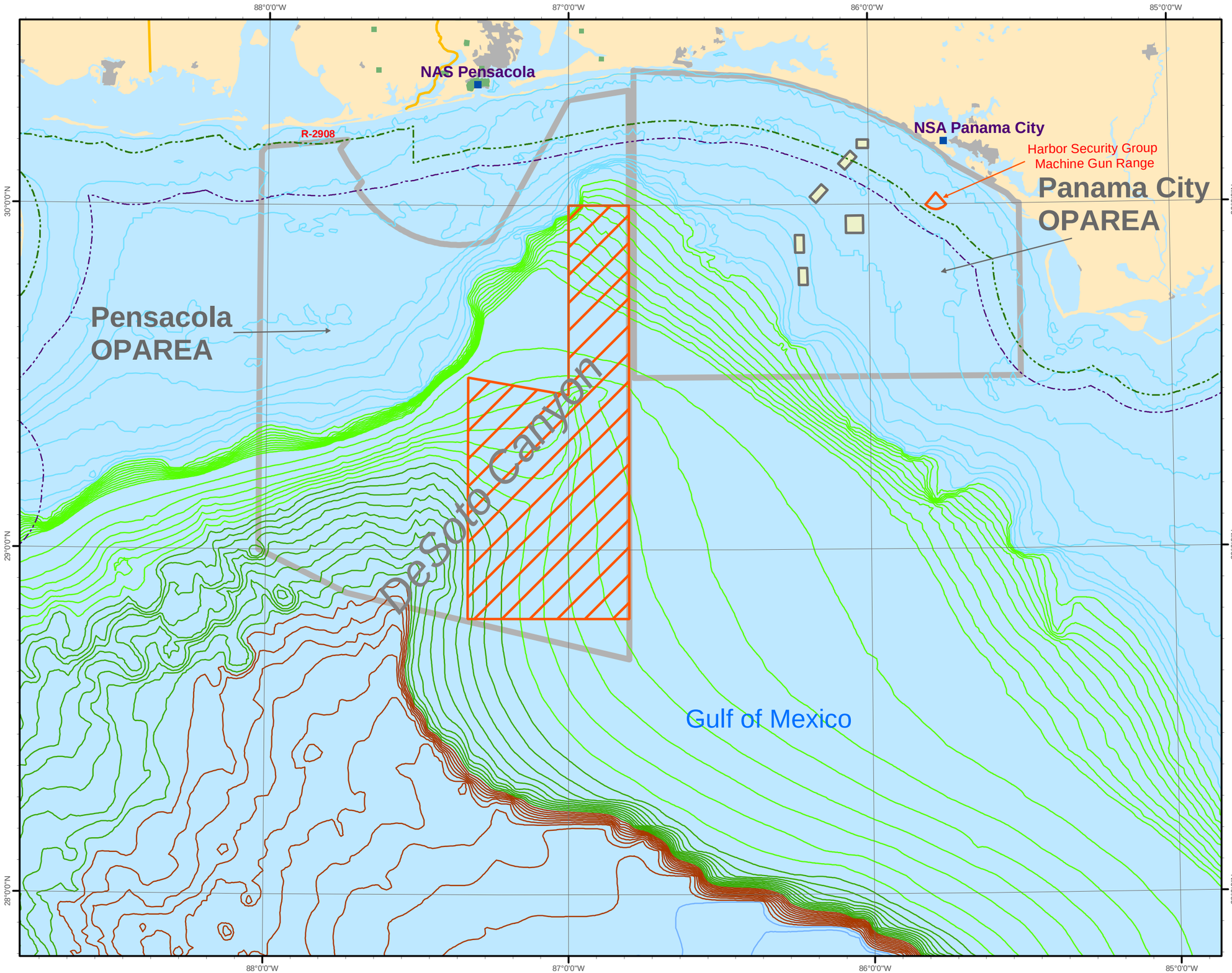


Bathymetry of the Panama City and Pensacola OPAREAs

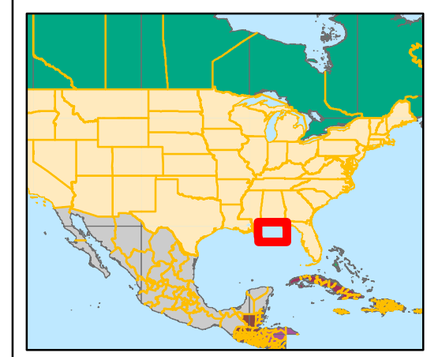
Figure 3.1-1

Legend

- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Panama City Existing MINEX Boxes
  No Action Alternative
- Eastern GOMEX BOMBEX HotBox

Bathymetry Contour Interval (Meters)

- -5000 to -5300
- -4000 to -4900
- -3000 to -3900
- -2000 to -2900
- -1000 to -1900
- -100 to -900
- -10 to -90
- Operating Areas (OPAREAs)



N

1:1,189,843

10 5 0 10 20 Nautical Miles

20 10 0 20 40 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources:
National Geospatial Intelligence Agency (NGA) Database;
Special Use Airspace Document AP/1A;
COMLANTFLT 3120.26E Document.

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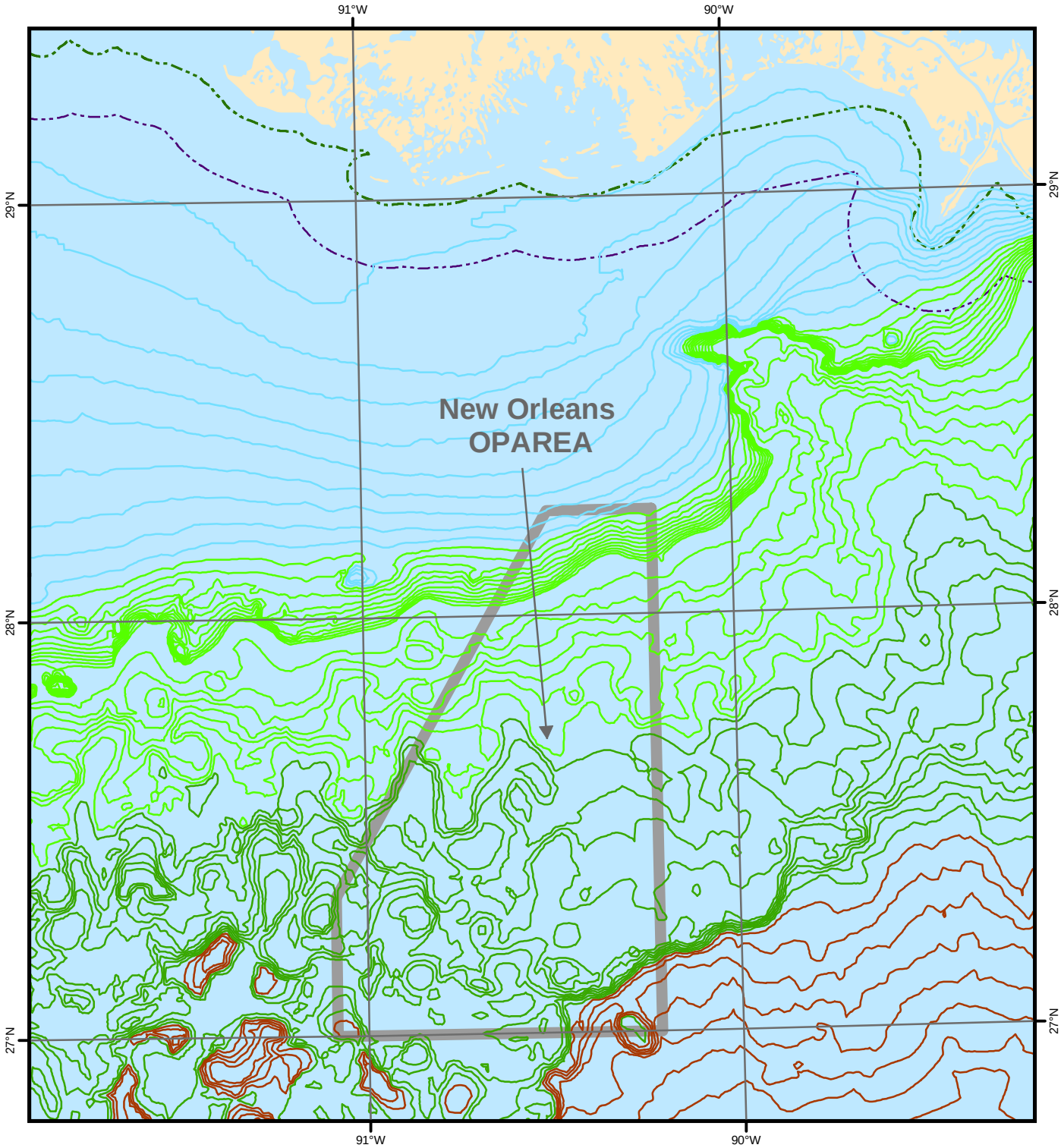


Legend

Bathymetry Contour Interval (Meters)

- -5000 to -5300
- -4000 to -4900
- -3000 to -3900
- -2000 to -2900
- -1000 to -1900
- -100 to -900
- -10 to -90

State Seaward Extent
TX & FL 9 nm; AL, MS & LA 3 nm

12 nm Territorial Limit

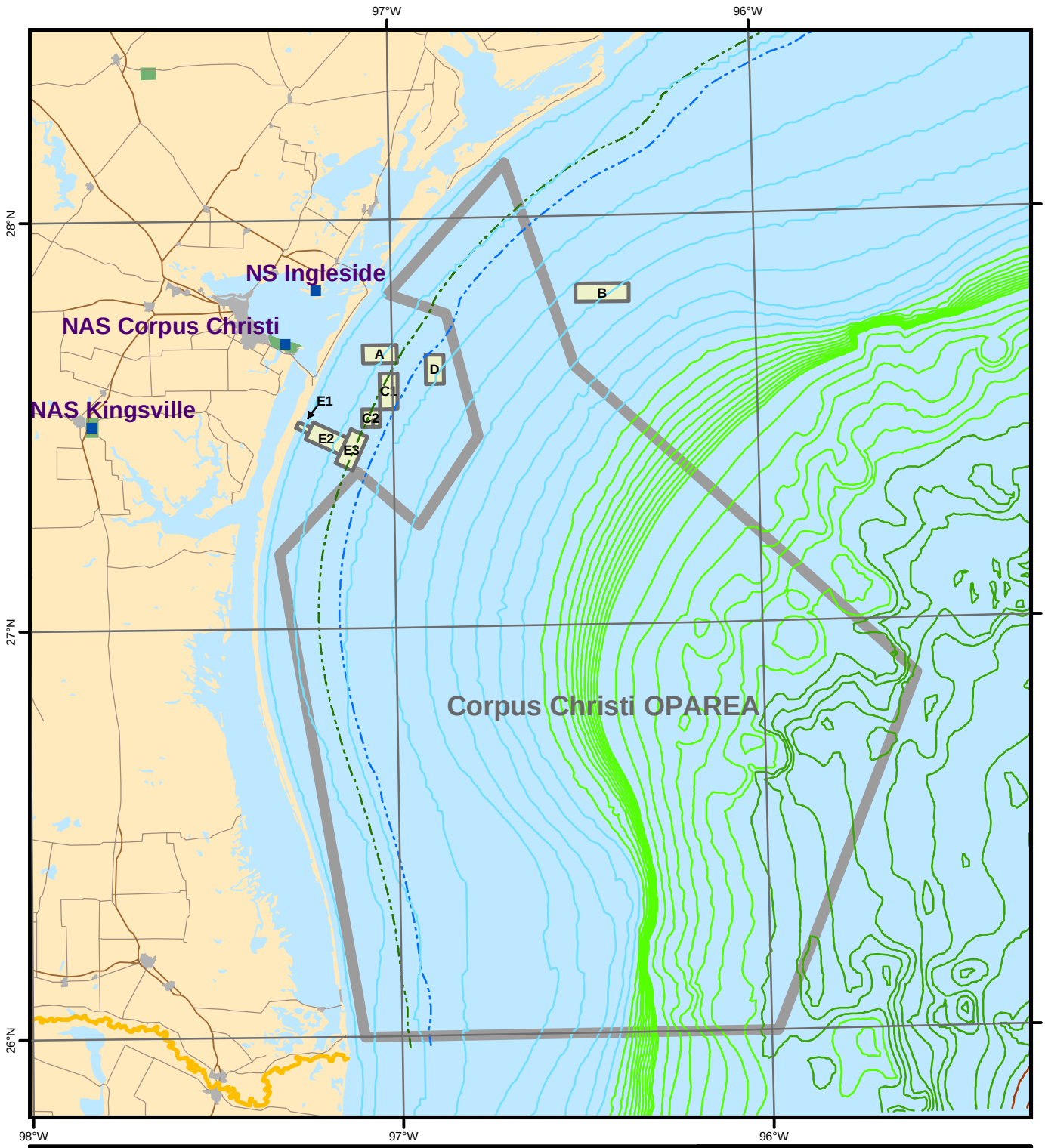
Operating Areas (OPAREAs)

Coordinate System:
WGS 1984 UTM Zone 15 (Meters)

0 12.5 25 50
Nautical Miles

Figure 3.1-2

Bathymetry of the New Orleans OPAREA



Legend

Bathymetry Contour Interval (Meters)

- -5000 to -5300
- -4000 to -4900
- -3000 to -3900
- -2000 to -2900
- -1000 to -1900
- -100 to -900
- -10 to -90

State Seaward Extent
TX & FL 9 nm; AL, MS & LA 3 nm

12 nm Territorial Limit

Corpus Christi MINEX Boxes

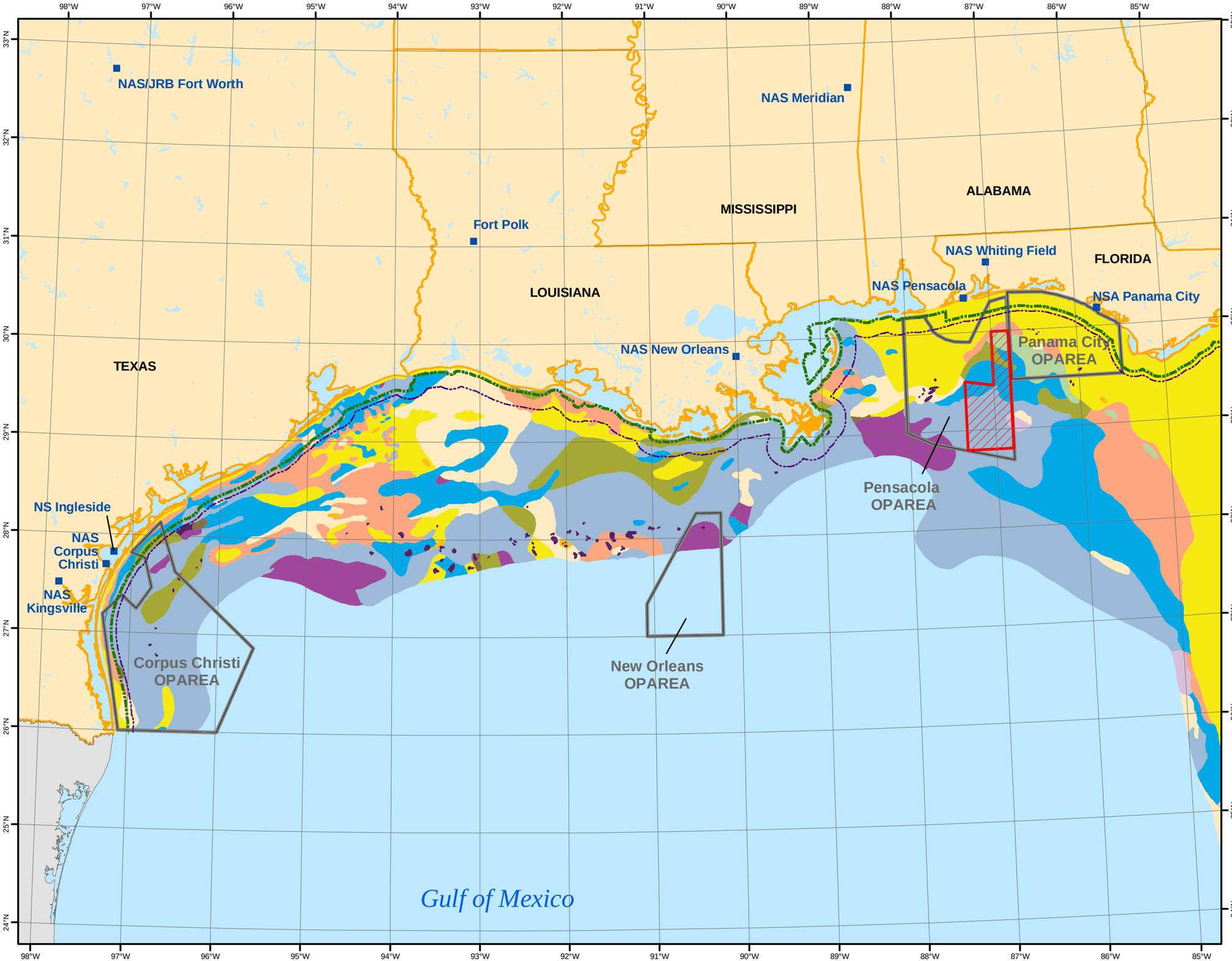
Operating Areas (OPAREAs)

Coordinate System:
WGS 1984 UTM Zone 14 (Meters)

0 10 20 40 60
Nautical Miles

Figure 3.1-3

Bathymetry of the Corpus Christi OPAREA

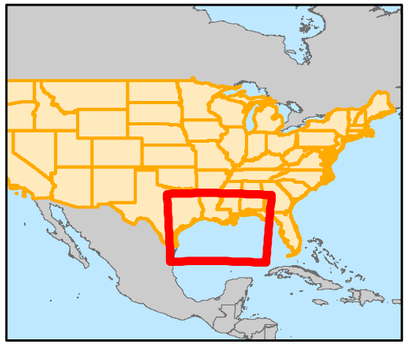


Bottom Sediments
GOMEX EIS/OEIS Study Area

Figure 3.1-4

Legend

- Clay
- Sandy Clay
- Silty Clay
- Sand
- Clayey Sand
- Silty Sand
- Silt
- Clayey Silt
- Sandy Silt
- Sand/Silt/Clay
- Gravelly Sand
- Hardbottom
- Eastern GOMEX BOMBEX HotBox
- Operating Area (OPAREA)
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit



N

1:4,130,000

500 250 0 500 1,000 Nautical Miles

2,000 1,000 0 2,000 Kilometers

Projection: UTM Zone 15N
Datum: WGS84

Sources:
Sheridan. P., and P. Caldwell, 2002;
NOAA martime limits, 2005-2006;
COMLANTFLT 3120.26E Document, ESRI.

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faulting, complexly deformed salt deposits, and extensive carbonate deposition (DoN, 2007a). Historically, evaporate (salt) deposits formed in areas of the Gulf where the sea was shallow and when the climate was very dry. As shallow seas persisted over time, coral reefs formed, and the deposition of limestone and other carbonate rocks and sediments dominated areas such as the eastern GOMEX (NOAA, 2009). During recent geological time, the western and central GOMEX have been dominated by sediment deposition from the Mississippi River System and its ancestors; more than 9 miles of sediments have been deposited in the northern Gulf, with the maximum deposition paralleling the present-day Louisiana and Texas shoreline (Krug and Marrified, 2007; DoN, 2007a).

The GOMEX's continental margin (the boundary or transition between continents and ocean basins) consists of the three physiographic provinces typical of a passive margin: the continental shelf, continental slope, and continental rise.

The continental shelf is the seaward extension of the continent, almost like a submarine platform. A gentle incline or gradient (<1:1,000), low relief (<65 feet), widths of about 62 miles, and maximum water depths of 425 feet on average, worldwide, distinguish the continental shelf (Kennett, 1982; DoN, 2007a). The width of the continental shelf in the GOMEX Study Area is highly variable, from almost nonexistent off southeastern Florida to more than 125 miles in width off west Florida (DoN, 2007a). The depth at which the shelf break (the change in gradient that marks the transition between the continental shelf and continental slope provinces) ranges from about 30 to 650 feet (DoN, 2007a). The location of the shelf break on the West Florida Shelf is described as indefinite (DoN, 2007a) and marks a transition to the West Florida Terrace, which is regarded as part of the continental slope even though it exhibits gradients similar to those found on the continental shelf. The continental shelf near the mouth of the Mississippi River is extremely narrow (~6 miles), because the river delta in this area has expanded over time, covering the majority of the continental shelf in the north-central Gulf. Along the Texas-Louisiana coast, the shelf width ranges between a maximum of 125 miles near the Texas-Louisiana border to a minimum of 56 miles at the mouth of the Rio Grande (DoN, 2007a).

Topography of the continental slope in the northeastern Gulf is relatively smooth and featureless with the notable exception of the DeSoto Canyon located off the coast of the Florida Panhandle (DoN, 2007a). The DeSoto Canyon marks the transition between the Mississippi River-influenced clastic or terrestrial sedimentary regime to the west and the carbonate system to the east and south along western Florida. The continental slope off western Florida is quite different than that of the northern Gulf as it is distinguished by steep gradients and irregular topography. Gradients on the West Florida Terrace, the shoreward most portion of the slope, are not unlike gradients on the shelf, which is nearly flat with a seaward incline of <0.1°.

In the northern portion of the Panama City installation there are four small ponds (all managed ponds), wetlands, and open ditches. No streams bisect the installation and surface water bodies receive storm water runoff from U.S. Highway 98 and Thomas Drive through a system of grass swales and concrete culverts. The ponds comprise 2.98 acres of open water wetlands (the only open water wetlands on the installation) and those ponds that have experienced excessive growth of algae and other aquatic plants have been controlled through the addition of triploid grass carp which are effectively controlling the growth of algae (DoN, 2006b).

During recent geological time, the western and northern GOMEX have been dominated by sediment deposition from the Mississippi River System and its ancestors. In the northern Gulf, the estimated thickness of deposited sediments is more than 9 miles, with the maximum deposition paralleling the present-day Louisiana and eastern Texas shoreline (DoN, 2007a). Overall, the sediments found in the GOMEX largely are clastic and are derived from terrestrial sources, of which the most common types are sandstone and shale. The soft, unconsolidated clastic sediments found on much of the continental

shelf of the north-central and western GOMEX are discharged primarily from the Rio Grande and Mississippi River System and their predecessors. While the main areas of deposition have changed over time in response to shifting river source locations, the type of sediment input from rivers is primarily soft sediments such as sand, silt, clay, or combinations of these (Krug and Merrifield, 2007). The Gulf's southern and eastern continental shelf and slope are unaffected by the large volume of riverine-transported sediments and are biogenic in origin, consisting primarily of carbonate sands. The sand substrate found off western Florida is likely a mix of quartzose and biogenic carbonate remains of organisms such as coral, foraminifera, coccoliths, and mollusks (DoN, 2007a). Bottom sediments found in the deep water central sections of the Gulf (on the abyssal plains) are primarily composed of very fine particles, such as clay or silt, and are typical of deep oceanic sediments (NOAA, 2009).

The roles of oceanic, Gulf-wide and local currents, and their interactions to effect coastal change were examined in a comprehensive study of 30 years of data from bayfloor sediment samples, radiocarbon tests and seismic surveys from Galveston, Matagorda and Corpus Christi bays in Texas, Mobile Bay in Alabama, Calcasieu Bay in Louisiana and Sabine Lake on the Texas-Louisiana border found that rising sea levels and dry periods of significantly reduced sediment flowing into bays resulted in dramatic flooding events that could result in an increase in some bays by as much as one-third over a period of 100 or 200 years (ScienceDaily, 2008).

Currently the Gulf is involved in an immense, river-switching, delta-building event that occurs once a millennium. This event coincides with massive physical, hydrological, chemical and biological changes in the Gulf environment, including a sediment load (200 million cubic metters per year) nearly 20 times that delivered by all the rivers of the East Coast of the United States. (Krug and Merrifield, 2007) Input of nutrient rich sediment is the prime cause of hypoxia in the northern Gulf of Mexico. Hypoxia is lethal to many to many species of aquatic and marine organisms and positively can influence fishery production in adjacent coastal waters.

McMullen County Range

The McMullen County Range is located in south central McMullen County and occupies approximately 10,625 acres in Texas. The Yankee Target is in the northern target area within the McMullen County Range. The Yankee Target comprises a total of 2,800 acres and an additional 2,400 acres of buffer zone land that surrounds the impact area. Approximately 25 acres of the Yankee Target property are owned by the Navy and the remainder (approximately 2,775 acres) is leased by the Navy from private owners. The Navy leases through a Memorandum of Agreement (MOA) approximately 365 acres of the range to the Texas Air National Guard. The Dixie Target is in the southern target area within the McMullen County Range.

The Dixie Target comprises a total of 7,825 acres, which includes a centrally located 360-acre munitions impact area and an additional 7,465 acres of buffer zone land that surrounds the central target impact area. Approximately 1,735 acres of the main Dixie Target property is owned by the Navy and the remainder (approximately 6,093 acres) is leased by the Navy in addition to 47 acres that is leased from a private owner to access the site.

The McMullen County Range is located in the South Texas Plains physiographic region of Texas within the Greater Nueces River Basin. The topography is gently rolling with elevation ranging from 375 feet above mean sea level (MSL) in the south to 250 feet MSL along the Nueces River to the north and west. This formation consists of alternating beds of clay and sandstone. Oligocene deposits of the Frio Formation, mostly clay with some gypsum and calcareous concretions, underlie the eastern half of the tract (DoN, 2007b).

Most of the Complex is covered by deep, well-drained sandy to silty soil on level to gently sloping topography. The water table at both the Yankee and Dixie Targets is very deep and overlain by impermeable formations. No karst formations have been identified in the area and due to the high clay content of the local soils, percolation of surface water. Both target areas are crossed by intermittent streams (DoN, 2007d). There are no areas that contain jurisdictional wetlands or hydric soil, although some stock ponds may have small clusters of cattails. Alluvial soil is likely along the terraces of the Nueces River. Remnant sloughs or other features of the braided stream terrace of the Nueces River contain many small depressions of silty and clayey soil. These swales hold water during wet seasons but are dry during summer and fall (DoN, 2006a).

The Yankee Target has an elevation of about 280 feet above MSL at the southwest and gently slopes down to about 250 feet above MSL at the northeast corner near the Guadalupe Creek. Much of the range acreage, especially outside the impact area, is vegetated with various native grasses, mesquite, and prickly pear. Specific range management areas such as firebreak roads, the main impact area, and the strafe pit on the Yankee Target are kept free of vegetation through regular root plowing. These vegetation-free zones within the impact area are cleared and plowed to provide visual definition and to absorb the impacts of practice ordnance on the Yankee Target. Firebreak roads are cleared and maintained to control brushfires and serve as access roads to the main impact areas of the target ranges (DoN, 2007b).

Noxubee County Range

The SEARAY Target, Noxubee County Range is the primary land target within the Meridian Range Complex. The general ground elevation of the SEARAY Target impact area is approximately 242 feet above MSL. The State of Mississippi contains at least 10 physiographic regions or physiographic provinces, and each has a unique combination of surface geology, soil, and topography. The SEARAY Target is located within the Interior Flatwoods physiographic region (DoN, 2007e). The majority of the area is flat terrain underlain by Porters Creek Clay typical of the Flatwoods. The Lower Wilcox Formation is the groundwater source for the region (DoN, 2007e).

The SEARAY Target Range is in the North Central Hills region and is characterized by sands and clays of the Wilcox Group (Paleocene) and the Claiborne Group (Eocene), topography of ridges and valleys, and an acidic soil (DSU, 2003). Much of the range acreage within the impact area is maintained as cleared, semi-improved space in the immediate area of the target (DoN, 2007c). The elevation at SEARAY target is approximately 350 ft above MSL. Most of the land is characterized by gently sloping terrain with the flattest areas occurring in alluvial floodplains of major creeks (DoN, 2007e). The SEARAY Target is in the Hashuqua Creek watershed and the Macedonia Creek watershed with both drain into Noxubee River and the Tombigbee Basin. There are wetlands that have been identified which are associated with these drainages (DoN, 2007e).

NSA Panama City Demolition Pond

The Demolition Pond is in the Gulf Coastal Lowlands within the Apalachicola Embayment (a major structural feature that characterizes the geology of the Florida reserve and river system). The surface geology of the Florida Panhandle is sedimentary, comprised of limestones, organics, and clastics (silt, clay, sand, and gravel). The Demolition Pond is in Bay County, which is relatively flat in relief, averaging from sea level to approximately 17 feet above MSL, and is mostly covered with Pleistocene to Recent quartz sands. Near the coast, sedimentary fill is underlain by metamorphosed Paleozoic deposits. The county is underlain by water-yielding zones in both the sand and limestone strata. The pond is part of 2.98 acres of open water wetlands (the only open water wetlands on the installation)

(DoN, 2006b) and in 2006 a Wetland Resource Permit/Authorization was given to the installation to conduct underwater testing of small explosive devices (FLDEP, 2006).

Military Operating Areas (MOAs)

Basic flight instruction, intermediate and advanced jet training, combat search and rescue, progressive spins, air intercept control, aerial refueling, maintenance and standardization flights, and mission training are typical activities in the MOAs in the GOMEX Range Complex. These MOAs are all located over land areas. The MOAs include Meridian 1 East and West, Pine Hill East and West, Pensacola North, Pensacola South, Brownwood 1 West, Brownwood 1 East, Brownwood 2 West, Brownwood 2 East, Brownwood 3, Brownwood 4, and Kingsville 1-5. Other than the expenditure of chaff and flares, no ordnance is used in MOAs. Chaff is non-hazardous and when deployed diffuse a cloud of fibers that is undetectable to the human eye. This material may remained suspended in air from ten minutes to ten hours and can travel up to 200 miles from the point of release. Flares are designed to burn completely with only small amounts of ash and a small, round plastic end cap remaining (1.4 inch diameter). Flare debris can also be expected to travel large distances from the point of release. There would be no impact on soils and sediments from training in the MOAs, therefore they are not discussed under Environmental Consequences. For a more detailed discussion of chaff and flares and their composition and hazardous materials see Section 3.2, Hazardous Materials and Hazardous Waste.

3.1.3 Environmental Consequences

The primary effect of the Navy's training activities in the GOMEX Study Area would be the deposition of expended training materials on the ocean bottom and their accumulation over time. Some of the proposed training activities in the marine waters of the GOMEX OPAREAs would have no direct contact with the geological features of the Study Area, which lie at some depth below the surface. Data from Tables 2.2-4, 2.2-5, 2.2-6, and 3.1-2 were used to determine the total amount of training materials deposited annually per square nautical mile of each training area and the entire Study Area. This section considers only the physical effects of these materials on bathymetry and sediments. The effects associated with the chemical properties of expended training materials are discussed in Section 3.2.2. Effects of explosions and debris deposition on benthic organisms are addressed in Section 3.6, Marine Communities.

3.1.3.1 No Action Alternative

Deposition of Expended Training Materials

Most at sea training exercises do not affect ocean bottom topography or sediments. Some training activities, such as underwater detonations, could result in localized disturbance of soft bottom benthic habitats and slightly increase local turbidity or create shallow depressions in bottom sediments. There would be long-term, minor impacts to benthic habitats from strikes and accumulation of Non-explosive Practice Munitions (NEPM). These effects disappear over time under the influence of natural ocean circulation and sediment transport. These effects are not considered to be significant. Mine moorings, composed of 8-15 ft^3 of concrete and weighing 1,200-2,400 lbs, would have some temporary bottom disturbance when dropped into water from the boat. Mine moorings would be used in the Corpus Christi and Panama City OPAREAs (see Appendix D for a detailed description of the use of mine moorings). If the moorings get covered up or move due to currents, then the Navy would retrieve them and redeploy. The probability of impact is low, with the small numbers of moorings, their small bottom footprint, and their temporary nature.

TABLE 3.1-2
MILITARY EXPENDED TRAINING MATERIALS IN GOMEX EIS STUDY AREA

Training Areas and Number of Training Items	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
Entire Offshore Study Area[1] (14,844 nm^2)	51,952	76,055	76,062
Number of Items per nm^2	3.5	5.1	5.1
20 Year Aggregate Density per nm^2	70	102	102
W-151/Panama City OPAREA (3,084 nm^2)	16,000	16,000	16,000
Number of Items per nm^2	5.2	5.2	5.2
20 Year Aggregate Density per nm^2	104	104	104
New Orleans OPAREA (2,676 nm^2)	0	0	0
Number of Items per nm^2	0	0	0
20 Year Aggregate Density per nm^2	0	0	0
Corpus Christi OPAREA (6,878 nm^2)	24,163	24,100	24,100
Number of Items per nm^2	3.5	3.5	3.5
20 Year Aggregate Density per nm^2	70	70	70
W-155A (Hotbox)/Pensacola OPAREA (1,459 nm^2)	52	24,155	24,107
Number of Items per nm^2	0.0	16.6	16.5
20 Year Aggregate Density per nm^2	0.7	332	330
W-151 A/B or W-155A/Pensacola and Panama City OPAREAs (7,312 nm^2)	11,820	11,820	11,820
Number of Items per nm^2	1.6	1.6	1.6
20 Year Aggregate Density per nm^2	32	32	32
McMullen County Range/Yankee Target (18 acres for target area)	27,636	27,636	27,636
Number of Items per acre[2] (note assumes no range clearance)	1,533	1,533	1,533
McMullen County Range/Dixie Target (6.5 acres for target area)	1,433	1,433	1,433
Number of Items per acre[2] (note assumes no range clearance)	221	221	221
Noxubee County Range/SEARAY Target (10.1 acres for target area)	21,045	21,045	21,045
Number of Items per acre[2] (note assumes no range clearance)	2,075	2,075	2,075

1. See Figure 1.1-1, Excluding New Orleans OPAREA where no ordnance is dropped.
2. To compare land ranges to offshore areas, multiply by 848 to convert items per acre to items per sq nm.

Source: Table 2.2-8

A mine shape assembly includes a concrete anchor, mooring line (steel cable or chain), and the mine shape. Up to 60 non-explosive mine shapes would be temporarily placed in the training area. The

entire assembly (mine shape, mooring line, and anchor) is deployed concurrently from a boat or aircraft and recovered following the exercise (usually within 7 to 30 days). This exercise results in slight increases in local turbidity or creates shallow depressions in bottom sediments. With the small numbers of moorings, their small bottom footprint, and their temporary nature, these effects are not considered to be significant.

Section 3.2.2 discusses in detail the affected environment for military expended materials. Twenty-two percent of the 236 bombs deployed in the offshore GOMEX Range Complex are live. Bombs with live ordnance are fused to detonate on contact with the water, and it is estimated that 99 percent of them would explode within 5 feet of the ocean surface (DoN, 2005). Table 2.2-8 gives the detail of the training materials in each of the training areas. The aggregate effects of expended materials from training activities on ocean bottom sediments in the offshore GOMEX OPAREAS (Corpus Christi, Pensacola, and Panama City OPAREAS - See Figure 2.1-1) can be assessed in terms of the number of deposited items per unit area of bottom surface. Approximately 51,952 training items are currently expended in the offshore GOMEX Study Area (see Table 3.1-2). Assuming an ocean floor area of about 14,844 nm^2 this amounts to approximately 3.5 items per nm^2 assuming an even distribution of activities (see Table 3.1-2).

Of the 51,952 training items, approximately 50,480 or 97 percent are medium caliber cannon and small arms ammunition. These guns fire cartridges ranging from approximately 2 ¼ inch (5.56 mm) to almost 9 inches (8.78 inch – 25 mm) long (unfired). Due to the small size of the military expended material and low density of expended materials, sediment stability on the ocean bottom is not affected by the cannon and small arms munitions. The other materials making up the training items consist of approximately 1,472 naval gunfire shells and bombs would not be deposited in the exact same location each time; and even if they were, due to ocean currents, the materials would not likely settle in the same vicinity. It is difficult to project an exact rate of military expended material disposition as it is dependent on numerous physical factors to include ocean temperature, current density, drift disposition, size of the object, chemistry and mineralogy. Disturbance to the natural ocean processes does not occur. In addition to these training items, this is also the case for the other military expended material, the majority of which is chaff, which is made up of small aluminum-coated silica glass fibers.

Military expended materials can accumulate in ocean bottom sediments over the entire period of military training, so a short-term analysis does not capture the magnitude of the environmental effects. In a worst-case scenario, assuming the same amounts of training materials are used annually for 20 years, the aggregate density of debris on the ocean floor under the No Action Alternative would be about 70 items per nm^2.

Each of these materials sinks to the ocean floor throughout the GOMEX OPAREA. The small amount of material is spread over a relatively large area. This expended material settles to the ocean bottom and is covered with sediments over time. Due to the small size and low density of materials, sediment stability on the ocean bottom in U.S. Territory would have no impact under the No Action Alternative. Sediment stability on the ocean bottom in non-territorial waters would not cause harm under the No Action Alternative.

Most of the training military expended material would be non-explosive practice munitions (NEPM), and thus harmless, but some of the military expended material would consist of metals such as lead. Although there have not been studies of the specific military expended material dropped in the GOMEX OPAREA, studies have been conducted for other underwater ranges. In 2005, the Canadian Forces Maritime Experimental and Test Ranges (CFMETR) near Nanoose, British Columbia, was analyzed for chemical effects associated with expendable components from activities involving sonobuoys, torpedoes, expendable mobile ASW training targets (EMATT), and auxiliary dry cargo Carriers (ADC)

(ESG, 2005). These expended materials contain many of the same contaminants as training materials used in the GOMEX OPAREA. In the CFMETR study, the analysis focused on lead, copper, lithium and Otto fuel (torpedo fuel). The document stated that metal contaminants were most likely to concentrate in fine-grained particulate matter, especially when smaller than 63 micrometers (µm). The findings of the Environmental Assessment demonstrated that CFMETR operations did not cause a measurable effect on sediment quality (ESG, 2005). Based on the lower density of expended components in the GOMEX OPAREAs, either NEPM or toxic military expended material would measurably affect sediment quality. This concentration of training military expended material in U.S. Territory would have no impact on bottom topography and sediment quality under the No Action Alternative. This concentration of training military expended material in non-territorial waters would not cause harm to bottom topography and sediment quality under the No Action Alternative.

Underwater Detonations in Panama City and Corpus Christi OPAREAs

Underwater detonations would annually consist of 34 charges used in the Panama City OPAREA and 83 charges (including 20 grenades) used in the Corpus Christi OPAREA (Table 2.2-8). Depending on the bottom type, the effects range from very minor disturbance of fine, silty mud bottom substrates to seafloor cratering which would be expected due to explosive detonations in areas of soft substrate. Crater depths are primarily dependent on bottom sediment type, as different sediment types react differently to the forces of explosions. In addition, crater width decreases as bottom depth increases. Crater effects are temporary in sand and mud bottoms. These underwater detonations, could slightly increase local turbidity or create shallow depressions in bottom sediments; however, these are temporary effects that disappear over time under the influence of natural ocean circulation and sediment transport (DoN, 1995). A detailed discussion of ocean circulation and sediment transport can be found in Section 3.3 Water Resources.

McMullen County Range

No explosive filled ordnance is currently authorized for the McMullen County Range. Training consists of dropping approximately 2,636 non-explosive practice munitions and expending 25,000 cannon rounds annually at the Yankee Target. The entire Yankee target configuration is contained within a 1,000-ft diameter circle. On the Dixie target approximately 1,433 non-explosive practice munitions would be dropped. The entire Dixie target configuration is contained within a 600-ft diameter circle. About 29,069 training items would be expended under the No Action Alternative (see Table 2.2-8).

This results in localized soil disturbance at the target areas. Expended munitions are cleared as part of range maintenance. This clearance of expended materials is considered “low disturbance” as only the surface expended munitions are removed. Because of this range maintenance, the concentration of expended munitions would have a less-than-significant effect on soil.

Noxubee County Range

No explosive filled ordnance is currently authorized for the SEARAY Target at the Noxubee County Range. Training consists of dropping approximately 21,045 non-explosive practice munitions at or near the target per year (see Table 2.2-8). The entire target configuration is contained within a 750-ft diameter circle.

This results in localized soil disturbance at the target. Expended munitions are cleared as part of range maintenance. This clearance is considered “low disturbance” as only the expended munitions are removed. Because of this range maintenance, the concentration of expended munitions would have a less-than-significant effect on soil.

MOAs

Basic flight instruction and mission training occur in Meridian, Pine Hill, Pensacola, Kingsville, and Brownwood MOAs. Other than the expenditure of chaff and flares, no ordnance is used in MOAs and therefore there would be no impact on soils and sediments from training in the MOAs. For some of the training in Brownwood MOA chaff and flares are expended at high altitudes, but these expenditures would have no impact on soils and sediments.

NSA Panama City Demolition Pond

Training at the Demolition Pond consists of detonating underwater explosive charges. Localized bottom effects occur when the force of the blast wave disturbs the bottom soil and vegetation. Similar to the disturbances in the ocean OPAREAs, detonations would have localized effects. The smaller pond detonations would have much smaller effects, but because of the closed nature of the pond, natural water circulation would take longer than in an ocean environment for the bottom effects to disappear. These training events occur approximately 90 days per year.

3.1.3.2 Alternative 1

Deposition of Expended Training Materials

Most at sea training exercises would have no potential to affect ocean bottom topography or sediments. The difference in training activities between the No Action Alternative and Alternative 1 could result in a decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training from Alternative 1. There is a slight increase from the No Action Alternative to Alternative 1 in potential impacts to benthic habitats from strikes and accumulation of NEPM. The potential slight increase under Alternative 1 in local turbidity or creations of shallow depressions in bottom sediments would be temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.

The aggregate effects of expended materials from training activities on ocean bottom sediments in the GOMEX OPAREAs (Corpus Christi, Pensacola, and Panama City OPAREAs**)** can be assessed in terms of the number of deposited items per unit area of bottom surface. About 76,055 training items would be expended under Alternative 1. Assuming an ocean floor area of about 14,844 nm^2, this would be about 5.1 items per nm^2 (see Table 3.1-2).

Of the 76,055 training items, approximately 74,480 or 97 percent are medium caliber cannon and small arms ammunition. These guns fire cartridges ranging from approximately 2 ¼ inch (5.56 mm) to almost 9 inches (8.78 inch – 25 mm) long (unfired). Due to the small size of the military expended material and low density of expended materials, sediment stability on the ocean bottom is not affected by the cannon and small arms munitions. The other materials making up the training items consist of approximately 1,575 naval gunfire shells and bombs that would not be deposited in the exact same location each time; and even if they were, due to ocean currents, the materials would not likely settle in the same vicinity. It is difficult to project an exact rate of military expended material disposition as it is dependent on numerous physical factors to include ocean temperature, current density, drift disposition, size of the object, chemistry and mineralogy. Disturbance to the natural ocean processes does not occur. In addition to these training items, this is also the case for the other military expended material, the majority of which is chaff, which is made up of small aluminum-coated silica glass fibers.

Military expended material would accumulate in ocean bottom sediments over the entire period of military training, so a short-term analysis does not capture the magnitude of the environmental effects. In a worst-case scenario, assuming the same amounts of training materials would be used annually for

20 years, the aggregate density of military expended material on the ocean floor would be about 102 items per nm^2.

Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the training military expended material would be NEPM NEPM military expended material at this density would not measurably affect sediment quality. This concentration of training military expended material in U.S. Territory would have no impact on bottom topography and sediment quality under Alternative 1. This concentration of training military expended material in non-territorial waters would not cause harm on bottom topography and sediment quality under Alternative 1.

Underwater Detonations in Panama City and Corpus Christi OPAREAs

In Alternative 1 there would be no underwater detonations in the Panama City and Corpus Christi OPAREAs. In Corpus Christi, there would be approximately 20 grenades used in anti-swimmer defense.

McMullen County Range

For Alternative 1 the impacts to the range would be the same as anticipated under the No Action Alternative (Section 3.1.3.1).

Noxubee County Range

For Alternative 1 the impacts to the range would be the same as anticipated under the No Action Alternative (Section 3.1.3.1).

NSA Panama City Demolition Pond

For Alternative 1 the impacts to the demolitions pond would be the same as anticipated under the No Action Alternative (Section 3.1.3.1).

3.1.3.3 Alternative 2 (Preferred Alternative)

Deposition of Expended Training Materials

The expended materials that are expected if the Navy were to choose Alternative 2 for implementation are very similar to those anticipated for Alternative 1 (Section 3.1.3.2). About 76,062 training items would be expended under Alternative 2. The increase of 7 training materials over the levels proposed in Alternative 1 would not change the number of items per square nautical miles or the 20 year aggregate density per square nautical mile over those levels anticipated in Alternative 1. This concentration of training military expended material in U.S. Territory would have no impact on bottom topography and sediment quality under Alternative 2. This concentration of training military expended material in non-territorial waters would not cause harm on bottom topography and sediment quality under Alternative 2.

Underwater Detonations in Panama City and Corpus Christi OPAREAs

In Alternative 2 there would be no underwater detonations in the Panama City and Corpus Christi OPAREAs.

McMullen County Range

For Alternative 2 the impacts to the range would be the same as anticipated under the No Action Alternative (Section 3.1.3.1).

Noxubee County Range

For Alternative 2 the impacts to the range would be the same as anticipated under the No Action Alternative (Section 3.1.3.1).

NSA Panama City Demolition Pond

For Alternative 2 the impacts to the demolitions pond would be the same as anticipated under the No Action Alternative (Section 3.1.3.1).

3.1.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to bathymetry and sediments.

3.1.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.1-3, the environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on bathymetry, sediment, and soil resources would have no impact in U.S. Territory. In non-territorial waters, the environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on bathymetry, sediment, and soil resources would not cause harm.

TABLE 3.1-3
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE BATHYMETRY, SEDIMENTS, AND SOIL IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
NEPM	Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the training military expended material would be NEPM, and thus harmless. NEPM expended material at this density would not measurably affect sediment quality. Localized disturbance of soft bottom benthic habitats from underwater detonations. Long-term minor impacts to benthic habitats from strikes and accumulation of NEPM.	Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the training military expended material would be NEPM, and thus harmless. NEPM expended material at this density would not measurably affect sediment quality.
HE		
Expended Materials		
Impact Conclusion	The environmental effects of the No Action Alternative on Bathymetry and Sediments resources would have no impact in U.S. Territorial Waters.	In Non-Territorial Waters, the environmental effects of the No Action Alternative on Bathymetry and Sedicments resources would not cause harm.
Alternative 1		
NEPM	Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the training military expended material would be NEPM, and thus harmless. NEPM expended material at this density would not measurably affect sediment quality.	Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the training military expended material would be NEPM, and thus harmless. NEPM expended material at this density would not measurably affect sediment quality.
HE		

TABLE 3.1-3 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE BATHYMETRY AND SOIL IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Expended Materials	Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. Slight increase in potential impacts to benthic habitats from strikes and accumulation of NEPM.	
Impact Conclusion	The environmental effects of Alternative 1 on Bathymetry and Sediments resources would have no impact in U.S. Territorial Waters.	In Non-Territorial Waters, the environmental effects of Alternative 1 on Bathymetry and Sediments resources would not cause harm.
Alternative 2		
NEPM	Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the training military expended material would be NEPM, and thus harmless. NEPM expended material at this density would not measurably affect sediment quality. Decrease in disturbance to soft bottom benthic habitats from underwater detonations based on elimination of Mine Neutralization training. Slight increase in potential impacts to benthic habitats from strikes and accumulation of NEPM.	Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the training military expended material would be NEPM, and thus harmless. NEPM expended material at this density would not measurably affect sediment quality.
HE		
Expended Materials		
Impact Conclusion	The environmental effects of Alternative 2 on Bathymetry and Sediments resources would have no impact in U.S. Territorial Waters.	In Non-Territorial Waters, the environmental effects of Alternative 2 on Bathymetry and Sediments resources would not cause harm.

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3.2 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

3.2.1 Introduction and Methods

Hazardous materials are chemical substances that pose a substantial threat to human health or the environment. In general, these materials pose hazards because of their quantity, concentration, physical, chemical, or infectious characteristics. Hazardous materials include, but are not limited to, petroleum products, coolants, paints, adhesives, solvents, corrosion inhibitors, cleaning compounds, and photographic materials. Hazardous materials are also often used in high technology missiles, munitions, and targets because they are strong, lightweight, reliable, long-lasting, or low-cost. When missiles, munitions, and targets are used for their intended purpose, component hazardous materials, such as flare residue or candle mix, are expended on and in the water. Also, non-hazardous materials enter the water, such as parts of a device made of non-reactive materials, including parts made of steel or aluminum, polymers (*e.g.*, nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent persistent seabed litter, their strong resistance to degradation and their chemical composition mean that they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds. Both hazardous materials and non-hazardous materials are not retrieved after they are expended. Other hazardous materials include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads. Each of the constituents from these components has the potential to affect human health and the environment through direct contact with individuals, water, soil, or air.

Used hazardous materials and chemical byproducts generated at sea are not considered to be hazardous waste until offloaded at port. Current Navy environmental compliance policies and procedures reinforce the Clean Water Act's prohibition against discharge of harmful quantities of hazardous substances into or on U.S. waters out to 200 nm. Navy ships are required to conduct operations at sea in such a manner as to minimize or eliminate any adverse impacts on marine environment. This includes stringent hazardous waste discharge, storage, dumping, and pollution prevention requirements.

A hazardous waste may be a solid, liquid, semi-solid, or contain gaseous material that alone or in combination may: 1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or 2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed, or otherwise managed. Resource Conservation and Recovery Act (RCRA): 42 USC § 6901 *et seq*. regulates management of solid waste and hazardous waste.

Military Munitions Rule – This rule clarifies when conventional and chemical military munitions become a solid waste, which then may be regulated as hazardous waste under the RCRA. Military munitions are not considered hazardous waste under two conditions stated in the EPA Military Munitions Rule and the DoD Interim Policy on Military Munitions (1997). These conditions cover virtually all the uses of missiles, munitions, and targets at the GOMEX Range Complex. Specifically, munitions are not considered hazardous waste when they are:

- Used for their intended purpose, including training of military personnel and explosive emergency response specialists or for research and development activities, and when they are recovered, collected, and destroyed during range clearance events.
- Unused and being repaired, reused, recycled, reclaimed, disassembled, reconfigured, or subjected to other material recovery activities.

The Consolidated Hazardous Materials Reutilization and Inventory Management Program (CHRIMP) Manual (DoN updated) and the 2005 Hazardous Materials Minimization, Hazardous Waste Reutilization and Disposal Guide (DoN, 2008a) provide information on management of hazardous waste, both afloat and ashore. These documents provide a comprehensive compilation of procedures and requirements mandated by law, directive, or regulation. They have a compliance orientation to ensure safe and efficient control, use, transport, and disposal of hazardous waste.

Hazardous material and waste generated afloat are stored in approved containers and offloaded for proper disposal within five working days of arrival at a Navy port. The CHRIMP provides assistance in the development and implementation of local hazardous material management. It is available online at: http://www.naspensacola.navy.mil/logistics/chrimp.pdf.

3.2.1.1 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this Final EIS/OEIS includes several warfare areas (*e.g.*, Mine Warfare, Air Warfare, *etc.*) and each includes multiple types of training operations (*e.g.*, Bombing Exercise (Air-to-Surface), Gunnery Exercise (Surface-to-Surface), *etc.*). Likewise, several activities (*e.g.*, weapons firing, target deployment, *etc.*) are accomplished under each operation. Accordingly, the analysis in this section is organized by specific activity rather than warfare area or operation.

To address potential impacts, the approach to analysis includes characterizing the yearly test and training operations that may contribute hazardous materials, hazardous constituents, and non-hazardous expended material to the GOMEX Range Complex ocean, air, and land environment. These include missile flights; targets expenditure; ship, boat, and aircraft operations; and weapons firing.

Study Area

In this Final EIS/OEIS, the hazardous material and hazardous waste study area is the same as defined in Section 1.5.

Data Sources

Data and analyses used in this section were taken from Department of the Navy and Department of Air Force sources, which are listed in the Reference Section (Chapter 7) Most often, these sources were environmental analyses that were performed on similar operations, munitions, and equipment used in similar conditions as that of the GOMEX OPAREA. If a direct correlation could not be made between a previous analysis and any of the Alternatives in this EIS, it was not used.

Significance Criteria and Impact Thresholds

Numerous federal, state, and local regulations govern the handling, storage, and disposal of waste and hazardous materials (see Appendix K). The primary objective of the regulations is to protect public health and the environment. A significant impact would result if the use of hazardous materials or the generation of hazardous waste resulted in a violation of any of the laws cited in Appendix K.

3.2.1.2 Warfare Areas and Associated Environmental Stressors

Aspects of the proposed actions that are likely to act as stressors were identified by conducting an analysis of the warfare areas, operations, and specific activities included in the alternatives. Appendix D provides detailed descriptions of operations. Table 3.2-1 presents identified stressors and their association with specific operations that would occur within the GOMEX Range Complex. Check-marked cells in Table 3.2-1 are associated with the operation and associated training items that are carried forward for detailed analysis in this Final EIS/OEIS.

Table 3.2-2 identifies the training item source associated with the component hazardous materials, other hazardous materials, and non-hazardous materials for each operation and the training area location where the operation would occur. Operations that do not produce component hazardous materials, other hazardous materials, and non-hazardous materials or introduce any of these into the environment by the nature of their operation as defined in this chapter are not carried forward.

TABLE 3.2-1
POTENTIAL STRESSORS ASSOCIATED WITH HAZARDOUS AND NON-HAZARDOUS MATERIALS

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Mine Warfare Deployment/Recovery**	**Non-Explosive Practice Munitions**	**Underwater Detonations and High Explosive Ordnance**	**Military Expended Material**
Mine Warfare (MIW)					
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA	✓			
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓			
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	✓
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B		✓	✓	✓
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓		✓
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A		✓		✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Panama City OPAREA		✓		✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Corpus Christi OPAREA UNDET BOX E3		✓		✓

TABLE 3.2-1 (Continued)
POTENTIAL STRESSORS ASSOCIATED WITH HAZARDOUS AND NON-HAZARDOUS MATERIALS

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Mine Warfare Deployment/Recovery**	**Non-Explosive Practice Munitions**	**Underwater Detonations and High Explosive Ordnance**	**Military Expended Material**
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155				
MSO to include VBSS/MIO- Helo	W-151/W-155				
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓		✓	
Air Warfare (AW)					
Air Intercept Control (AIC)	W-151; W-155		✓		
Strike Warefare					
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓		✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓		✓
Amphibious Warfare (AMW)					
Firing Exercise (FIREX) with IMPASS	W-151A/B; W-155A		✓	✓	✓
Electronic Combat (EC)					
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A				✓
Chaff Exercises (CHAFFEX)	Brownwood MOAs				✓
Flare Exercises (FLAREX)	W-155A/B				✓
Flare Exercises (FLAREX)	Brownwood MOAs				✓

TABLE 3.2-1 (Continued)
POTENTIAL STRESSORS ASSOCIATED WITH HAZARDOUS AND NON-HAZARDOUS MATERIALS

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Mine Warfare Deployment/Recovery**	**Non-Explosive Practice Munitions**	**Underwater Detonations and High Explosive Ordnance**	**Military Expended Material**
Mission Area Training[37]					
Mission Area Flight Training	W-92; W-54; Brownwood MOAs		✓		✓
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312				
Salvage Diver Training	NSA Panama City Demolition Pond				
EOD Tech Training	NSA Panama City Demolition Pond			✓	✓
Security Force Training	NSA Panama City Demolition Pond			✓	✓
Diver Training	NSA Panama City Demolition Pond				

[37] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

TABLE 3.2-2
HAZARDOUS AND NON-HAZARDOUS TRAINING ITEMS ASSOCIATED WITH THE OPERATIONS

Operation	Training Area	Training Area Proximity	Hazardous/Non-Hazardous Training Item
Mine Countermeasures (MCM) - Airborne, MK-103	Corpus Christi OPAREA and Panama City OPAREA	Panama City OPAREA: 50% Corpus Christi OPAREA: 50%	• MD54 Explosive (0.002 lb net explosive weight charge, MK-17 cutter)
MCM - Surface (In MCM, an explosive cutter is used. It is a device powered by a small explosive charge which is fitted to a sweep wire to cut or part the moorings of mines or moored obstructions.)	Corpus Christi OPAREA and Panama City OPAREA	Panama City OPAREA: 50% Corpus Christi OPAREA: 50%	• 20 lb net explosive weight charge
Mine Neutralization - Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	Panama City OPAREA: 50% Corpus Christi OPAREA: 50%	• 20 lb net explosive weight charge
Mine Neutralization - Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	Panama City OPAREA: 28% Corpus Christi OPAREA: 72%	• 5 lb Demo charge • 10 lb Demo charge • 20 lb Demo charge
Bombing Exercise (Air–to-Surface)	Pensacola W-155 Hotbox	Inside 3 nm 1 % 3-12 nm 2% Outside 12 nm 97%	• MK-80 series bombs • MK-76 bomb • BDU-45 bomb • Marine marker smoke float
Gunnery Exercise (Air-to-Surface)	W-155 Hotbox	Inside 3 nm 5 % 3-12 nm 5% Outside 12 nm 90%	• 20-mm cannon shell • Floating At-Sea Target (10-ft diameter red balloon tethered by sea anchor), 50-gallon steel drum, or other available target such as a cardboard box (non-hazardous) • Marine marker smoke float
Gunnery Exercise (Surface–to-Surface)	W-155 Hotbox	Outside 12 nm 100%	• 5 inch/54 cal NEPM • 20-mm (CIWS) • 76-mm • 25-mm cannon shells • .50 cal machine gun • High Speed Maneuvering Surface Target (HSMST), trimaran or radar reflective surface balloon (Killer Tomato), Floating at-sea target (FAST), 55 gal drum or balloon (non-hazardous)

TABLE 3.2-2 (Continued)
HAZARDOUS AND NON-HAZARDOUS TRAINING ITEMS ASSOCIATED WITH THE GOMEX RANGE COMPLEX OPERATIONS

Operation	Training Area	Training Area Proximity	Hazardous/Non-Hazardous Training Item
Gunnery Exercise (Surface–to-Surface) (Boat)	Panama City OPAREA	9 nm	• 7.62-mm Machine Gun rounds
Gunnery Exercise (Surface–to-Surface) (Boat)	Corpus Christi UNDET Box E3	9 nm	• 7.62-mm Machine Gun rounds (A151) • 50 cal (A555) • 40-mm (B576) • MK3A2 grenades
Air Intercept Control (AIC)	W-151; W-155	Outside 12 nm 100%	• Flares • Chaff
Bombing Exercises (BOMBEX) – Air to Ground	SEARAY Target; Dixie Target; Yankee Target	Inside 3 nm 100% SEARAY Target: 94% Dixie Target: 4% Yankee Target: 2%	• BDU-33 25 lb NEPM • MK-76 25 lb NEPM • MK-82 500 lb NEPM • Marine marker smoke float
Gunnery Exercises (GUNEX) – Air-to-Ground	Yankee Target	Inside 3 nm 100%	• 20-mm rounds • Ground Targets (vehicles, tanks) (non-hazardous)
Firing Exercises (FIREX) – Surface-to-Surface (with IMPASS)	W-151 A/B; W-155A	Outside 12 nm 100%	• 5 inch (NEPM) • Surface targets: IMPASS, Trimaran, SPAR, Killer Tomato
Chaff Exercise (CHAFFEX) – Aircraft and Ships	W-151 A/B; W-155A	Outside 12 nm 100%	• Chaff
Flare Exercise (FLAREX)	W-155A/B	Outside 12 nm 100%	• Flares
Mission Area Flight Training	W-92; W-54; Brownwood MOAs	Inside 3 nm 5% 3-12 nm 5% Outside 12 nm 90%	• None
Basic Flight Instruction (and MAT MOAs)	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312	Inside 3 nm 100%	• None
Salvage Diver Training	NSA Panama City Demolition Pond	Inside 3 nm 100%	• Ordnance related items (detonation cord, timers, fuses, blasting caps) • TNT, 1 lb NEW 40-mm rounds
Underwater Demolitions, EOD	NSA Panama City Demolition Pond	Inside 3 nm 100%	• Ordnance related items (detonation cord, timers, fuses, blasting caps) • Charge, Demil, M183, 1.25 NEW • Charge, Demil, C-4, 1.25 NEW • Marine marker smoke float

TABLE 3.2-2 (Continued)
HAZARDOUS AND NON-HAZARDOUS TRAINING ITEMS ASSOCIATED WITH THE GOMEX RANGE COMPLEX OPERATIONS

Operation	Training Area	Training Area Proximity	Hazardous/Non-Hazardous Training Item
Security Force Training	NSA Panama City Demolition Pond	Inside 3 nm 100%	• Ordnance related items (detonation cord, timers, fuses, blasting caps) • 40-mm rounds • Smoke Grenades
Diver Training	NSA Panama City Demolition Pond	Inside 3 nm 100%	• Ordnance related items (detonation cord, timers, fuses, blasting caps) • Charge, Demil, C-4, 1.25 NEW

3.2.2 Affected Environment

Hazardous Materials and Hazardous Constituents

Hazardous materials are broadly defined as those materials with clearly hazardous properties that are in general use in commercial and industrial applications. They are required for maintenance and operation of vessels, machinery, and equipment used by the Navy in training activities. All commands (ship or shore) can return excess and unused hazardous materials to the Hazardous Material Minimization Center (HAZMINCEN) located at their assigned Naval Station (DoN, 2008a).

Hazardous constituents can generally be defined as hazardous materials present at low concentrations in a generally non-hazardous matrix, such that their hazardous properties do not produce acute effects. Navy vessels conducting training do not intentionally release hazardous constituents into the water. The USEPA and DoD, however, have identified numerous waste streams from Navy vessels that do or may contain hazardous constituents. Waste streams from Navy vessels that may contain hazardous constituents include hull coating leachate, bilge water/oil water separator discharges, gray water, cooling water, weather deck runoff, chain locker effluent, elevator pit effluent, and photographic laboratory drains. Small boat engines discharge petroleum products in their wet exhaust.

Current Navy training operations use a variety of solid and liquid hazardous materials. Hazardous materials required in GOMEX Range Complex training are broadly classified as shipboard materials necessary for normal operations and maintenance, such as fuel and paint and training materials. Training materials include both live munitions (considered to be hazardous materials because they contain explosives or propellants, but not considered to be a hazardous waste), practice munitions, and non-munitions training materials.

Some training materials, including gun ammunition, bombs, missiles, targets, chaff, and flares are expended on the range and not recovered and include component hazardous materials, as stated above. Non-hazardous items entering the water, and component hazardous materials (*e.g.*, flare residue or candle mix), typically are not recovered, as mentioned above. A small percentage of training items containing military explosives fail to function properly, and - if not recovered - remain on the range as unexploded ordnance.

Quantities of training items currently used in Navy training operation within the GOMEX Range Complex are listed on Tables 2.2-7 and 2.2-8. Training events and explosives occurring in the Demolition Pond are shown on Table 2.2-6.

Hazardous Materials Baseline Conditions

Open ocean areas are typically considered relatively pristine with regard to hazardous materials and hazardous waste. Hazardous materials are present on the ocean, however, as cargo and as fuel, lubricants, and cleaning and maintenance materials for marine vessels and aircraft. Infrequently, large hazardous material leaks and spills—especially of petroleum products—impact the marine environment and adversely affect marine life. No quantitative information is available on the overall types and quantities of hazardous materials present on the sea ranges at any given time.

Navy vessels present within the GOMEX Range Complex represent a small fraction of the overall commercial and recreational boat traffic and, correspondingly, account for only a small fraction of the hazardous materials present within the GOMEX Range Complex. As described earlier, Navy training activities in open ocean areas involve the use of fuel, lubricants, explosives, propellants, batteries, oxidizers, and other hazardous substances. The Navy makes every effort to minimize its use of hazardous materials during training, and recovers and reuses unexpended training materials to the extent practicable as described in the 2005 Hazardous Materials Minimization, Hazardous Waste Reutilization and Disposal Guide available online at http://www.cnrma.navy.mil/environmental/hazardous_waste.htm.

Hazardous Waste Baseline Conditions

Hazardous waste is present within the GOMEX Range Complex, both on surface vessels and in bottom sediments. Commercial, scientific, and military vessels generate small quantities of hazardous waste during their operations. These materials typically are accumulated while at sea, and then offloaded and transported to land disposal facilities when in port. No quantitative information is available on the overall types and quantities of hazardous waste present on the sea ranges at a given time, nor on their distribution among the various categories of vessels.

As a result of the past practice of ocean disposal of hazardous waste, isolated deposits of various types of hazardous waste may be found on the ocean floor. Although no such sites have been identified within the Navy's sea ranges, the potential for one or more hazardous waste deposits to be present cannot be discounted.

3.2.3 Environmental Consequences:

The 2005 Hazardous Materials Minimization, Hazardous Waste Reutilization and Disposal Guide available online (http://www.cnrma.navy.mil/environmental/hazardous_waste.htm) provides points of contact and detailed information regarding shipboard hazardous waste and material turn-in.

The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) prohibits certain discharges of oil, garbage, and other substances from vessels. The MARPOL Convention and its Annexes are implemented by national legislation, including the Act to Prevent Pollution from Ships (APPS) (33 USC 1901 to 1915) and the Federal Water Pollution Control Act (FWPCA) (33 USC 1321 to 1322). These statutes are further implemented and amplified by DoN and the Office of the Chief of Naval Operations Environmental and Natural Resources Program, which establishes Navy policy, guidance, and requirements for the operation of Navy vessels. The vessels operating on the Navy GOMEX Range would comply with the discharge requirements established in this program, minimizing or eliminating potential impacts from discharges from ships.

Aviation fuels (JP-5 and JP-8) are complex mixtures of aliphatic and aromatic hydrocarbons composed of approximately 80 to 90 percent alkanes and cycloalkanes; 10 to 20 percent aromatics (benzene and alkylbenzenes); one percent olefins; less than five percent polycyclic aromatic hydrocarbons (PAHs); and small amounts of additives (antioxidants, dispersants, corrosion inhibitors, *etc.*). Most fuel

components, which are quite volatile, readily vaporize to the atmosphere where they degrade. Even when released to surface water or soil, the most volatile components of the jet fuels (low molecular weight alkanes and aromatics) would be expected to evaporate quickly. Less-volatile components, which tend to absorb to soil particles or to sediments in surface water, could persist but would eventually degrade.

Fuel dumping by aircraft rarely occurs. DoN aircrews are prohibited from dumping fuel below 6,000 feet, except in an emergency situation. Above 6,000 feet, the fuel has enough time to completely vaporize and dissipate and would therefore have a negligible effect on the surface below. A study performed by Air Force (USAF, 2002) indicates that 735 gallons of fuel ejected from an aircraft at 5,000 feet altitude would result in approximately 99 percent evaporation before fuel hits the surface. Additionally, jet fuel has a short half-life, and consequently does not persist in the marine environment.

The Navy has recently implemented the Water Range Sustainability Environmental Program Assessment (WRSEPA) Policy (29 August 2008) to ensure the long-term viability of our operational ranges while protecting human health and the environment (Chief of Naval Operations, 2008). The impact of training materials expended in the marine environment will be a focus of the WRSEPA Policy. Protective measures will be considered and implemented if practicable to sustain range operations, maintain environmental compliance, and address unacceptable risks associated with munitions constituents and MEMCs. Protective measures are actions or best management practices designed and implemented to abate, prevent, minimize, stabilize, or eliminate the release or the threat of release of munitions constituents and MEMCs and risks to human health or the environment.

Military component hazardous materials from military training can leak or leach small amounts of toxic substances into surface water, soil, and/or groundwater as they degrade and decompose (see Table 3.2-3). These items decompose very slowly, so the volume of component hazardous material and other hazardous material that decomposes within the training areas, and the amounts of toxic substances being released to the environment, gradually increase over the period of military use. Concentrations of some substances in sediments surrounding these hazardous materials increase over time, but sediment transport via currents can eventually disperse these contaminants outside training areas where they will be present at very low concentrations and, thus, have no effect on the environment.

TABLE 3.2-3
COMPONENT HAZARDOUS MATERIALS

Training Application/ Munitions Element	Component Hazardous Material
Pyrotechnics Tracers Spotting Charges	Barium chromate Potassium perchlorate Chlorides Phosphorus Titanium compounds
Oxidizers	Lead oxide
Delay Elements	Barium chromate Potassium perchlorate Lead chromate

TABLE 3.2-3 (Continued)
COMPONENT HAZARDOUS MATERIALS

Training Application/ Munitions Element	Component Hazardous Material
Propellants	Ammonium perchlorate
Fuses	Potassium perchlorate
Detonators	Fulminate of mercury Potassium perchlorate
Primers	Lead azide
Other Explosives	2-Amino-4,6-dinitrotoluene (2-A-4,6-DNT 4-Amino-2,6-dinitrotoluene (4-A-2,6-DNT) 1,3-Dinitrobenzene (1,3-DNB) 2,4-Dinitrotoluene (DNT) 2,6-DNT Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) Methyl-2,4,6-trinitrophenylnitramine (Tetryl) Nitrobenzene Nitroglycerin 2-Nitrotoluene 3-Nitrotoluene 4-Nitrotoluene Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) Perchlorate 1,3,5-Trinitrobenzene (1,3,5-TNB) 2,4,6-Trinitrotoluene (TNT) Metals (*e.g.,* aluminum, arsenic, lead, mercury)

Source: DoN, 2008b

3.2.3.1 No Action Alternative

Navy training operations conducted under the No Action Alternative use a variety of material. Material required on the GOMEX Range Complex is broadly classified as shipboard material necessary for normal operations and maintenance, such as fuel and paint and MEM. MEM includes both HE and NEPM. Some MEM, including gun ammunition, bombs, missiles, targets, chaff, and flares are expended on the range and not recovered. A small percentage of training items containing military explosives may fail to function properly and, if not recovered, may remain on the range as unexploded ordnance.

MEM that falls into the water may release small amounts of toxic substances as it degrades and decomposes. The items degrade very slowly, so the volume of expended decomposing training material within the training areas—and the amounts of toxic substances being released to the environment—gradually increase over the period of military use. Concentrations of some substances in sediments surrounding the expended material would increase over time. Sediment movements in response to tidal surge and longshore currents, and sediment disturbance from ship traffic and other sources, would eventually disperse contaminants. The following paragraphs discuss the characteristics and the fate and transport of training items used within the GOMEX Range Complex.

Bombs

Typically, bombing exercises (BOMBEX) at sea involve one or more aircraft bombing a target simulating a hostile surface vessel. Most of the bombs used at sea in GOMEX Range Complex exercises are non-explosive practice munitions (NEPM) without explosive warheads. NEPM are also called bomb dummy units (BDU). They are bomb bodies filled with an inert material (*e.g.*, concrete) and configured with either low-drag conical tail fins or high-drag tail fins for retarded weapon delivery. A BDU has the same ballistics as a live bomb. Inert mine shapes are pieces of concrete or steel cases formed in the shape of a mine filled with concrete. Both could be used within the GOMEX Range Complex. Although lacking high explosive filler, practice bombs may be equipped with spotting charges that contain a small amount of titanium tetrachloride, and that produce a visual indication of impact. The spotting charge is a small smoke charge activated by a mechanical fuze when the bomb hits the ground to readily see where the bomb hits the target for scoring purposes. Detonation of the spotting charge consumes approximately 98 to 99 percent of the explosive component (DoN, 2002.) The 1 to 2 percent of explosive component not consumed is generally dispersed, with most falling to the soil in the immediate vicinity of the impact and the balance being dispersed in the air subject to wind currents and weather conditions.

Live Bombs are to be dropped (with and without laser targeting) in the Pensacola OPAREA, W-155 Hotbox (see Fig. 2.1-1). Under the No Action Alternative, bombs deployed at the W-155 Hotbox include: 28 MK-82 and 24 MK-83. Bombs with live ordnance would be fused to detonate on contact with the water, and it is estimated that 99 percent of them would explode within a depth of 5 feet (DoN, 2005).

Bomb bodies are steel and the bomb fins are either steel or aluminum. The steel may contain small percentages (typically less than 1%) of any of the following: carbon, manganese, phosphorus, sulfur, copper, nickel, chromium, molybdenum, vanadium, columbium, or titanium. The aluminum fins, in addition to the aluminum, may also contain: zinc, magnesium, copper, chromium, manganese, silicon, or titanium. Bombs currently used at the GOMEX Range Complex sea range and their approximate weight, length, and diameter are provided in Table 3.2-4. The MK-80 series of bombs includes consideration of Tritonal or H6 filled cases (as in the case of the MK-82/84) as well as PBXN-109 filled cases (BLU 109/110/111).

TABLE 3.2-4
HE BOMBS RECENTLY DEPLOYED BY EXERCISE AIRCRAFT ON THE GOMEX RANGE COMPLEX SEA RANGE

Bomb Type	Type	~Weight (pounds)	~Length (inches)	~Diameter (inches)
MK-82/GBU-30/38 (live) (192 lb NEW)	General Purpose	500	90	11
MK-83/GBU-32 (live) (415 lb NEW)	General Purpose	1,000	119	14
MK-84/GBU-31 (live) (945 lb NEW)	General Purpose	2,000	129	18

One hundred percent of the bombs used on land targets would be NEPM without HE filler. Land targets are the Yankee and Dixie targets at the McMullen County Range, and the SEARAY target within the Meridian, Mississippi MOA. The Yankee Target on the McMullen County Range consists of a 360-acre, rectangular-shaped munitions impact area. The bombing target is a bull's-eye containing scrap aircraft engine canisters surrounded by concentric rings of used tires.

Strafing pits are used for air-to-ground gunnery training. Air-to-ground gunnery training (strafing) primarily uses 20-mm target practice ammunition. The projectiles of the 20-mm target practice (TP) rounds contain no explosives, lead, or spotting charges, and are constructed of steel and non-ferrous alloys. However, different weapons of the same caliber may use different types of rounds for training. During night training, 20-mm tracer projectiles are used; these contain a small charge of incendiary material. Strafe targets are generally suspended banners, drag chute panels, or other suitable wooden targets with a sand pit or berm immediately down-range to capture the training rounds.

Recent ordnance records at the Yankee Target (DoN, 2007) indicate 99% of ordnance items larger than 20-mm are BDU-33s. However, only 20-mm inert/ball/TP rounds will be used at Yankee target.

In 1994, an Environmental Baseline Survey performed for the U.S. Air Force at Yankee Target found "no significant concerns for soil or water contamination." (USAF, 1994). A Range Condition Assessment, performed prior to this Comprehensive Range Evaluation (CRE) found that "no environmental issues were identified that could potentially cause off-range contaminant migration or that will adversely impact the daily operations or overall sustainability of the Dixie and Yankee targets" (DoN, 2007). Specifically, there has been no known migration of contaminants toward offsite locations; no evidence of onsite or offsite impact to air, soil, surface water, groundwater, vegetation, wildlife, or people; and no reports or complaints by offsite residents and visitors of environmentally-related impacts.

An Operational Range Clearance (ORC) Plan calls for annual and 5-year expanded clearances of the McMullen County Range. The plan includes procedures for removal and disposal or recycling of range scrap and debris (e.g., munitions, munitions residue, and target residue). The range scrap and debris processing and recycling procedures contained in the ORC Plan are taken from the guidelines and requirements for management of hazardous material generated by the Navy, which are contained in DoD Directive 4160.21-M, "Defense Material Disposition Manual," Chapter 4, 14 February 1995 and DoD INST 4140.62, as updated by Section 13-15, NAVSEA OP5, June 2006.

The SEARAY target also only allows NEPM, and its Range Clearance Plan contains similar range management practices as the McMullen County Range.

Bombs Fate and Transport

Practice bombs entering the water would be substantially devoid of combustion chemicals found in the warheads of explosive bombs. They are typically made of concrete and steel. These components are consistent with the primary component building blocks of today's artificially built reef structures. The steel and iron, though durable, would corrode over time, with no noticeable environmental impacts. The concrete is also durable and would offer a beneficial substrate for benthic organisms. After sinking to the bottom, the physical structure of bombs would be incorporated into the marine environment by natural encrustation and/or sedimentation (DoN, 2006b). Refer to Section 3.3, Water Resources for additional detail regarding water quality.

Small fragments of detonated bombs would settle to the sea floor. Un-recovered ordnance would also sink to the bottom where solid metal components would be corroded by seawater at slow rates. Over time, natural encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the material and conditions in the immediate marine and benthic environment. Expended ordnance scattered on the ocean floor would be widespread and have a minimal impact on the benthic environment.

Ground (inland) targets (Yankee, Dixie, and SEARAY targets) are used at McMullen County and Noxubee County Ranges. Practice bombs are allowed on all three targets, but strafing runs are allowed only at the Yankee Target. The facilities consist of a bull's-eye target, and practice bomb targets such

as buses, tanks, convoys, aircraft engine canisters, and boxes. Most of the ranges is surrounded by ranch lands. The targets are not completely destroyed or expended, because only non-explosive practice ordnance is used at these ranges. EOD on the McMullen Bombing and Gunnery Range is the responsibility of the Navy and is conducted twice per year. EOD personnel inspect and neutralize any unspent spotting charges on the recovered practice munitions. The deactivated and spent ordnance items are stockpiled in the corresponding target Range Holding Area (RHA) for removal. Additionally, EOD personnel inspect and retrieve any cleared 20mm and 30mm ammunition and expended casings. Operational Range Clearance (ORC) efforts are conducted in accordance with the Navy's policy (CNO letter 3000 Ser N34/4U741226 of 2 Apr 04) and USAF's ORC policy. ORC activities will predominantly involve the (manual) collection of recoverable sub scale (less than/equal to 25 lb) NEPM.

The ORC Plan, December 2007, calls for annual and 5-year expanded clearances of the McMullen Range. The plan includes procedures for removal and disposal or recycling of range scrap and debris (e.g., munitions, munitions residue, and target residue). The range scrap and debris processing and recycling procedures contained in the ORC Plan are taken from the guidelines and requirements for management of hazardous material generated by the Navy, which are contained in DoD Directive 4160.21-M, "Defense Material Disposition Manual," Chapter 4, 14 February 1995 and DoD INST 4140.62, as updated by Section 13-15, NAVSEA OP5, June 2006.

The SEARAY target also only allows inert bombs, and its Range Clearance Plan contains similar range management practices as the McMullen County Range. Due to these routine range clearance activities, long term soil contamination is not expected. As stated above, ORC policy requires the removal of all UXO and range scrap/debris within and 100 ft out from the target area. Furthermore, ORC policy at Section 4b(4) requires the annual removal of all UXO and range scrap/debris within and 100 ft out from the perimeter of strafe target run-in lines. The loose soil at the Yankee Target strafing locations reduces the potential for expended rounds to remain on the ground surface. Furthermore, due to the loose soil in the target area and the typical round penetration into the subsurface, there is minimal potential for surface ricochet hazards. The regular inspection of the strafing target area surface conditions by Range Management should minimize the potential for ricochets, since clearance activities would be planned and implemented when triggered by the presence of surface debris posing a potential ricochet hazard.

It is unlikely that Munition Constituents (MCs) would be released to the environment at either the Dixie or Yankee Targets because they only receive practice munitions that do not contain high explosives. Normally practice bomb spotting charge materials are fully consumed following the impact of the bomb and there are no MC marker compounds (TNT, RDX, HMX, DNT, and perchlorate) in residual or unfired spotting charges. The only potential for MCs at the Dixie and Yankee Targets would be related to the small amounts C4 high explosives used to neutralize and deactivate the isolated practice bomb spotting charges that failed to completely function or did not activate on contact with the ground (RCA Report, DoN, 2007). Based the operational history of the Dixie and Yankee Targets at the McMullen Bombing and Gunnery Range, there is no significant concern of an MC release into the environment or an MC source that could pose an imminent and substantial threat to human health or the environment.

Targets and Countermeasures

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units and are usually recovered for reuse. Small concentrations of fuel and ionic metals are released during battery operation and could enter the water, thus contaminating limited areas; however, they do not represent a source of substantial environmental degradation.

Surface targets include Integrated Maritime Portable Acoustic Scoring and Simulator Systems (IMPASS); Improved Surface Tow Targets (ISTT); QST-35 Seaborne Powered Targets (SEPTAR); and

expendable marine markers (smoke floats). Expended surface targets commonly used in addition to marine markers include cardboard boxes, 55-gallon steel drums, and a 10-foot diameter red balloon tethered by a sea anchor (also known as a "killer tomato"). Floating debris may be lost from target boats.

A typical aerial target drone is powered by a jet fuel engine, generates RF signals for tracking purposes, and is equipped with a parachute to allow recovery. They also contain oils, hydraulic fluid, batteries, and explosive cartridges as part of their operating systems. There are also recoverable, remotely controlled target boats and underwater targets designed to simulate submarines. If severely damaged or displaced, targets may sink before they can be retrieved. Aerial targets on the GOMEX Range Complex would include AST/ALQ/ESM pods; Banner drones; BQM 74E drones; and TALDs. The only expendable target is the TALD; all other aerial targets are non-expendable.

Target and Countermeasures Fate and Transport

Potentially hazardous material in targets (*e.g.*, BQM-74) include fuel and batteries. A BQM-74 starts operation with 107 lbs of liquid fuel, and it was assumed that 20 percent of the fuel (21.5 lbs) remains at the completion of each mission. It was also conservatively assumed that 20 percent of the fuel was composed of PAHs (PAHs such as acenaphthene generally make up less than 4% of fuel oil, and naphthalene is generally less than 1% [National Research Council, 1985]). This analysis also assumed a worst-case scenario in which the target would be destroyed on impact with the water rather than recovered intact. The majority of targets are recovered by use of an engine cut-off switch and a parachute. The target is retrieved from the water by helicopter.

In the case of a severe malfunction and a crash, water surface impacts would occur at a speed of at least 500 knots (600 miles per hour) and could realistically affect an area up to 10 times the size of the target (taking into consideration water displacement). A typical target (BQM-74) is approximately 12.9 feet long, 2.3 feet high, with a wingspan of approximately 5.8 feet. Therefore, the analysis assumed a circle with a diameter of 58 feet would encompass the affected area. Given the low density of the hazardous constituents (*e.g.*, fuel, oil) relative to seawater, the analysis also assumed that only the top 3 feet of the water column would be affected. Based on these assumptions, the affected surface area would be about 10,600 ft_2 and the affected volume of seawater would be 2.5 by 105 gallons. The resulting concentration of PAHs would be 503 µg/L for each operation. This concentration is below the threshold established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). Note: 1 µg/L = 1 ppb.

Most target fragments would sink quickly in the sea. Expended material that sinks to the sea floor would gradually degrade, be overgrown by marine life, and/or be incorporated into the sediments. Floating non-hazardous expended material may be lost from target boats and would either degrade over time or wash ashore as flotsam. Non-hazardous expended material is defined as all parts of a device made of non-reactive materials, including parts made of steel or aluminum, polymers (*e.g.*, nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent persistent seabed litter, their strong resistance to degradation and their chemical composition mean that they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.

Canadian Forces Maritime Experimental and Test Ranges (CFMETR) is located in Nanoose Bay on the east coast of Vancouver Island, north of Nanaimo. It was established jointly by Canada and the United States in 1965. Its operations focus on torpedo, sonobuoy and underwater testing of military equipment. CFMETR tests 300 to 400 torpedoes annually, mostly the MK-48. Unrecovered material includes: 93,000 km of copper guidance wire, 1300 tons of lead weight, debris from 60,000 sunken sonobuoys, 2,000 parachutes, and 4,000 smoke flares. Yet, after years of accident free use, an extensive study

conducted in Canada (Environmental Sciences Group, 2005) at CFMETR near Nanoose, British Columbia, concluded that in general, the direct impact of debris accumulation on the sea floor appeared to be minimal, and had no detectable effects on wildlife or sediment quality.

At the Yankee, Dixie, and SEARAY targets, debris and scrap material from the targets will be cleaned up in accordance with the ORC and therefore present no long term soil contamination issues.

Marine Markers (Smoke Floats)

Marine markers are pyrotechnic devices dropped on the water's surface. They are used in training exercises to mark a surface position on the ocean. The chemical flame of a marine marker burns like a flare, but also produces smoke.

The MK-58 is composed of tin and contains two red phosphorus pyrotechnic candles and a seawater-activated battery. The MK-58 marine marker is 21.78 inches long and 5.03 inches in diameter, weighs 12.8 pounds, and produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes (http://www.ordnance.org/mk58.htm)..

Marine Markers Fate and Transport

Smoke from marine markers would be rapidly diffused by air movement. The marker itself is not designed to be recovered and would eventually sink to the bottom and become encrusted and/or incorporated into the sediments.

Phosphorus contained in the marker settles to the sea floor where it reacts with the water to produce phosphoric acid, until all phosphorus is consumed by the reaction. Combustion of red phosphorus produces phosphorus oxides, which have a low toxicity to aquatic organisms. The red phosphorus is not anticipated to have a significant effect on the marine environment (DoN, 2006b). Refer to Section 3.3, Water Resources for additional detail regarding water quality.

Naval Gun Fire

Naval gun fire within the GOMEX Range Complex would use NEPM 5-inch and 76-mm rounds. Non-explosive ordnance practice shells would not be recovered and would sink to the ocean floor. Solid metal components of non-explosive ordnance would also sink.

Naval Gun Fire Fate and Transport

Shell fragments rapidly decelerate through contact with the surrounding water and settle to the sea floor. Un-recovered ordnance also sinks to the bottom. Metal shells and fragments would be corroded by seawater at slow rates, with comparable slow release rates. Over time, natural encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the material and conditions in the immediate marine and benthic environment. However, the release of contaminant from unexploded ordnance, non-explosive ordnance, and fragments is not expected to result in substantial degradation of marine water quality. Refer to Section 3.3, Water Resources for additional detail regarding water quality.

Naval Gun Fire on Land Targets (Strafing Runs) Fate and Transport

As discussed earlier in this section, air-to-ground gunnery training (strafing) primarily uses 20-mm target practice ammunition. The projectiles of the 20-mm target practice (TP) rounds contain no explosives, lead, or spotting charges, and are constructed of steel and non-ferrous alloys. However, different weapons of the same caliber may use different types of rounds for training. The constituents of these strafing practice rounds include aluminum alloy, copper alloy, steel, nitrocellulose, nitroglycerin, dibutylphthalate, potassium nitrate, potassium oxalate, potassium sulfate, graphite, barium nitrate, lead

styphnate, calcium silicide, trinitroresorcinol, gum Arabic, brass, acacia (technical), acetylene black, and tin dioxide. During night training, 20-mm tracer projectiles are used; these contain a small charge of incendiary material. Over time, rounds and fragments from strafing runs accumulate beneath the ground surface and begin to corrode. Rates of deterioration would vary, depending on the material and conditions in the immediate soil. Because periodic cleanups of target areas are specified in Range Complex Management Plans, it is expected that concentrations of some substance in sediments would not increase over time. Therefore, the release of contaminant from these types of rounds and resulting metal fragments is not expected to result in substantial degradation of soil quality or ground water quality.

Small Arms and Close-In Weapons System Fire

Small arms ammunition used in the GOMEX Range Complex consists of the .50 (caliber) machine gun round, the 7.62-mm NATO rifle/machine gun round, and the inert 40-mm practice round. The .50 caliber cartridge consists of a cartridge case, primer, propelling charge, and the bullet. Ammunition used in .50 caliber cartridge often contains lead cores surrounded by a metal jacket. Projectiles used in the 7.62-mm NATO and .50 (caliber) machine gun cartridges most often contain an antimony lead alloy or steel core with a copper alloy or filding metal-clad steel jacket.

Medium caliber weapons, such as the Close-In Weapon System (CIWS) and similar shipboard cannons, fire the 25-mm round and the 20-mm round, at large targets such as vehicles, buildings, or aircraft. The 25-mm round is one of the standard sizes of ammunition for NATO forces. The 25-mm round is a two piece projectile, having a common steel cartridge case, pressed in tracer pellets, staked aluminum base, and propellant. 20-mm rounds are similarly made and usually consist of inert tungsten alloyed with various steels to add strength. Upon sinking to the sea bottom, metal shells and fragments from the 25-mm and 20-mm rounds would be corroded by seawater at slow rates, with comparable slow release rates. Over time, natural encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the material and conditions in the immediate marine and benthic environment. It should be noted however, that there may be instances when a ship's supply of 25-mm inert tracer-equipped ammunition runs low. In these cases, permission may be granted to use 25-mm ammunition with high explosive incendiary (HEI) tracer. However, the release of contaminant from these types of rounds and resulting metal fragments is not expected to result in substantial degradation of marine water quality.

Small Arms and Close-In Weapons System Fire Fate and Transport

Expended .50-caliber and 7.62-mm projectiles may release small amounts of lead, iron, aluminum, and copper into the sediments and the overlying water column as they corrode. The total number of rounds that would be fired in the No Action Alternative is on Table 2.2-4. High concentrations in sediments would be restricted to a small zone around the bullet, and releases to the overlying water column would be quickly diluted (DoN, 2006a).

Other Hazardous Material

Various types of small, expended training items are shot, thrown, dropped, or placed within the training areas. These include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid.

Other Hazardous Material Fate and Transport

Other hazardous material that falls into the water as a result of military training may release small amounts of toxic substances as it degrades and decomposes. Because these items degrade very slowly, concentrations of some substances in sediments in the area would increase over time. Sediment

movements in response to tidal surge and longshore currents, and sediment disturbance from ship traffic and other sources, would eventually disperse contaminants outside the training areas.

Chaff

Radiofrequency chaff (chaff) is an electronic countermeasure designed to reflect radar waves and obscure aircraft, ships, and other equipment from radar tracking sources. Chaff is non-hazardous and consists of aluminum-coated glass fibers (about 60 percent silica and 40 percent aluminum by weight) ranging in lengths of 0.3 to 3 inches with a diameter of about 40 micrometers. Chaff is released or dispensed from Navy ships/aircraft in cartridges or projectiles that contain millions of chaff fibers.

For each chaff cartridge used, a plastic end cap and Plexiglas piston is released into the environment in addition to the chaff fibers. The end cap and piston are both round and are 1.3 inches in diameter and 0.13 inches thick (Spargo, 2007).

It is estimated that 382 CHAFFEX exercises would be held per year, releasing about 3,764 rounds (cartridges) of chaff.

Chaff Fate and Transport

When deployed, a diffuse cloud of fibers that is undetectable to the human eye is formed. Chaff is a very light material that can remain suspended in air anywhere from 10 minutes to 10 hours and can travel considerable distances from its release point, depending on prevailing atmospheric conditions (Arfsten, *et al.*, 2002). Doppler radar has tracked chaff plumes containing approximately 900 grams of chaff drifting 200 miles from the point of release with the plume covering a volume of greater than 400 cubic miles (Arfsten, *et al.*, 2002).

Based on the dispersion characteristics of chaff, large areas of open water would be exposed to chaff, but the chaff concentrations would be low. For example, Hullar, *et al.* (1999) calculated that a 4.97 mi by 7.46 mi (37.1 mi^2 or 28 nm^2) area would be affected by deployment of a single cartridge containing 150 grams of chaff. The resulting chaff concentration would be about 5.4 g/nm^2. This corresponds to less than 179,000 $fibers/nm^2$ or less than 0.005 $fibers/ft^2$, assuming that each canister contains 5 million fibers.

The fine, neutrally buoyant chaff streamers act like particulates in the water, temporarily increasing the turbidity of the ocean's surface, but are quickly dispersed.

The end caps and pistons would sink; however, some may remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. The expended material could also be transported long distances before becoming incorporated into the bottom sediments.

Flares

Infrared decoy flares are used within the GOMEX Range Complex. Infrared decoy flares are also called "self protection flares." They consist of an aluminum case approximately 8 inches long with a 1 to 1.5-inch diameter.

The type of metal burned in the flare determines the color of the flame; most flares burn magnesium to produce a white flame. Traces of orange indicate the burning of the aluminum casing. Solid flare and pyrotechnic residues may contain, depending on their purpose and color, aluminum, magnesium, zinc, strontium, barium, cadmium, and nickel, as well as perchlorates. Hazardous constituents in pyrotechnic residues are typically present in small amounts or low concentrations, and are bound in relatively insoluble compounds. As inert, incombustible solids with low concentrations of leachable metals, these materials typically do not meet the RCRA criteria for characteristic hazardous waste. The perchlorate compounds present in the residues are relatively soluble, although persistent (*i.e.*, do not break down

readily into other compounds under natural conditions) in the environment, and should disperse quickly (DoN, 2008b).

Under normal operations, the only decoy flare waste material that would enter the water would be ash and a small, round plastic end cap (approximately 1.4-in diameter). In rare instances an unburned, dud flare could enter the water. While no data specifying absolute flare reliability rates are available, the dud rate is estimated at less than one percent based on studies conducted by the Air Force (USAF, 1997). Decoy flares (1,840 annually) would be used under the No Action Alternative.

Flares Fate and Transport

Flares are designed to burn completely, thus reducing the amount of waste material that falls to the sea surface. Similar to chaff cartridge end caps and pistons discussed above, plastic flare end caps would be released into the marine environment where they would persist for long periods. The end caps would typically sink; however, some could remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. The expended material could also be transported long distances before becoming incorporated into the bottom sediments.

Laboratory leaching tests of flare pellets and residual ash using synthetic seawater found barium in the pellet tests, while boron and chromium were found in the ash tests. The pH of the test water was raised in both tests. Ash from flares is dispersed over the water surface and then settles out. Chemical leaching occurs throughout the settling period through the water column, and any leaching after the particles reach the bottom are dispersed by currents. The compounds present in the residues are relatively soluble, although persistent (*i.e.*, do not break down readily into other compounds under natural conditions) in the environment, and should disperse quickly (DoN, 2007).

Dud flares would sink to the bottom and slowly degrade. Based on studies conducted by the Air Force, flare dud degradation products in saltwater would include magnesium and barium (USAF, 1997). Incidental flare duds falling into marine environments would not be expected to generate adverse affects due to the small amount of chemicals released (USAF, 1997), the small number of dud flares, and the large dilution capacity of the receiving waters of the GOMEX Range Complex.

Underwater Detonations

The combustion products from the detonation of high explosives that are commonly found in sea water are carbon monoxide, carbon dioxide, hydrogen, water, nitrogen, and ammonia. The primary contaminant that would be released from explosives used in mine warfare training are nitroaromatic compounds such as trinitrotoluene (TNT), cyclonite (Royal Demolition Explosive or RDX, which is Hexahydro-1,3,5-trinitro-1,3,5-triazine and makes up 91 percent of C-4), and octogen (High Melting Explosive or HMX) (URS *et al.*, 2000). Lesser amounts of a number of other nitroaromatic compounds, such as octogen (High Melting Explosive [HMX]), tetryl (2,4,6-trinitrophenylmethylnitramine), and picric acid (a primary hydrolysis product of tetryl in seawater) are also used in some applications, such as fuses and primers. Refer to Section 3.3, Water Resources for additional detail regarding water quality.

Under the No Action Alternative, at sea underwater detonations during GOMEX Range Complex operations would be associated with mine neutralization exercises and port and expeditionary security force training. Within the Corpus Christi OPAREA, underwater detonations take place in either the MINEX Box or the Explosive Detonation Box. Within the Panama City OPAREA, underwater detonations take place in six MINEX Boxes and a much larger Eastern GOMEX Hot Box. Explosive ordnance disposal (EOD) detachments place explosive charges next to or on inert practice mines. Charges used by EOD divers consist of 5-lb, 10-lb, or 20-lb explosives. These charge sizes reflect the size of charges EOD divers use to detonate mines in combat or real-world conditions. Charges used by

Surface MCM training with Remotely Operated Vehicles can range up to 20-lbs. The total amounts of Net Explosive Weights (NEW) detonated annually within each of the MIW OPAREAs are shown on Table 3.2-5.

Underwater explosions would also occur during training at the Panama City Demolition Pond, where four types of training exercises occur. The training exercises are: Salvage Diver Training, Explosive Ordnance Demolition (EOD) Technician Training, Security Force Training, and Diver Training. The Demolition Training Pond, Naval Support Activity, Panama City is a facility that conducts underwater testing of small explosive devices. Charges range from 1¼-1b to 5-1b TNT equivalent. Frequency of detonation would be 2 to 4 per month with 1 to 2 devices detonated per occasion. Annual NEW used for the Demolition Pond are shown on Table 3.2-6, using 5-lb charges for the calculation of annual NEW. (Actual amounts of charges on average used at the Demolition Pond would be slightly less than 5 lbs.)

Underwater Detonations Fate and Transport

Practice bombs entering the water would be devoid of combustion chemicals found in the warheads of explosive bombs. They are typically made of concrete, steel, and iron. These components are consistent with the primary component building blocks of today's artificially built reef structures. The steel and iron, though durable, would corrode over time, with no noticeable environmental impacts. The concrete is also durable and would offer a beneficial substrate for benthic organisms. Due to the large ocean area of the GOMEX Range Complex, expended ordnance would be dispersed over a widespread area. The minimal expended materials over a wide area would not affect sediment stability on the ocean bottom or cause disturbance to natural ocean processes.

Chemical products of underwater explosions are initially confined to a thin, circular area called the surface pool. It is estimated that 100% of the solid explosion products and 10% of the gases remain in the pool (DoN, 2001). After the turbulence of the explosion has dispersed, the pool stabilizes and the chemical products are diluted and become undetectable. Because of continued dispersion and mixing, no buildup of explosion products in the water column would occur. Chemical effects to the marine environment and water quality are considered to be negligible from a BOMBEX (DoN, 2005). Initial concentrations of the chemical by-products of ordnance detonations are not hazardous to marine life and are rapidly dispersed in the ocean. Small and mostly metallic pieces of the bomb eventually come to rest on the seafloor with each detonation. Numerous steel non-explosive practice bombs, likewise, find their way to the seafloor. All these materials slowly deteriorate with time and, given that they will be spread out over a relatively large area, their potential impact on the environment is considered negligible.

Initial concentrations of explosion by-products are not expected to be hazardous to marine life (DoN 2001) and would not accumulate in the training area because exercises are spread out over time and chemicals rapidly disperse in the ocean (DoN, 2001). Therefore, no adverse effects from chemical by-products would be expected.

The Demolition Pond Area is depicted in Figure 2.1-6. The demolition pond current training and proposed operations are further described in Table 2.2-6. Within the Underwater Demolition Pond, exercises would be conducted only 90 days per year, including training for salvage divers, explosive ordnance disposal technicians, security forces, and divers. Localized bottom effects occur when the force of the blast wave disturbs the bottom soil and vegetation. Commonly used materials include detonation chords, timers, fuses, blasting caps, marine markers, smoke flares, TNT, and C-4. The amounts of TNT and C-4 used in the exercises are less than in surface water. Residual 2,4,6-trinitrotoluene is rapidly broken down into other chemical compounds by sunlight. Microorganisms in

water and sediment break down the compound more slowly. Small amounts of 2,4,6-trinitrotoluene can accumulate in fish and plants. C-4 is made up of explosives, plastic binder, plasticizer, and usually, a marker or taggant chemicals, such as 2,3-dimethyl-2,3-dinitrobutane (DMDNB) to help protect the explosive and identify its source. Daily tides will result in some dispersal of chemicals over time. However, the Demolition Pond is protected from wave action by shoreline on three sides. Therefore, a more rapid accumulation of component hazardous materials and other hazardous materials can be expected in the Demolition Pond than in open ocean waters.

Under the No Action Alternative, there would be a long-term, minor, and localized accumulation of hazardous materials, component hazardous materials, non-hazardous materials, and expended materials on the ocean floor, *Sargassum* mats, beaches, and soils within the GOMEX Range Complex. The chemical contamination effects would be negligible, and would result in no significant impacts or harm.

TABLE 3.2-5
ANNUAL NET EXPLOSIVE WEIGHTS
FOR MINE WARFARE ON GOMEX SEA RANGES

System or Ordnance	No Action Alternative Sorties/Events	No Action Alternative NEW (lbs)	Location
MK-103 mechanical sweep MD54 (0.002 lb/shot)	10	0.02	Corpus Christi OPAREA
AN/SLQ-38 mechanical sweep MD54 (0.00514 lb/shot)	12	0.06168	
AN/SLQ-48 (MP1) (0.00514 lb/shot)	14	0.07196	
AN/SLQ-48 (MP2) (60 lb charges)	8	480	
AN/SLQ-48 (MP3) (60 lb charges)	8	480	
EOD 5 lb charge	14	70	
EOD 10 lb charge	31	310	
EOD 20 lb charge	2	40	
MK-103 mechanical sweep MD54 (0.002 lb/shot)	10	0.002	Panama City OPAREA
AN/SLQ-38 mechanical sweep MD54 (0.00514 lb/shot)	12	0.06168	
AN/SLQ-48 (MP1) (0.00514 lb/shot)	14	0.07196	
AN/SLQ-48 (MP2) (60 lb charges)	8	480	
AN/SLQ-48 (MP3) (60 lb charges)	8	480	
EOD 5 lb charge	13	65	
EOD 10 lb charge	3	30	
EOD 20 lb charge	2	40	

TABLE 3.2-6
ANNUAL NET EXPLOSIVE WEIGHTS
FOR UNDERWATER DEMOLITION TRAINING

Range Operation	No Action Alternative Sorties/Events	NEW (lbs)*	Location
Salvage Diver Training	1,282	6410	Underwater Demolition Pond
EOD Tech Training	51	255	
Security Force Training	12	60	
Diver Training	29	145	

*5 lbs NEW used to calculate annual total, although the actual amount per operation would be less.

3.2.3.2 Alternative 1 – Increase Operational Training, Expand Warfare Missions, Accommodate Force Structure Changes, and Enhance Range Capabilities

GOMEX Range Complex training operations involving hazardous materials would increase by varying degrees from current levels in support of the Fleet Response Training Plan (FRTP). In some cases, there will be a decrease in the amount of component hazardous materials, other hazardous materials, and non-hazardous materials. Those scenarios are described in Tables 2.2-4 and 2.2-7. Only the number of training operations would increase or decrease; no new training activities (*i.e.*, weapons firing, target deployment, *etc*.) would be introduced. The largest percentage increases under Alternative 1, is gunnery exercises, followed by underwater demolitions in the Demolition Pond by Salvage Diver Training Exercises. Hazardous materials use would be proportionate to the number of sorties/events within these training operations.

Vessels, aircraft, and other military assets employed in these operations would carry and use hazardous materials for routine operations and maintenance. Increases in hazardous materials transport, storage, and use to support increased training operations under Alternative 1 would be managed in compliance with current Navy policy and procedures. No new types of hazardous materials would be required, and existing hazardous materials storage and handling facilities, equipment, supplies, and procedures would continue to provide for adequate management of these materials. No releases of hazardous materials to the environment and no unplanned exposures of personnel to hazardous materials are anticipated.

The amounts of hazardous waste generated by normal vessel and aircraft operations and maintenance during training under Alternative 1 would be about the same as that generated under the No Action Alternative. Under Alternative 1, the amounts of hazardous waste generated by other training operations would increase.All hazardous waste would continue to be managed in compliance with current Navy policies and procedures. No substantial changes in hazardous waste management are anticipated for operating Navy assets under Alternative 1.

MEM use under Alternative 1, as compared to the No Action Alternative would be as follows:

- use of high explosive bombs would increase by 103 bombs due to F/A-18 VFA-204 unit level training;
- use of non-explosive practice bombs would remain the same;
- use of expended targets would increase by 69 percent;
- use of marine markers (smoke floats) would increase by 364 percent;
- use of high-explosive naval gun ammunition rounds would remain the same;
- use of non-explosive practice naval gun ammunition would increase by 67 percent;
- the use of grenades would remain the same;
- use of chaff would remain the same;
- use of defensive/decoy flares would remain the same; and
- use of 0.00514-, 0.002-, 5-, 10, 20-, and 60-lb charges would decrease from the No Action Alternative by 54 percent.

Table 2.2-4 shows that under Alternative 1, an additional 103 HE bombs would be dropped into the water, but there would be no increase in the number of NEPM bombs dropped into the water. There would be no increase in the number of NEPM bombs that will be dropped on land targets. All detonated bomb fragments and any unexploded ordnance would settle to the sea floor. Over time, natural encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the material and conditions in the immediate marine and benthic environment. Expended ordnance scattered on the ocean floor would be widespread and have a minimal impact on the benthic environment.

MK-58s would be used during bombing, gunnery, and Security Force Training exercises within the GOMEX Range Complex. Under Alternative 1, the use of marine markers would increase from the No Action Alternative by 364% (124 markers per year). Smoke from marine markers would be rapidly diffused by air movement. The marker would sink to the bottom and become encrusted and/or incorporated into the sediments. Phosphorus contained in the marker is not anticipated to have a significant effect on the marine environment (DoN, 2006b).

Naval gun fire within the GOMEX Range Complex would use NEPM 5-inch and 76-mm rounds. Under Alternative 1, the overall use of naval gun ammunition, including medium caliber cannon and Close-In Weapons Systems (CIWS), would not increase from the No Action Alternative.

Chaff would be used during Chaff Exercise (CHAFFEX) training in the SUA over the Panama City and Pensacola OPAREAs. Under Alternative 1, the use of chaff rounds would not increase from the No Action Alternative. Also, the use of flares would not increase from the No Action Alternative.

Under Alternative 1, underwater detonations in the GOMEX Range Complex operations associated with mine neutralization and mine countermeasures exercises and mission area training would be discontinued. Bombing events using HE bombs would increase slightly in W-155, due to VFA-204 unit level training. There would be 24,000 cannon rounds due to GUNEX of the F/A-18 aircraft, but decreases in S-S GUNEX expenditures of 5-inch, 76-mm, .50 cal, CIWS rounds, and 25-mm rounds. Underwater explosions at Demolition Pond would remain the same as the No Action Alternative. There would be a long-term, minor, and localized accumulation of hazardous materials, component hazardous materials, non-hazardous materials, and expended materials on the ocean floor, *Sargassum* mats, beaches, and soils within the GOMEX Range Complex. The chemical contamination effects would be negligible, and would result in no significant impacts or harm.

3.2.3.3 Alternative 2 – Increase Operational Training, Accommodate Force Structure Changes, and Implement Enhancements (Preferred Alternative)

Tables 2.2-4 and 2.2-7 show the training operations increases within the GOMEX Range Complex under Alternative 2. Gunnery Exercises would experience the largest percentage increase. Hazardous materials use would be proportionate to the number of sorties/events within these training operations.

Vessels, aircraft, and other military assets employed in these operations would carry and use hazardous materials for routine operations and maintenance. Increases in hazardous materials transport, storage, and use to support increased training operations under Alternative 2 would be managed in compliance with current Navy policies and procedures. No new types of hazardous materials would be required. Existing hazardous materials storage and handling facilities, equipment, supplies, and procedures would continue to provide for adequate management of these materials. No releases of hazardous materials to the environment and no unplanned exposures of personnel to hazardous materials are anticipated under this alternative.

The overall amount of hazardous waste generated by normal vessel and aircraft operation and maintenance during training under Alternative 2 would be more than that generated under the No Action Alternative. This increase would be due primarily to the increased number of training operations anticipated under Alternative 2. All hazardous waste would continue to be managed in compliance with current policies and procedures. No substantial changes in hazardous materials management practices are anticipated under Alternative 2.

Military Expended Materials

MEM use under the Preferred Alternative (Alternative 2) would be the same as Alternative 1 except for the following:

- use of high explosive bombs would decrease by 152 bombs;
- use of NEPM bombs would increase by 1 percent;

use of expended targets would increase by 70 percent.

Under the Preferred Alternative (Alternative 2), the use of HE bombs would decrease 92 percent compared to the No Action Alternative. Only four MK-83 bombs would be delployed annually under Alternative 2. Under Alternative 2, underwater detonations in the GOMEX Range Complex operations associated with mine neutralization exercises and mission area training would be discontinued.

3.2.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse impacts or harmful effects.

3.2.5 Summary of Environmental Effects (NEPA and EO 12114)

Hazardous materials and waste used and generated during the GOMEX Range Complex training operations would be managed in accordance with applicable federal and state regulations, and DoD service guidelines. Any spills or mishaps would be handled pursuant to all applicable federal and state laws, and DoD regulations.

Military munitions are not considered hazardous waste when used for their intended purpose, which includes training of military personnel and research and development activities. This virtually includes all missiles, munitions, and targets used at the GOMEX Range Complex. A review of the use of munitions and targets was conducted and their hazardous constituents' disposition was analyzed. The components that contain hazardous constituents include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads.

Non-hazardous material is defined as all parts of a device made of nonreactive materials, including parts made of steel or aluminum, polymers (*e.g.*, nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent persistent seabed litter, their strong resistance to degradation and their chemical composition mean that they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds into the surrounding environment (DoN, 2009). Non-hazardous material that sinks to the sea floor would gradually degrade, be overgrown by marine life, and/or be incorporated into the sediments. Floating non-hazardous material may be lost from target boats and would either degrade over time or wash ashore as flotsam.

Component hazardous materials, other hazardous materials, and non-hazardous materials would introduce small amounts of potentially hazardous chemicals into the marine environment. The water quality analysis of all current and proposed operations indicates that concentrations of constituents of concern associated with component hazardous materials, other hazardous materials, and non-hazardous materials in the GOMEX Range Complex are well below water quality criteria established to protect aquatic life (see Section 3.3, Water Resources).

The combustion products from the detonation of high explosives are commonly found in sea water – carbon monoxide, carbon dioxide, hydrogen, water, nitrogen, and ammonia. The primary contaminant that would be released from explosives used in mine warfare training are nitroaromatic compounds such as TNT, cyclonite (Royal Demolition Explosive or RDX), and octogen (High Melting Explosive or HMX) (URS, *et al.*, 2000). Initial concentrations of explosion by-products are not expected to be

hazardous to marine life (DoN, 2001) and would not accumulate in the area training because exercises are spread out over time and the chemicals would rapidly disperse in the ocean. Therefore, no adverse effects from chemical by-products would be expected.

As summarized in Table 3.2-7, no significant overall impacts and/or harm from hazardous materials or hazardous waste are anticipated under the No Action Alternative, Alternative 1, or the Preferred Alternative (Alternative 2.) Expended training materials would be deposited in offshore areas, become buried in the sea floor sediments, and has no substantial environmental effects or harm. The overall volume of component hazardous materials, other hazardous materials, and non-hazardous materials would increase in Alternative 1 and the Preferred Alternative (Alternative 2) in correlation to changes in operations.

TABLE 3.2-7
SUMMARY OF COMPONENT HAZARDOUS MATERIALS, OTHER HAZARDOUS MATERIALS, AND NON-HAZARDOUS MATERIALS ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE GOMEX RANGE COMPLEX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Component Hazardous Material, Other Hazardous Material, and Non-Hazardous Material	Long-term, minor, and localized accumulation of expended materials on the ocean floor, *Sargassum* mats, and beaches.	Long-term, minor, and localized accumulation of expended materials on the ocean floor and *Sargassum* mats.
Chemical Contamination	Negligible effects.	Negligible effects.
Impact Conclusion	No significant impacts.	No significant harm.
Alternative 1		
Component Hazardous Material, Other Hazardous Material, and Non-Hazardous Material	Long-term, minor, and localized accumulation of expended materials on the ocean floor, *Sargassum* mats, and beaches. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of expended materials on the ocean floor and *Sargassum* mats. Slight increase compared to No Action.
Chemical Contamination	Negligible effects.	Negligible effects.
Impact Conclusion	No significant impacts.	No significant harm.
Alternative 2 (Preferred Alternative)		
Component Hazardous Material, Other Hazardous Material, and Non-Hazardous Material	Long-term, minor, and localized accumulation of expended materials on the ocean floor, *Sargassum* mats, and beaches. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of expended materials on the ocean floor and *Sargassum* mats. Slight increase compared to No Action.
Chemical Contamination	Negligible effects.	Negligible effects.
Impact Conclusion	No significant impacts.	No significant harm.

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3.3 WATER RESOURCES

3.3.1 Introduction and Methods

Water resources are analyzed in this Final EIS/OEIS in the marine and terrestrial environments subject to impacts of the No Action and Action Alternatives. The marine environment refers to offshore, high salinity waters, and is further defined by prevailing currents, harbor flushing hydraulics, and tidal variations. On land, water resources include surface features such as lakes, ponds, rivers, streams, and other wetlands, as well as groundwater features (aquifers). Appendix K addresses the federal, state, and local environmental review programs that do, or may, apply to the No Action Alternative, Alternative 1, and Alternative 2.

3.3.1.1 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this Final EIS/OEIS includes several warfare areas (*e.g.*, Mine Warfare, Air Warfare, *etc*.) and most warfare areas include multiple types of training exercises (*e.g.*, Mine Warfare; search, identify, neutralize within Air Warfare areas; detect, track, engage). Likewise, several activities (*e.g.*, vessel movements, aircraft overflights, weapons firing, *etc*.) are accomplished under each operation, and those activities typically are not unique to that exercise. For example, many of the operations involve Navy vessel movements and expended materials. Accordingly, the analysis for water quality is organized by specific activity and/or stressors associated with that activity, rather than warfare area or operations.

For the purposes of this analysis, water quality is evaluated with respect to possible release of hazardous constituents from aircraft and surface and subsurface vessels. To address potential impacts, the approach to analysis includes characterizing the yearly test and training operations that may contribute hazardous materials, hazardous constituents, and non-hazardous constituents (military expended materials) to the GOMEX Range Complex marine and terrestrial aquatic environments. These include missile flights; target expenditures; ship, boat, and aircraft operations; weapons firing; and expended materials from various training operations. This section of the Final EIS/OEIS reviews the water resources and impacts to water quality associated with training in the GOMEX Range Complex. Potential impacts to other environmental resources are addressed in the respective sections of this chapter as appropriate. A full discussion of hazardous materials and hazardous waste is presented in Section 3.2.

Study Area

For the purposes of water quality impacts analysis within the GOMEX Study Area, the study area for water quality may be classified as either: (1) marine aquatic environment, or (2) terrestrial aquatic environment. This Final EIS/OEIS assesses impacts to water quality within marine environments within the Corpus Christi OPAREA, New Orleans OPAREA, Pensacola OPAREA, Panama City OPAREA, and the NSA Panama City Demolition Pond, in addition to various warning areas, as shown in Figure 1.5-1. In addition to sea-based training in the GOMEX OPAREAs, the GOMEX Range Complex includes 15 nm^2 of land area. The two land target range areas operated by the Navy along with associated SUA include:

- Noxubee County Range (Noxubee County, Mississippi): Air-to-ground training range (non-explosive practice munition [NEPM] ordnance only). The range includes the SEARAY Target and SUA designated as R-4404A-C.

- McMullen County Range (McMullen County, Texas): Air-to-ground training range (NEPM ordnance only). Includes the SUA designated as R-6312A-C. McMullen County Range includes the Yankee and Dixie Targets.

Data Sources

State and federal regulations, as well as each state's water resource/water quality programs were reviewed. Available reference materials, including the Marine Resource Assessment (MRA) for the GOMEX Study Area (DoN, 2007), prior Environmental Assessments (EA) and Environmental Impact Statements (EIS), were reviewed, and are cited, as appropriate.

Factors Used to Assess the Significance of Effects

This Final EIS/OEIS analyzes potential effects to water quality in the context of the federal Clean Water Act (CWA), Coastal Zone Management Act (CZMA), and state CWA and CZMA implementation programs. The CZMA encourages state governments to preserve, protect, develop, and where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. To encourage states to participate, CZMA allows federal assistance to any coastal state that is willing to develop and implement a comprehensive coastal management program. Florida, Alabama, Mississippi, Louisiana, and Texas all participate in the CZMA implementation. In its reauthorization of the CZMA in 1990, Congress identified non-point source pollution as a major factor in the continuing degradation of coastal waters.

The primary objective of these federal and state regulations is to protect public health and the environment, as well as biological resources. A significant impact would result if the use of hazardous materials or the generation of hazardous waste resulted in a violation of any of the laws cited above.

3.3.1.2 Warfare Areas and Associated Water Resources Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to water quality. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Final EIS/OEIS. As shown in Table 3.3-1, three potential stressors to water quality are carried forward for analysis, including expended materials, chemical pollutants, and sediment displacement. The potential effects of these stressors on water quality are analyzed in detail in Section 3.3.3.

Table 3.3-2 identifies the training item source associated with expended materials, chemical pollution, and sediment displacement for each operation and the training area location relative to the shoreline where the operation would occur. Operations that will not expend material or introduce chemical pollutants into the environment by the nature of their operation as defined in this chapter are not carried forward and include: Mine Countermeasures Exercises, Unmanned Aerial Vehicle Operations, Detect to Engage, and Noncombatant Operations.

3.3.2 Affected Environment

3.3.2.1 Regional Overview

Water characteristics, sediment transport, deposition and circulation are discussed below in relation to water resources in marine and terrestrial environments. Fate and transport of hazardous constituents is discussed in Section 3.2, Hazardous Materials and Hazardous Waste.

3.3.2.2 Water Resources in Marine Environments

The GOMEX OPAREA is located in the coastal and offshore waters of the Gulf of Mexico adjacent to the States of Florida, Mississippi, Louisiana and Texas and extends seaward into waters more than 2,000 m deep. Water quality in the marine environment is determined by a complex set of interactions between chemical and physical processes operating continuously in the ocean system. This dynamic equilibrium is expressed by a variety of indicators, including temperature, salinity, dissolved oxygen, and nutrient levels. Water pollutants alter the basic chemistry of sea water in various ways. The following discussion characterizes in general terms the major determinants of marine water quality in the GOMEX OPAREA.

TABLE 3.3-1
SUMMARY OF POTENTIAL STRESSORS TO WATER RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Expended Materials**	**Chemical Pollution**	**Sediment Displacement**
Mine Warfare (MIW)				
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA			
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	
Mine Neutralization –Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Surface Warfare (SUW)				
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox	✓	✓	✓
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B	✓	✓	✓
Gunnery Exercise (Air-to-Surface) (GUNEX[A-S])	W-155 Hotbox	✓		

TABLE 3.3-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO WATER RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Expended Materials**	**Chemical Pollution**	**Sediment Displacement**
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S])(Ship)	W-151 A/B; W-155A	✓		
Gunnery Exercise (Surface-to-Surface)(GUNEX [S-S])(Boat)	Panama City OPAREA	✓	✓	✓
Gunnery Exercise (Surface-to-Surface)(GUNEX [S-S])(Boat)	Corpus Christi UNDET BOX E3	✓	✓	✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155		✓	
MSO to include VBSS/MIO- Helo	W-151/W-155		✓	
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓		
Air Warfare (AW)				
Air Intercept Control (AIC)	W-151; W-155			
Strike Warfare (STW)				
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target	✓		✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target	✓		✓
Amphibious Warfare (AMW)				
Firing Exercises (FIREX) -IMPASS	W-151A/B; W-155A	✓		
Electronic Combat (EC)				
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓		
Chaff Exercises (CHAFFEX)	Brownwood MOAs	✓		
Flare Exercises (FLAREX)	W-155A/B	✓		
Flare Exercises (FLAREX)	Brownwood MOAs	✓		

TABLE 3.3-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO WATER RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Expended Materials**	**Chemical Pollution**	**Sediment Displacement**
Mission Area Training[38]				
Mission Area Flight Training	W-92; W-54; Brownwood MOAs			
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-5=6312			
Salvage Diver Training	NSA Panama City Demolition Pond	✓	✓	
Underwater Demolitions	NSA Panama City Demolition Pond	✓	✓	✓
Security Force Training	NSA Panama City Demolition Pond	✓	✓	
Diver Training	NSA Panama City Demolition Pond	✓	✓	

TABLE 3.3-2
EXPENDABLE TRAINING ITEM ASSOCIATED WITH THE GOMEX RANGE COMPLEX OPERATIONS

Warfare Area and Operation	Training Area Proximity	Expendable/Hazardous Training Item
Port and Expeditionary Security CC and Panama City OPAREAs	Panama City OPAREA (port security)	• 7.62-mm projectiles • 50-caliber projectile
	Corpus Christi OPAREA (port security)	• 20 8 oz grenade charges • 7.62-mm projectiles • 40-mm projectiles (inert) • .50 cal projectiles
Mine Countermeasures Exercise	Outside 12 nm	None
Mine Neutralization	Outside 12 nm	• One or two 10-20 lb explosive charges up to 60 lbs TNT equivalent

[38] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

TABLE 3.3-2 (Continued)
EXPENDABLE TRAINING ITEM ASSOCIATED WITH THE GOMEX RANGE COMPLEX OPERATIONS

Warfare Area and Operation	Training Area Proximity	Expendable/Hazardous Training Item
Air-to-Surface Gunnery Exercise	Outside 12 nm	• .50-caliber projectile • 7.62-mm projectile • Marine Marker (Smoke float)
Missile Exercise (Air-to-Surface) Laser Only	Outside 12 nm	None
Missile Exercise (Air-to-Surface) (Laser and Live Fire)	Outside 12 nm	• AGM-114 (Hellfire) missile (live or inert) • AGM-65 missile • MK-25 Marine Marker (Smoke Float)
Bombing Exercise (Sea)	Outside 12 nm	• BDU-45 bomb • MK-82 bomb • MK-20 bomb • MK-76 bomb • MK-83 bomb • MK-25 Marine Marker (Smoke Float)
Surface-to-Surface Gunnery Exercise (Ship)	Outside 12 nm	• 25-mm projectile • 5-inch projectile • 76-mm projectile • .50-caliber projectile • 25-mm projectile • Floating At-Sea Target (10-foot diameter red balloon tethered by sea anchor), 50-gallon steel drum, or other available target such as a cardboard box
Missile Exercise (Air-to-Air)	Outside 12 nm	• AIM-120 AMRAAM missile (live or inert) • AIM-7 (Sparrow) missile (live or inert) • AIM-9 (Sidewinder) missile (live or inert) • Expendable Aerial Target: Tactical Air-Launched Decoy (TALD)
Electronic Combat Operations	Outside 12 nm	• Chaff • Flares • Pyrotechnics that simulate visual missile launch
Detect to Engage	90% Outside 12 nm 10% 3-12 nm	None
Surface-to-Air Gunnery Exercise	Outside 12 nm	• 5-inch projectile • 20-mm projectile cannon shell • 76-mm projectile
Firing Exercises – Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Outside 12 nm	• 5-inch projectile • Flares - Illumination
Chaff Exercise	Outside 12 nm	• Flares - infrared decoys • Chaff
Maritime Law Enforcement Operations	Outside 12 nm	• .50-caliber projectile • 7.62-mm projectile • MK-25 Marine Marker (Smoke Float)

TABLE 3.3-2 (Continued)
EXPENDABLE TRAINING ITEM ASSOCIATED WITH THE GOMEX RANGE COMPLEX OPERATIONS

Warfare Area and Operation	Training Area Proximity	Expendable/Hazardous Training Item
Mine Laying	Inside 3 nm	• MK-76 Inert • MK-83 Inert • BDU-45
Combat Search and Rescue	Inside 3 nm	• .50-caliber blanks • 7.62-mm blanks
Bombing Exercise (Land)	Inside 3 nm	• MK-76 Inert Bomb • BDU-48
Air Combat Maneuver	Outside 12 nm	• Flares • Chaff

The Gulf of Mexico is the ninth largest body of water in the world with a surface area of 1,540,000 km^2 and an encompassing volume of 2,430,000 km (Wiseman and Sturges, 1999). The Gulf is an intercontinental sea that is nearly enclosed by land; it is extensive enough in size to be classified as a small ocean basin. Two openings in the surrounding landmasses allow seawater to flow into the GOMEX from the Caribbean Sea through the Yucatan Channel and to exit from the Gulf into the northwestern Atlantic Ocean through the Florida Straits. Two major rivers discharge freshwater into the GOMEX: the Mississippi River in the southern United States and the Rio Grande on the Mexico-United States border. These rivers add a tremendous volume of freshwater to the Gulf, draining more than 40 percent of the contiguous United States and 50 percent of Mexico (Hirsch, 1995). The Mississippi River System has the seventh largest riverine discharge in the world (Meade, 1995). Although the Rio Grande is a large and significant river, its discharge into the GOMEX has been severely reduced due to upstream diversion of its water by both Mexico and the United States for irrigation and drinking water.

Pollution Sources

The northern Gulf is inundated with both point and non-point source pollutants. The majority of the contaminant point sources along the northern Gulf coast are derived from petroleum refineries or petrochemical plants. The U.S. gulf coast petrochemical industry (including offshore and onshore development, petroleum transport, and processing/refining of petroleum products) is the largest in the U.S. (MMS, 1998). Point source pollution also originates from wastewater treatment plants, sewer system overflows, septic systems, industrial facilities, and animal feeding operations. Nutrient pollution has had a major impact on coastal waters, contributing to toxic algal blooms, loss of seagrass habitat and coral reefs, and oxygen depletion (U.S. Commission on Ocean Policy [USCOP], 2004). Estuarine waters can directly or indirectly affect marine water quality of coastal waters. The interagency 2004 Draft National Coastal Condition Report II rated coastal waters along the southeast United States as being in fair condition (USCOP, 2004). Artificial reefs, oil and gas structures, and shipwrecks that may affect marine water quality are discussed in Section 3.6 – Marine Communities. The heavy concentration of activity in coastal areas, combined with pollutants flowing from streams far inland and others carried through the air great distances from their source, are the primary causes of nutrient enrichment, hypoxia, harmful algal blooms, toxic contamination, sedimentation, and other problems that plague coastal waters (USCOP, 2004).

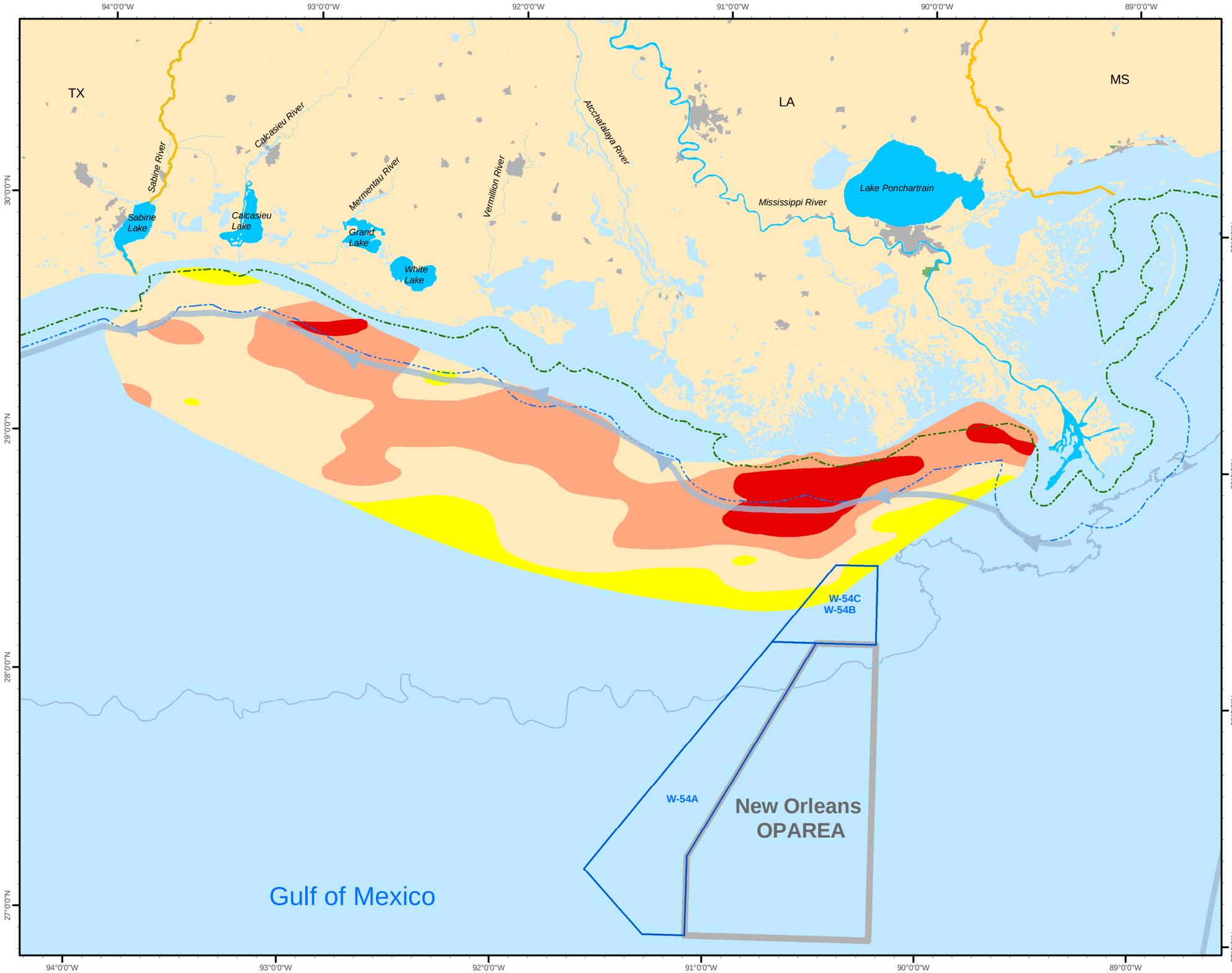
Non-point source pollution arises when rainfall and snowmelt carry contaminants over land, into streams and groundwater, and down to coastal waters. Non-point source pollutants include: fertilizers and pesticides from rural farms and urban lawns; bacteria and viruses from livestock and pet waste; sediments from improperly managed construction sites and timber harvesting; oil and chemicals flowing over streets, parking lots, and industrial facilities; and a variety of pollutants being blown along airborne pathways. Ninety percent of impaired water bodies do not meet water quality standards at least in part because of nonpoint source pollution. The majority of non-point source pollution entering rivers, estuaries, coastal waters, and ultimately the oceans is from agricultural and storm water runoff (USCOP, 2004).

The extensive concentrations of non-point source pollutants carried by riverine and other discharges have had a tremendously negative impact on the water quality of the northern GOMEX. Urban and agricultural discharge into the northern GOMEX contributes high concentrations of nutrients, pesticides, and fecal coliform bacteria as well as significant concentrations of heavy metals (Garbarino *et al.*, 1995). Waste and runoff from 75 percent of U.S. farms and 80 percent of U.S. cropland are discharged into the GOMEX via the Mississippi River System (MMS, 1998).

The degradation of water quality in the northern Gulf is evident along the coast as well as offshore. A large area of the northern Gulf, spanning an average of 12,700 km^2 and extending from the Mississippi River Delta westward along the upper Texas continental shelf to Galveston, has been systematically monitored and mapped since 1985. This region is known as the “dead zone” due to the oxygen-depleted or hypoxic (<2 mg/L of oxygen) bottom water that occurs seasonally (Figure 3.3-1) (Rabalais *et al.*, 2002; LUMCON, 2005). Hypoxia means "low oxygen." In estuaries, lakes, and coastal waters low oxygen usually means a concentration of less than 2 parts per million. Hypoxic conditions are typically present during the late spring and summer, but have been reported as early as February and as late as October (MMS, 1998; Rabalais *et al.*, 2002 as cited in DoN, 2007 [MRA]). In 2002, the dead zone reached its maximum recorded extent, spanning an area of 22,000 km^2 (USGS, 2005). In 2005, the extent of the dead zone spanned 11,840 km^2, an area smaller than predicted by computer modeling (LUMCON, 2005). This development was not surprising, as sampling of the hypoxic area was conducted after Tropical Storm Cindy and Hurricane Dennis influenced the north-central Gulf, increasing the volume of fresh water and causing mixing of the water column off the Louisiana coast in early July 2005 (LUMCON, 2005).

Hypoxia is the direct result of the natural processes of nutrification and eutrophication; the combination of a significantly increased nutrient supply with increasingly longer hours of sunlight stimulates excessive algal growth. When the algae die, they sink to the bottom where they are decomposed by oxygen dependent bacteria, which deplete the bottom water of oxygen (Dandelski and Buck, 1998). At the same time, stratification of the water column occurs as warmer, oxygen-rich surface waters become separated from the colder, denser bottom waters by a strong thermocline. Bottom-water hypoxia is a common effect of nutrient enrichment (nutrification) that especially impacts species such as fish, shrimp, and crabs (Craig *et al.*, 2001). Hypoxia tends to decrease biodiversity; alters marine food webs; leads to habitat loss; and in extreme cases, results in death (Craig *et al.*, 2001; Rabalais *et al.*, 2002).

Eutrophication and the resulting hypoxia can become persistent when an overabundance of nutrients consistently enters an aquatic ecosystem, as occurs seasonally in the north-central Gulf. It is estimated that the nitrogen concentration entering the GOMEX has increased almost three-fold since the 1950s (Rabalais *et al.*, 2002).



Frequency of Mid-Summer Bottom Hypoxia
The GOMEX Dead Zone

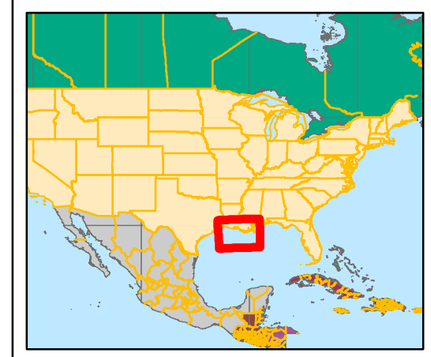
Figure 3.3-1

Legend

- Loop Current
- Shelf Break
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Warning Areas (W)
- Operating Areas (OPAREA)

Frequency of Bottom Hypoxia (<2.0 mg/l dissolved oxygen)

- <= 25%
- >= 25%
- >= 50%
- >= 75%



N

1:1,735,198

10 5 0 10 20 30 Nautical Miles

20 10 0 20 40 60 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources: National Geospatial Intelligence Agency (NGA) Database;Special Use Airspace Document AP/1A; COMLANTFLT 3120.26E Document.
Frequency of mid-summer bottom water hypoxia (<2 mg/l dissolved oxygen) off the Louisiana coast from 1985 to 2002. This area is also known as the "dead zone." Source data: USGS (2005). Source Information: Rouse et al. (2005). Map adapted from Rabalais et al. (2002).

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Currents

Warm (>26°C) Caribbean Sea surface waters form the Yucatan Current, which flows into the GOMEX through the Yucatan Channel. The Yucatan Current is derived from the Caribbean Current, which together form the beginning of the Gulf Stream System, the complex system of surface currents that flows from the Caribbean Sea into the GOMEX and northwestern Atlantic Ocean. The Gulf Stream System is composed of the following surface currents: Yucatan Current, Loop Current, Florida Current, and Gulf Stream Current. The Antilles Current, located north of the Greater Antilles and flowing westward, also feeds into the Gulf Stream System off southeastern Florida. Of the Gulf Stream System, only the Loop Current and Florida Current occur in the GOMEX Study Area.

Temperature and Salinity

Seasonal variations in sea surface temperature occur uniformly across the Gulf with maximum temperatures occurring in summer (July through September) and minimum temperatures occurring in mid-winter (February through March) (Müller-Karger *et al.*, 2000). Temperature differences between the eastern and western Gulf are attributed to the influx of warm Caribbean waters through the Yucatan Channel, which dominates the sea surface temperature in the eastern Gulf. Throughout much of the year in the central and eastern GOMEX, there is a strong north to south gradient of increasing surface water temperature. It is only in summer that this pattern reverses and the warmest waters are found in the northern Gulf nearest to shore. The overall temperature range for all seasons is approximately 18° to 31°C.

The marine environment has a high buffering capacity (*i.e.*, the pH of seawater is relatively stable) due to the presence of dissolved elements, particularly carbon and hydrogen. Most of the carbon in the sea is present as dissolved inorganic carbon that originates from the complex equilibrium reaction of dissolved carbon dioxide (CO_2) and water. This CO_2-carbonate equilibrium system is the major buffering system in seawater, maintaining a pH between 7.5 and 8.5.

The major chemical parameters of marine water quality include pH, dissolved oxygen, and nutrient concentrations. The major ions present in seawater are sodium, chloride, potassium, calcium, magnesium, and sulfate.

Sea surface salinities in the northern Gulf vary seasonally and are heavily influenced by outflow from the Mississippi River (Davis *et al.*, 1996). In months with little freshwater input, the salinities along the coast range from 29 to 32 practical salinity units (psu) (MMS, 1998). During the spring and summer when the freshwater input volume from the Mississippi and other rivers is high, a strong salinity gradient forms with salinities typically less than 20 psu in shelf waters (MMS, 1998). The mixed layer in the central, open Gulf extends from 100 to 150 m with salinities between 36.0 and 36.5 psu (MMS, 1998).

Sediment Transport and Mississippi River Basin Contributions

The Lower Mississippi River, extending from Cairo, Illinois to the Gulf Coast, annually transports approximately 170 million tons of sediment (Thorne *et al.*, 2000). Historically, the quantity and caliber of sediment derived from catchment erosion have been affected by changes in land use and management. For example, soil erosion increased during the 19th and early 20th centuries due to settlement by Europeans and this may have elevated catchment sediment supply to the Mississippi River, while more recently the supply of sediment from tributaries is known to have decreased markedly as a result of river engineering and management. Specifically, the construction of large dams as part of the Mississippi River and various tributaries has trapped sediment that would otherwise have been supplied to the Mississippi, particularly by the Missouri River. Marked changes have also occurred in the extent of eroding bankline along the Mississippi and these must have reduced the input of sediments.

For example, during the last three decades, a sustained construction program of bank revetments and dikes has produced a stable alignment. Given these trends in sediment supply from catchment, tributary and bank sources, it is not surprising that most studies of sediment movement report a large decrease in measured sediment loads at selected monitoring stations along the Mississippi River over the last 50 years (Kesel, 2003; Dardeau and Causey, 1990). However, Thorne *et al.* (2000) argue that the bed material load must have increased since the 1940s. This argument is based on analysis of morphological changes observed along the river that have led to an overall increase in slope and available stream power, coupled with the fact that bed material sizes along the river have remained almost constant (Thorne *et al.*, 2000).

3.3.2.3 Water Resources in Terrestrial Environments

Noxubee County Range, Noxubee County, Mississippi

The Noxubee County Range is an air-to-ground training range that uses NEPM only. This range, located in Noxubee County north of Meridian, Mississippi, includes the SEARAY Target and the SUAs designated as R-4404A-C. The Noxubee County Range is shown on Figure 2.1-5.

Pine forested (loblolly pines) and clear cut flatlands surround the range and comprise the majority of the area beneath R-4404A/B/C area. Development in the area mainly consists of low density single family residences, and is limited to State Routes 14 and 21, rural roadways, and the towns of Macedonia, Mashulaville, and New Salem. Mashulaville is the most developed of the towns with approximately 50 structures built within a 1-mile radius of the town center.

The range is 670 acres in size, and was acquired in 1976 and expanded in 1978 to its current size. An additional 2,231 acres of buffer zone is regulated through a perpetual and assignable easement. Ground cover on the range can be described as maintained open space in the target, approach, and command and control areas. The maintained open space facilitates the monitoring of bombing accuracy and improves fire safety. The majority of the remaining portion of the range and buffer zone is vegetated landscape/pine forested flatlands that isolate the public from the target area and provide a buffer for dropped ordnance that may miss the target or ricochet away from the target area.

The Noxubee County Range is situated on a slight topographic ridge, and the site is drained by intermittent tributaries of Dry Creek (to the northeast), Macedonia Creek (to the east) and Hashuqua Creek (to the west). All three of these creeks are within the Noxubee River watershed, which contains 17 CWA Section 303(d) impaired waters (USEPA, 2008). Dry, Macedonia, and Hashuqua Creeks are not listed as impaired waters.

McMullen County Range, McMullen County, Texas

The McMullen County Range, similar to the Noxubee County Range, is an air-to-ground training range without the use of explosive ordnance (only NEPM ordnance). This range, located in McMullen County, Texas (approximately 65 miles south of San Antonio and 80 miles northwest of Corpus Christi, Texas), includes the SUAs designated as R-6312A-C. The McMullen Range includes the Yankee and Dixie Targets, and is shown on Figure 2.1-4. Operations analyzed in this Final EIS/OEIS are limited in impacts to the Yankee and Dixie target area within the McMullen Range; therefore, the target areas are the only areas within the McMullen Range carried forward for analysis.

Terrain within the Yankee / Dixie Target Area is gently rolling, with little topographic relief. Primary drainage is to the northeast into Guadalupe Creek, a perennial stream located adjacent to the northeastern corner of the McMullen Range. Guadalupe Creek is part of the Nueces River watershed. The target area is bisected by an ephemeral drainage which runs from the northwest to the southeast. This drainage is interrupted by the Main Bomb Target within the Yankee Target Area and the strafing

pit. Both areas have been in operation for over 35 years (TRC Mariah Associates, 1996). Numerous smaller drainages and swales occur throughout the range. Prior to Navy acquisition, the area was heavily grazed and root plowed. Coupled with past explosive ordnance use, the Yankee Target Area is dominated by disturbance-tolerant plant species, such as mesquite thickets, salt-cedar communities along drainages, and interspersed rough cocklebur.

In 1996, the Navy identified a wetland that was protected under Section 404 of the Clean Water Act (CWA). The wetland, a 1.75 acre stock tank, was considered "isolated." At the time of the delineation, isolated wetlands were considered jurisdictional. Under current interpretations of Section 404 CWA authority, isolated wetlands are typically not considered jurisdictional; therefore, this wetland area most likely is not jurisdictional under Section 404 of the CWA. Similarly, ephemeral streambeds are expected to be non-jurisdictional based on current interpretation of Section 404 CWA authority.

Although Guadalupe Creek is not identified as CWA 303(d) impaired water, a reach of the Nueces River (to which Guadalupe Creek is tributary) is an impaired water due to low amounts of dissolved oxygen (DO) (USEPA, 2008), most likely due to agricultural runoff within the Nueces River watershed.

3.3.3 Environmental Consequences

3.3.3.1 No Action Alternative

Table 3.2-2, in Section 3.2 (Hazardous Materials and Hazardous Waste), lists the expended training items in the GOMEX Range Complex. Detailed descriptions of hazardous materials and constituents of concern are discussed in Section 3.2 (Hazardous Materials and Hazardous Waste), and are described in subsequent paragraphs relative to water quality. This Final EIS/OEIS does not contain training items associated with sonar training. The Navy prepared the Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS for the use of multiple sonar types in the East Coast and Gulf OPAREAs of the United States. A summary of the Final AFAST EIS/OEIS is provided in Section 3.20.

Water Quality in Marine Environments

Vessel Discharge into Marine Environments

Shipboard waste-handling procedures governing the discharge of non-hazardous waste streams were established for commercial and Navy vessels. These categories of waste include: (a) Liquids: "black water" (sewage); "gray water" (water from deck drains, showers, dishwashers, laundries, *etc*.); and oily waste (oil water mixtures); and (b) Solids (garbage). Table 3.3-3 summarizes the waste stream discharge restrictions for Navy vessels at sea.

Bombs

Under the No Action Alternative 228 bombs will be expended. Most (77%) will be inert practice bombs either full sized concrete filled or small 'subcaliber' bombs which are designed to replicate their corresponding real bombs' ballistics. Bombs with HE filler (23%) will be detonated on water impact, 99% of which will burst within 5 feet of the surface. Blast effects (overpressure) and fragments will be produced by HE bombs detonating.

Chemical effects to the marine environment and water quality are considered to be negligible from a BOMBEX (DoN, 2005a). Initial concentrations of the chemical by-products of ordnance detonations are not hazardous to marine life and are rapidly dispersed in the ocean. Small and mostly metallic pieces of the bomb will quickly come to rest on the seafloor with each detonation. Numerous steel non-explosive practice bombs will likewise find their way to the seafloor. All these materials will slowly

TABLE 3.3-3
SUMMARY OF NAVY POLLUTION CONTROL DISCHARGES RESTRICTIONS

Discharge Type	Zone (distance from shore)				
	0-3 nm	**3-12 nm**	**12-25 nm**	**>25 nm**	**>50 nm & High Seas**
Sewage (Black Water)	No discharge[1]	Direct discharge permitted			
Graywater	If no pierside collection capability, direct discharge permitted.	Direct discharge permitted			
Oily Waste	Discharge allowed if waste has no visible sheen. If equipped with Oil Content Monitor (OCM), discharge <15 ppm oil.		If equipped with OCM, discharge <15 ppm oil. Ships with Oil/Water Separator but no OCM must process all bilge water through the oil-water separator.		
Garbage (Non-Plastics)[2]	No discharge	Pulped or comminuted food and pulped paper and cardboard may be discharged	Bagged shredded glass and metal waste may be discharged. Submarines may discharge in this zone in depths >1,000 fathoms.	Direct discharge permitted.[3]	
Garbage (Plastics)	No discharge[4]				
Hazardous Materials	No discharge		No discharge, except as permitted by OPNAVINST 5090.1C Appendix L		No discharge unless > 200 nm or as permitted by OPNAVINST 5090.1C Appendix L
Medical Waste	No discharge				No discharge[5]

Source: Figure 22-1 *in* OPNAVINST 5090.1C (30 October 2007)

Notes:

1. Discharge of sewage within 3 nm allowed under emergency conditions
2. Garbage is processed to eliminate floating marine debris. Surplus material is retained at sea for disposal ashore.
3. Surface ships use pulpers and shredders for all discharges of food products, paper, cardboard, glass, and metal wastes. Shredded metal and glass waste are bagged prior to disposal. Submarines may discharge sinkable compacted garbage.
4. Minimal discharges are authorized if plastic waste processor is inoperable and necessary for health and safety of ship and crew. Record keeping requirements in place for at-sea discharge of plastic garbage.
5. If health and safety are threatened, steam, sterilize waste, package and weight for negative buoyancy. No discharge of sharps (e.g. needles, scalpels).

deteriorate with time and, given that they will be spread out over a relatively large area, their potential impact on the environment is considered negligible.

Targets and Countermeasures

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are typically not collected for reuse. There are no aerial targets within the GOMEX range for the No Action or Action Alternatives. Only surface targets would be deployed on the GOMEX Range Complex in the No Action Alternative.

Surface targets would include IMPASS synthetic target presentations, Improved Surface Tow Targets (ISTT); QST-35 Seaborne Powered Targets (SEPTAR); and expendable marine markers (smoke floats). Expended surface targets commonly used in addition to marine markers include cardboard boxes, 55-gallon steel drums, and a 10-foot diameter red balloon tethered by a sea anchor (also known as a "killer tomato"). Floating material, such as styrofoam, may be lost from target boats.

Small concentrations of fuel and ionic metals released during battery operation could enter the water and contaminate limited areas; however, they do not represent a source of substantial environmental degradation.

Marine Markers (Smoke Floats)

Smoke from pyrotechnic devices, such as marine markers dropped on the water's surface, is expected to rapidly diffuse by air movement. MK-58s are used in the GOMEX Study Area during bombing, gunnery, and Security Force Training exercises within the GOMEX Range Complex for the No Action Alternative. The marker itself is not designed to be recovered and would eventually sink to the bottom and become encrusted and/or incorporated into the sediments.

Phosphorus contained in the marker settles to the sea floor where it reacts with the water to produce phosphoric acid, until all phosphorus is consumed by the reaction. Combustion of red phosphorus produces phosphorus oxides, which have a low toxicity to aquatic organisms. The red phosphorus is not anticipated to have a significant effect on the marine environment (DoN, 2006b).

Naval Gun Fire

Naval gun fire within the GOMEX Range Complex would use non-explosive 5-inch and 76-mm rounds. The surface area of the ocean affected by the impact of a non-explosive 5-inch and 76-mm round is 20 in^2 and 12 in^2 respectively. An estimated 440 5-inch non-explosive rounds and 840 76-mm rounds are fired annually during the GOMEX Range Complex exercises that use 5-inch guns. When added together, this creates an estimated impact area accumulating to 0.000003 nm^2, which when compared to the total Navy GOMEX Range area (17,520 nm^2), becomes negligible.

Non-explosive ordnance practice shells would not be recovered and would sink to the ocean floor. Solid metal components of non-explosive ordnance would also sink. Un-recovered ordnance also sink to the bottom. Metal shells and fragments would be corroded by seawater at slow rates, with comparable slow release rates. Shell fragments rapidly decelerate through contact with the surrounding water and settle to the sea floor. Over time, natural encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the material and conditions in the immediate marine and benthic environment. However, the release of contaminant from unexploded ordnance, non-explosive ordnance, and fragments is not expected to result in substantial degradation of marine water quality. Contamination release amounts from these constituents are discussed in more detail in Section 3.2 (Hazardous Materials and Hazardous Waste).

Small Arms and Close-In Weapons System Fire

Ammunition cartridges often contain lead cores. The 20-mm and 25-mm projectiles used in Small Arms, Medium Caliber Cannon, Close-In Weapons System Fire, and Conventional Weapons Technical Proficiency Inspection (CWTPI) training are typically inert tungsten or other inert metal. A total of 40,080 rounds would be fired in the No Action Alternative for GUNEX operations off shore; 16,000 rounds (7.62-mm MG) for security force training off Panama City, 11,200 7.62, 10,000 .50 caliber MG and 2,880 40-mm (inert) M-19 rounds for Expeditionary Security Group training within the Corpus Christi MIW area. Expended .50 and 7.62-mm projectiles may release small amounts of iron, aluminum, and copper into the sediments and the overlying water column as bullets corrode. High concentrations in sediments would be restricted to a small zone around the bullet, and releases to the overlying water column would be quickly diluted (DoN, 2005d).

Military Expended Material

Various types of small, expended training items are shot, thrown, dropped, or placed within the training areas. These items include smoke grenades, and flares. Some military expended material (MEM) include material resulting from military training. For instance, items such as flare residue or candle mix, are not collected. MEM that falls into the water as a result of military training may release small amounts of toxic substances as it degrades and decomposes. The items degrade very slowly, so the volume of expended decomposing MEM chemical constituents within the training areas—and the amounts of toxic substances being released to the environment—gradually increases over the period of military use. Concentrations of some substances in sediments would increase over time. Sediment movements in response to tidal surge and longshore currents, and sediment disturbance from ship traffic and other sources, would eventually disperse contaminants outside the training areas.

Chaff

Chaff is non-hazardous and consists of aluminum-coated glass fibers (about 60% silica and 40% aluminum by weight) ranging in lengths of 0.3 to 3 inches with a diameter of about 40 micrometers. Chaff is released or dispensed from military vehicles in cartridges or projectiles that contain millions of chaff fibers. For each chaff cartridge used, a plastic end-cap and Plexiglas piston is released into the environment in addition to the chaff fibers. The end-cap and piston are both round and are 1.3 inches in diameter and 0.13 inches thick (Spargo, 2007).

Chaff would be used during Chaff Exercise (CHAFFEX) training in the SUA over the Panama City and Pensacola OPAREAs. Under the No Action Alternative, it is estimated that 382 exercises would be held per year, releasing about 3,764 rounds (cartridges) of chaff. Based on the dispersion characteristics of chaff, large areas of open water would be exposed to chaff, but the chaff concentrations would be low. For example, Hullar, *et al.* (1999) calculated that a 4.97-mile by 7.46-mile (37.1 mi^2 or 28 nm^2) area would be affected by deployment of a single cartridge containing 150 grams of chaff. The resulting chaff concentration would be about 5.4 g/nm^2. This corresponds to less than 179,000 $fibers/nm^2$ or less than 0.005 $fibers/ft^2$, assuming that each canister contains 5 million fibers. The fine, neutrally buoyant chaff streamers act like particulates in the water, temporarily increasing the turbidity of the ocean's surface, but are quickly dispersed. The low concentration of chaff that falls to the surface and the short-term turbidity duration of chaff particles represent a negligible effect to marine water quality.

Underwater Detonations

Approximately 97 underwater detonations of NEWs ranging from 5 to 60 lbs would be conducted under the No Action Alternative, in addition to smaller anti-swimmer grenade charges (discussed below). Most underwater detonations during GOMEX Range Complex operations would be associated with mine neutralization exercises. Underwater detonations create gaseous bubbles. Many of these gaseous

byproducts travel within this bubble to the water surface and escape into the atmosphere. A small amount of the gas, however, dissolves into the water column. The product with greatest potential to result in toxicity is hydrogen fluoride compounds. These compounds are a reaction product associated with the booster charge that incorporates a Viton® fluoropolymer binder formulation to stabilize the highly explosive nitramines in HLX. The hydrogen fluoride is either produced directly in the explosion or from hydrolysis of another product.

Anti-swimmer grenades (8 oz charges) are also included in the No Action Alternative for port security exercises in the Corpus Christi OPAREA (UNDET Box E3). The baseline use of grenades within this training area for MIW exercises does not exceed 20 grenades per year. These detonations occur in very shallow water areas and detonate at a depth of no greater than three meters. Due to the low NEW of these charges, the relatively large area of UNDET Box E3, and the low number of anti-swimmer grenade deployments, no long-term effects to water quality can be expected from this MIW activity. Short-term effects to water quality from anti-swimmer grenades include the introduction of chemical constituents that would quickly dissipate within the water column or outgas at the surface. These constituents and amount of by products within the 20 eight oz grenades are described in detail in Section 3.2 (Hazardous Materials and Hazardous Waste).

Explosive ordnance disposal (EOD) detachments place explosive charges next to or on inert practice mines. Charges used by EOD divers in the Demolition Pond consist of 1.5 lb and 5 lb charges. These charge sizes reflect the size of charges EOD divers use to detonate mines in combat or real-world conditions. Underwater explosions would also occur during SEAL platoon training exercises. Navy SEAL underwater demolitions and EOD operations usually take place in shallow water.

Initial concentrations of explosion by-products in open marine environments are not expected to be hazardous to marine life or water quality (DoN, 2001b) and would not accumulate in the training area because exercises are spread out over time and chemicals rapidly disperse in the ocean. No adverse effects from chemical byproducts would be expected within open waters. Within the Demolition Pond, a more rapid accumulation of explosive by-products can be expected relative to open ocean waters because the pond is protected from wave action by shoreline on three sides. The Demolition Pond, however, is subject to daily tides that will disperse some chemicals over time and training within the pond is only conducted 90 days per year. Because of the non-continuous use of the Demolition Pond and continuous tidal effects within this training area, no adverse effects from chemical byproducts would be expected.

Additionally, it was concluded that small-scale underwater detonations, including development tests of underwater weapons, underwater explosive research testing, and shock survivability tests of shipboard equipment showed no significant environmental effects to the benthic environment, water quality, or marine biota of the global commons (DoN, 1992). Testing occurred 18 nm offshore from Key West, Florida, where the depth of the water column ranged from approximately 1200 to 4,800 feet.

Explosive material contains fluorine, which upon detonation combines with hydrogen to form hydrogen fluoride, a highly corrosive gas. The United States has not produced any formal evaluation of risk to aquatic life from hydrogen fluorides; however, the European Union Committee for evaluation and control of the risks of existing substances has recommended risk-based benchmarks (Committee on Toxicity, Ecotoxicity and the Environment [CSTEE], 2000). Based on laboratory studies with freshwater species, they provide a probable no effect concentration (PNEC) of 0.9 and 0.4 mg/L for hard and soft water, respectively. These values are apparently close to background levels measured in many natural water bodies. Characterization of natural exposure levels and effects in saltwater are needed to provide further basis for the assessment of risks in marine systems. Only a small percentage (0.63%) of the available hydrogen fluoride explosive product is expected to become solubilized prior to

reaching the surface and the rapid dilution that would occur upon mixture with ambient water. As such, it is unlikely the explosive reactions would contribute contaminant risks to the aquatic community.

Military training activities in the GOMEX Range Complex, especially the use of live ordnance, are potential sources of water quality pollutants. Most of the NEWs for underwater detonation operations in the GOMEX Range Complex occur outside the 12 nm limit, and any potential impacts to water quality from combustion products are localized, temporary, and do not substantially affect water quality or resources in the Study Area. Further, the underwater detonations that occur in Demolition Pond and Corpus Christi MINEX Box E3 are low NEW with only short-term impacts associated with little sediment displacement. Therefore, the impact on water resources and water quality is less than significant in the No Action Alternative.

Water Quality in Terrestrial Environments

Bombs and Strafing Exercises

When used at the land ranges, practice bombs may contain spotting charges/signal cartridges that produce a visual indication of impact. A spotting charge can vary from a few grains of black powder to several pounds of high explosives. Strafing pits are used for air-to-ground gunnery training. Air-to-ground gunnery training (strafing) primarily uses 20-mm target practice ammunition. The 20-mm projectiles contain no explosives, lead, or spotting charges, and are constructed of steel and non-ferrous alloys. During night training, 20-mm tracer projectiles are used; these contain a small charge of incendiary material. Strafe targets are generally suspended banners, drag chute panels, or other suitable wooden targets with a sand pit or berm immediately down-range to capture the training rounds. Because of the physical embankments that surround strafing targets, there is little potential for these materials to accumulate in ephemeral drainages and migrate to offsite locations affecting water quality.

Land targets are the Yankee and Dixie targets at the McMullen County Range (R-6312), and the SEARAY target (R-4404A) within the Meridian, Mississippi MOA. As described in Chapter 3.2 (Hazardous Materials and Hazardous Waste), an Operational Range Clearance (ORC) Plan calls for annual and five-year expanded clearances of the McMullen Range and SEARAY target. The plan includes procedures for removal and disposal or recycling of range scrap and expended materials (*e.g.*, munitions, munitions residue, and target residue).

McMullen County Range

Under the No Action Alternative, 2,636 bombs will be deployed at the Yankee Target and 1,433 bombs deployed at the Dixie Target. The bombing target is a bull's-eye containing scrap aircraft engine canisters surrounded by concentric rings of used tires. Recent training bombs dropped on the McMullen County Range have included inert 25 lb bombs; inert 500 lb bombs; and inert 2,000 lb bombs (GOMEX RCMP, 2006). Prior training activities at the targets have included air-to-ground bombing with BDU-33, MK-76, MK-79, MK-82 (without spotting charges), MK-84, and MK-106 practice bombs. Under the No Action Alternative all bombs used on land targets would be practice bombs without explosive warheads.

In 1994, an Environmental Baseline Survey performed for the Air Force at Yankee Target found "no significant concerns for soil or water contamination." (USAF, 1994). A Range Condition Assessment, performed prior to this Environmental Baseline Survey found that "no environmental issues were identified that could potentially cause off-range contaminant migration or that will adversely impact the daily operations or overall sustainability of the Dixie and Yankee targets" (DoN, 2006). Specifically, there is no known migration of contaminants toward offsite locations and no evidence of onsite or offsite impact to surface water or groundwater.

SEARAY Target

The SEARAY target also only allows inert bombs, and its Range Clearance Plan contains similar range management practices as the McMullen County Range. Under the No Action Alternative, 21,045 bombs are deployed at the SEARAY Target.

As there is no known migration or fate transport of contaminants associated with bombs or strafing exercises, continued bombardment using inert ordnance and airborne strafing under the No Action Alternative will not significantly impact water quality in terrestrial environments, in accordance with NEPA. By definition, land-based training does not occur within territorial waters; therefore, EO 12114 is not applicable in this instance.

3.3.3.2 Alternative 1

Water Quality in Marine Environments

GOMEX Range Complex training operations involving hazardous materials would increase by varying degrees from current levels in support of the Fleet Response Training Plan (FRTP). In some cases, there would be a decrease in the amount of MEM and chemical constituents associated with MEM. Those changes are described in Chapter 3.2 (Hazardous Materials and Hazardous Waste). Only the number of training operations would increase or decrease; no new training activities (i.e., weapons firing, target deployment, etc.) would be introduced.

Under Alternative 1, approximately 331 bombs would be deployed, which is an increase of 103 bombs over the No Action Alternative. Of the 331 bombs deployed under Alternative 1, 105 bombs will be live (47%) and 176 bombs will be inert (53%). Under Alternative 1, the use of marine markers would increase from the No Action Alternative by 29%.

Gunnery Exercises would experience the largest percentage increases from No Action levels under Alternative 1, followed by underwater demolitions in the Demolition Pond by Salvage Diver Training Exercises. Conversely, Alternative 1 does not include any MINEX activities except for the MIW exercises involving anti-swimmer grenades (no change from the No Action Alternative). The amounts of MEM and chemical constituents associates with MEM, including hazardous materials, would increase and decrease in rough proportion to the overall increases and decreases in these training operations.

Training activities under Alternative 1 within the GOMEX Range Complex would introduce potential pollutants into the water column. Vessels, aircraft, and other military assets employed in these operations would carry and use materials that may affect water quality for routine operation and maintenance. These pollutants would be released in quantities and at rates that would not result in a violation of any water quality standard or criteria. Further, these pollutants are dispersed widely and in short duration, and are expected to dissipate quickly within the water column or outgas to the surface. Similar to the No Action Alternative, the proposed use of the Demolition Pond under Alternative 1, a more rapid accumulation of explosive by-products can be expected relative to open ocean waters because the pond is protected from wave action by shoreline on three sides. The Demolition Pond, however, is subject to daily tides that will disperse some chemicals over time and training within the pond is only conducted 90 days per year. Because of the non-continuous use of the Demolition Pond and continuous tidal effects within this training area, no adverse effects from chemical byproducts would be expected. Therefore, in accordance with NEPA, Alternative 1 would have no significant impact on water resources within territorial waters. Further, no harmful effects would be expected in non-territorial waters, in accordance with EO 12114.

Water Quality in Terrestrial Environments

Bombs and Strafing Exercises

Under Alternative 1, the number of bombs deployed at the Yankee Target, Dixie Target, and SEARAY Targets would not change as compared to the numbers specified for the No Action Alternative. Likewise, strafing rounds would not increase in Alternative 1. Therefore, in accordance with NEPA, Alternative 1 would not significantly impact water quality in terrestrial environments. As with the No Action Alternative, EO 12114 is not applicable to targets on land-based ranges.

3.3.3.3 Alternative 2 (Preferred Alternative)

Water Quality in Marine Environments

Similar to Alternative 1, only the number of training operations would increase or decrease under Alternative 2; no new training activities (i.e., weapons firing, target deployment, etc.) would be introduced. Alternative 2 does not include any MINEX activities. The amounts of MEM and chemical constituents associated with MEM, including hazardous materials, would vary in rough proportion to the overall increases and decreases in these training operations.

Under Alternative 2, 343 bombs would be deployed, of which only four bombs use explosive ordnance. Although the total number of bombs deployed under Alternative 2 increases over the No Action Alternative and Alternative 1, the number of explosive munitions used in a BOMBEX decreases from 42 and 145, respectively. In other words, most of the increases in bomb deployments under Alternative 2 are from increases in inert bombing. Under the Preferred Alternative (Alternative 2), the use of marine markers would increase from the No Action Alternative by 29 percent.

Under Alternative 2, vessels, aircraft, and other military assets employed in these operations would carry and use materials that may affect water quality for routine operation and maintenance. However, in accordance with NEPA, Alternative 2 would have no significant impact on water resources within territorial waters. Further, no harmful effects would be expected in non-territorial waters, in accordance with EO 12114.

Water Quality in Terrestrial Environments

Similar to Alternative 1, Alternative 2 would not increase the number of bombs deployed at the Yankee Target, Dixie Target, and SEARAY Targets as specified for the No Action Alternative. Likewise, strafing rounds would not increase in Alternative 2. Therefore, in accordance with NEPA, Alternative 2 would not significantly impact water quality in terrestrial environments. As with the No Action Alternative, EO 12114 is not applicable to targets on land-based ranges.

3.3.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that Alternatives 1 and 2 (Preferred Alternative) would not result in unavoidable significant adverse effects to water resources and water quality.

3.3.5 Summary of Environmental Effects (NEPA and EO 12114)

Training activities would introduce potential water pollutants to the water column. Based on the analysis presented above, however, these pollutants would be released in quantities and at rates that would not result in a violation of any water quality standard or criteria. Marine biota would not be substantially affected. Accordingly, these impacts would be less than significant, both individually and in the aggregate.

Table 3.3-4 provides a summary of water quality effects for the No-Action Alternative, Alternative 1, and Alternative 2. For purposes of analyzing such effects under both NEPA and EO 12114, the table

allocates effects on a jurisdictional basis (*i.e.*, under NEPA for actions or effects within U.S. Territory, and under EO 12114 for actions or effects outside U.S. Territory).

TABLE 3.3-4
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON WATER RESOURCES IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Expended Materials	Short- term, minor, and localized effects to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Long-term, minor, and localized accumulation of expended materials on the ocean floor, *Sargassum* mats, and beaches. Low-level accumulation of expended materials in the Demo Pond, mitigated by outflows exiting the pond due to tidal and surface flows. Low-level accumulation of chaff and expended rounds at SEARAY and Yankee/Dixie Target Areas.	Short- term, minor, and localized effects to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Long-term, minor, and localized accumulation of expended materials on the ocean floor, and *Sargassum* mats.
Chemical Pollution	Negligible effects.	Negligible effects.
Sediment Displacement	Negligible effects.	Negligible effects.
Impact Conclusion	Less than significant impacts.	No significant harm to the global commons.
Alternative 1		
Expended Materials	Short- term, minor, and localized effects to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Long-term, minor, and localized accumulation of expended materials on the ocean floor, *Sargassum* mats, and beaches. Low-level accumulation of expended materials in the Demo Pond, mitigated by outflows exiting the pond due to tidal and surface flows. Low-level accumulation of chaff and expended rounds at SEARAY and Yankee/Dixie Target Areas. Slight increase compared to No Action.	Short- term, minor, and localized effects to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Long-term, minor, and localized accumulation of expended materials on the ocean floor, and *Sargassum* mats.. Slight increase compared to No Action.

TABLE 3.3-4 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON WATER RESOURCES IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Chemical Pollution	Negligible effects.	Negligible effects.
Sediment Displacement	Negligible effects.	Negligible effects.
Impact Conclusion	Less than significant impacts.	No significant harm to the global commons.
Alternative 2		
Expended Materials	Short- term, minor, and localized effects to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Long-term, minor, and localized accumulation of expended materials on the ocean floor, *Sargassum* mats, and beaches. Low-level accumulation of expended materials in the Demo Pond, mitigated by outflows exiting the pond due to tidal and surface flows. Low-level accumulation of chaff and expended rounds at SEARAY and Yankee/Dixie Target Areas. Slight increase compared to No Action.	Short- term, minor, and localized effects to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Long-term, minor, and localized accumulation of expended materials on the ocean floor, *Sargassum* mats. Slight increase compared to No Action.
Chemical Pollution	Negligible effects.	Negligible effects.
Sediment Displacement	Negligible effects.	Negligible effects.
Impact Conclusion	Less than significant impacts.	No significant harm to the global commons.

3.4 AIR QUALITY

3.4.1 Introduction and Methods

Air quality in a given location is described by the concentration of various pollutants in the atmosphere, generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$), the size and topography of the air basin, and the prevailing meteorological conditions. The USEPA sets concentration levels for specific pollutants of concern with respect to the health and welfare of the general public. The six major pollutants of concern are carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), suspended particulate matter (PM_{10} and $PM_{2.5}$), and lead. The USEPA established the National Ambient Air Quality Standards (NAAQS) for these "criteria pollutants." The NAAQS establishes ambient concentrations of criteria pollutants considered protective of public health and welfare.

Pollutant emissions typically refer to the amount of pollutants or pollutant precursors introduced into the atmosphere by a source or group of sources. Pollutant emissions contribute to the ambient air concentrations of criteria pollutants, either by directly affecting the pollutant concentrations measured in the ambient air or by interacting in the atmosphere to form criteria pollutants. Primary pollutants, such as CO, SO_2, lead, and some particulates, are emitted directly into the atmosphere from emission sources. Secondary pollutants such as O_3, NO_2, and some particulates are formed through atmospheric photochemical reactions that are influenced by meteorology, ultraviolet light, and other atmospheric processes.

Wind direction determines the trajectory, or path, of air pollutants from their source to any receptor. Wind speed and the distance from the source determine the time it will take air pollutants to travel from source to receptor. At high wind speeds, the air experiences more mechanical turbulence and pollutants released near ground level disperse more rapidly. However, air pollutants emitted by elevated stack sources may be more rapidly transported to the ground during high wind speeds and can actually lead to higher ground-level pollutant concentrations. At low wind speeds, pollutants emitted from sources near ground level, such as vehicle exhaust, disperse at a slower rate.

The combination of a strong temperature inversion and light winds may lead to a layer of cold, stagnant air near the ground. Pollutants emitted from low-level sources, such as vehicles, are trapped in this layer of air. A persistent temperature inversion over a long period of time may lead to increased concentrations of air pollutants in the lower atmosphere from low-level sources.

The region of air that extends from the earth's surface to the base of the temperature inversion is referred to as the mixing layer. This layer of air is relatively well mixed due to heating from the sun and from human sources. The depth of the mixing layer defines the volume of air in which air pollutants can be mixed. The lower the depth of the mixing layer, the less volume available to disperse air pollutants. A persistent lack of a mixing layer or shallow mixing depth may lead to episodes of high pollution concentrations. The mixing layer is especially important in urban locations where large quantities of pollutants are released near ground level.

In general terms, the air quality of the GOMEX Range Complex is considered very good. As mentioned above, this is reflective of the pollutant concentrations, the size and topography of the GOMEX Range Complex, and the prevailing meteorological conditions. These conditions are further described in this section, but first is a discussion of the air quality regulatory framework.

Federal Air Quality Requirements

The USEPA is the agency responsible for enforcing the federal Clean Air Act (CAA) of 1970 and its 1977 and 1990 amendments (42 USC §7401 *et seq*.). The purpose of the CAA is to establish NAAQS,

classify areas as to their attainment status relative to the NAAQS, develop schedules and strategies to meet the NAAQS, and regulate emissions of criteria pollutants and air toxics to protect public health and welfare. Under the CAA, individual states are allowed to adopt ambient air quality standards and other regulations provided they are at least as stringent as federal standards.

The USEPA requires each state to prepare a State Implementation Plan (SIP) that describes how that state will achieve compliance with the NAAQS. A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all federal air quality standards. The predominant air quality regulations promulgated under the CAA potentially applicable to the proposed action include:

- NAAQS; and
- General Conformity Rule.

Implementation of the CAA is carried out through rules promulgated by the states through their respective agencies. For the proposed action, these agencies include: Florida (Florida Department of Environment Protection [FL DEP]); Alabama (Alabama Department of Environmental Management [ADEM]); Mississippi (Mississippi Department of Environmental Quality [MS DEQ]; Louisiana (Louisiana Department of Environmental Quality [LA DEQ]); and Texas (Texas Commission on Environmental Quality [TCEQ]). Additional information about state air quality regulations is contained in Appendix K.

National Ambient Air Quality Standards

The CAA requires USEPA to set NAAQS (40 CFR Part 50) for pollutants considered harmful to public health and the environment (See Appendix K for a table of the NAAQS). The CAA established two types of national air quality standards (primary and secondary). Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

Areas within a particular state that do not meet the NAAQS for a criteria pollutant are designated as being in “nonattainment” for that pollutant. Nonattainment status is further defined by the extent to which the standard is exceeded. Ozone nonattainment status is categorized by five classifications: marginal, moderate, serious, severe, and extreme; CO and PM_{10} nonattainment status is categorized by two classifications: moderate and serious. The remaining criteria pollutants have designations of either “attainment,” “nonattainment,” or “unclassifiable.” Areas that achieve the air quality standard after being designated in nonattainment are redesignated as in attainment following USEPA approval of a maintenance plan. These areas are commonly known as “maintenance areas,” signifying they are attainment areas with a maintenance plan approved by USEPA. The maintenance plan must include emissions budgets demonstrating measures to be taken to ensure the area continues to meet the NAAQS.

General Conformity Rule

The USEPA rule implementing the conformity requirements, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans,” was published on 30 November 1993 at 58 FR 63214 and codified at 40 CFR Parts 51 and 93. 40 CFR Part 51, Subpart W, contains the General Conformity Rule provisions that must be incorporated into SIPs, including the requirement that States revise the SIPs to include the conformity requirements. Once a SIP has been revised and approved by USEPA, the conformity requirements become federally enforceable and federal agencies are subject to the conformity requirements as they appear in the SIP. In cases where a Federal Implementation Plan (FIP) is in effect, federal actions must conform to the requirements of the FIP. Each federal agency

taking an action subject to the General Conformity Rule must make its own conformity determination (40 CFR Part 93.154).

A Conformity Review must be completed for every Navy action that generates air emissions. The action proponent is responsible for the documentation. The Conformity Review can be satisfied by (1) a determination that the action is not subject to the General Conformity Rule, (2) a Record of Non-Applicability, or (3) a Conformity Determination.

The action proponent may make a determination that the proposed action is not subject to the General Conformity Rule. Actions not subject to the rule are actions that occur in attainment areas, and that do not generate emissions in non-attainment areas; or actions where the criteria pollutant emitted (or its precursors) is one for which the area is in attainment. If NEPA documentation is prepared for the action, the determination shall be described in that documentation; otherwise, no documentation is required. This EIS/OEIS includes the determination that all actions occur within attainment areas (*i.e.*, SUA counties and coastal counties of Florida, Alabama, Mississippi, Louisiana, and Texas). Since the actions under assessment here would occur within attainment areas, the rule on general conformity is not applicable.

3.4.1.1 Assessment Methods and Data Used

The method used in this Final EIS/OEIS to assess the air quality impacts associated with existing and proposed Navy training and RDT&E within the GOMEX Range Complex include following these steps:

- Analyze existing federal and state air quality regulations applicable to the proposed action. Determine applicability of the General Conformity Rule;
- Analyze existing air quality in the range complex and the existing meteorological conditions;
- Analyze the types of emission sources associated with training and RDT&E within the GOMEX Range Complex;
- Review existing air quality assessments associated with individual Navy platforms and weapons systems; and
- Determine overall air quality impacts associated with existing and proposed Navy training and RDT&E within the range complex given the regulatory framework.

3.4.1.2 Warfare Areas and Associated Air Quality Stressors

Table 3.4-1 lists the warfare areas and associated training events conducted within the GOMEX Range Complex. For each training event, emission sources (environmental stressors) are listed. These sources/stressors are associated with either the training platform, the weapon system utilized during the exercise, or the target or support craft. Also included in the table are the distances from shore where the training events take place, and the altitude of training events. Emissions occurring above 3,000 feet are considered to be above the atmospheric inversion layer and are, therefore, without impact on the local air quality.

As shown in Table 3.4-1, the events that occur overland (*i.e.*, basic flight training, air-to-ground bombing exercises [A-G BOMBEX], air-to-ground gunnery exercises [A-G GUNEX], and Naval Support Activity (NSA) Panama City Pond Demolition Training are the only events projected to occur in the future within state territory.[39] These events would require a closer review for potential impacts to air quality ashore. All other events occur in the offshore areas (more than 12 nm from shore). The

[39] Due to Base Realignment and Closure (BRAC) action, the unit level mine warfare training events will not occur as part of the proposed action.

distance a training event occurs from shore is important from an air quality perspective because it helps to understand which Navy exercise emission sources would contribute to the overall air quality for human receptors. Firing Exercises (FIREX) and Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) events are always conducted at least 12 nm from shore, primarily due to safety constraints, but this also minimizes any potential for associated exhaust to influence overland air quality. Emissions associated with FIREX or GUNEX (S-S) would be minor cruiser or destroyer engine exhaust and gun barrel exhaust from firing the 5-inch guns.

3.4.1.3 Greenhouse Gas Emissions

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The accumulation of GHGs in the atmosphere regulates the earth's temperature. Scientific evidence indicates a trend of increasing global temperature over the past century due to an increase in GHG emissions from human activities. The climate change associated with this global warming is predicted to produce negative environmental, economic and social consequences across the globe.

Recent observed changes due to global warming include shrinking glaciers, thawing permafrost, a lengthened growing season, and shifts in plant and animal ranges (Intergovernmental Panel on Climate Change, 2007). Predictions of long-term negative environmental impacts due to global warming include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems including the potential loss of species, and a substantial reduction in winter snow pack. Predictions of these effects include exacerbation of air quality problems, a reduction in municipal water supply from the Sierra snowpack, a rise in sea level that would displace coastal businesses and residences, damage to marine and terrestrial ecosystems, and an increase in the incidence of infectious diseases, asthma, and other human health problems (California Environmental Protection Agency, 2006).

The most common GHGs emitted from natural processes and human activities include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Examples of GHGs created and emitted primarily through human activities include fluorinated gases (hydro fluorocarbons and per fluorocarbons) and sulfur hexafluoride. Each GHG is assigned a global warming potential (GWP). The GWP is the ability of a gas or aerosol to trap heat in the atmosphere. The GWP rating system is standardized to CO_2, which has a value of one. For example, CH_4 has a GWP of 21, which means that it has a global warming effect 21 times greater than CO_2 on an equal-mass basis. To simplify analyses, total GHG emissions from a source are often expressed as a CO_2 equivalent (CO_2e). The CO_2e is calculated by multiplying the emission of each GHG by its GWP and adding the results together to produce a single, combined emission rate representing all GHGs.

Federal agencies are, on a national scale, addressing emissions of GHGs by reductions mandated in federal laws and Executive Orders, most recently, Executive Order 13423. Several states have promulgated laws as a means to reduce statewide levels of GHG emissions. In particular, the California Global Warming Solutions Act of 2006 directs the State of California to reduce statewide GHG emissions to 1990 levels by the year 2020. In addition, groups of states (such as the Western Climate Initiative) have formed regionally-based collectives to jointly address GHG pollutants.

In an effort to reduce energy consumption, reduce dependence on petroleum, and increase the use of renewable energy resources in accordance with the goals set by Executive Order 13123 and the Energy Policy Act of 2005, the DoN and USMC have implemented a number of renewable energy projects (Naval Facilities Engineering Command [NAVFAC], 2006). The potential effects of proposed GHG

emissions are by nature global and cumulative impacts, as individual sources of GHG emissions are not large enough to have an appreciable effect on climate change. Therefore, the impact of proposed GHG emissions to climate change is discussed in the context of cumulative impacts in Chapter 6 of this EIS/OEIS.

TABLE 3.4-1
WARFARE AREAS AND ASSOCIATED AIR QUALITY ENVIRONMENTAL STRESSORS

		Stressors			Location			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Emissions**	**Aircraft Emissions**	**Ordnance Emissions**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**	**Below 3,000 ft Altitude**	**Above 3,000 ft Altitude**
Mine Warfare (MIW)								
Mine Countermeasures (MCM) – Airborne	Corpus Christi and Panama City OPAREAs		✓	✓	✓	✓	✓	
MCM-Surface	Corpus Christi and Panama City OPAREAs	✓		✓	✓	✓	✓	
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi and Panama City OPAREAs	✓		✓	✓	✓	✓	
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi and Panama City OPAREAs	✓		✓	✓	✓	✓	

TABLE 3.4-1 (Continued)
WARFARE AREAS AND ASSOCIATED AIR QUALITY ENVIRONMENTAL STRESSORS

		Stressors			Location			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Emissions**	**Aircraft Emissions**	**Ordnance Emissions**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**	**Below 3,000 ft Altitude**	**Above 3,000 ft Altitude**
Surface Warfare (SUW)								
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓		✓		✓
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B		✓	✓		✓		✓
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓			✓		✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Ship)	W-151 A/B; W-155A	✓		✓		✓	✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Panama City OPAREA	✓			✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Corpus Christi UNDET Area E3	✓		✓	✓		✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓			✓	✓	✓	
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓		✓	✓	✓	
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓			✓			
Air Warfare (AW)								
Air Intercept Control (AIC)	W-151; W-155		✓			✓		✓
Strike Warfare (STW)								
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓	✓	✓		✓	✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓		✓		✓	✓
Amphibious Warfare (AMW)								

TABLE 3.4-1 (Continued)
WARFARE AREAS AND ASSOCIATED AIR QUALITY ENVIRONMENTAL STRESSORS

		Stressors			Location			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Emissions**	**Aircraft Emissions**	**Ordnance Emissions**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**	**Below 3,000 ft Altitude**	**Above 3,000 ft Altitude**
Firing Exercise (FIREX) with IMPASS	W-151A/B; W-155A	✓		✓		✓	✓	
Electronic Combat (EC)								
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓	✓		✓		✓
Chaff Exercise (CHAFFEX)	Brownwood MOAs		✓	✓	✓			✓
Flare Exercises (FLAREX)	W-155A/B		✓	✓		✓		✓
Flare Exercise (FLAREX)	Brownwood MOAs		✓	✓	✓			✓
Mission Area Training[40]								
Mission Area Flight Training	W-92; W-54; Brownwood MOAs		✓	✓	✓	✓		✓
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312		✓		✓	✓		✓
Salvage Diver Training	NSA Panama City Demolition Pond			✓	✓		✓	
Underwater Demolitions	NSA Panama City Demolition Pond			✓	✓		✓	
Security Force Training	NSA Panama City Demolition Pond			✓	✓		✓	
Diver Training	NSA Panama City Demolition Pond			✓	✓		✓	

[40] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

3.4.2 Affected Environment

The GOMEX Range Complex Study Area assessed in this Final EIS/OEIS is a combination of offshore training sea space, undersea space, land ranges, and SUA (both over water and over land). The affected environment for purposes of air quality includes the SUA associated with the GOMEX OPAREAs, and the air above the Study Area counties of Florida, Alabama, Mississippi, Louisiana, and Texas, which air may mix with the Navy training space. For air quality purposes, a large portion of area assessed is that 20,810 nm^2 of SUA located above or associated with the GOMEX OPAREAs (*e.g.*, W-151, W-155, W-92, W-54, and W-228). Nearly all of W-151, W-155 and W-228 are located beyond the 12 nm U.S. territorial sea limits, and all of W-54 and W-92 are located beyond the U.S. territorial sea limits. Another large block of SUA analyzed for air quality purposes are the GOMEX Range Complex Military Operating Areas (MOA). These MOAs are scattered across parts of Texas, Mississippi, Alabama, and Florida. Other smaller areas assessed for air quality impacts in this Final EIS/OEIS include: 1) the restricted airspace (R-2908) located in Escambia County, Florida; 2) the restricted airspace regions R-6312 at the McMullen County Range; 3) R-4404 at the Noxubee County Range; and 4) the NSA Panama City Demolition Pond located in Bay County, Florida.

Regional Climate

The maritime climate of the GOMEX is considered to be subtropical and is heavily influenced by the clockwise (anti-cyclonic) circulation of the Bermuda High, a semi-permanent, high-pressure system located southeast of the Gulf (Twilley *et al.*, 2001). The Gulf is close enough in proximity to the Bermuda High that winds and weather patterns predominantly flow from the southeast, although seasonal fluctuations in the relative location and strength of the pressure system can have significant effects on weather in the Gulf region. During most of the winter (January through March), the Bermuda High is weaker and located further south than throughout the remainder of the year (Twilley *et al.* 2001). Weather patterns in the Gulf are further complicated by the influence of continental and tropical air masses. During winter, fronts linked to cold, continental air masses affect the northern Gulf by bringing strong north winds and drier air into the region. In spring (April through mid June), the Bermuda High strengthens and moves northward; if it does not weaken during summer (July through September), then seasonal rains are delayed and drought conditions can persist over much of southern Florida (Twilley *et al.*, 2001).

In general, summer weather conditions in the GOMEX Study Area are relatively consistent and stable with winds predominantly out of the southeast while winter weather conditions are more variable with winds predominantly from the east or northeast (MMS, 2007).

These mild temperatures and seasonal variations in wind conditions play a role in determining the existing air quality in the EIS/OEIS Study Area.

3.4.2.1 Florida Air Quality

The Florida portion of the proposed action Study Area includes offshore waters (W-151 and W-155) adjacent to portions of the Florida panhandle. It also includes the NSA Panama City Demolition Pond area, and portions of the Pensacola North and South MOAs. The nearest Florida counties to these Florida elements of the proposed action Study Area are the Counties of Gulf, Bay, Walton, Okaloosa, Santa Rosa, and Escambia. These counties are part of the Mobile (Alabama)-Pensacola-Panama City (Florida)-Gulfport (Mississippi) Interstate Air Quality Control Region (AQCR) (40 CFR Part 81.68). Pursuant to 40 CFR Part 81.310, this AQCR and component Florida counties bordering the Study Area are designated as being in attainment for all criteria pollutants. Florida is one of just three states east of the Mississippi that currently meets all National Ambient Air Quality Standards, and the only highly urbanized state (FDEP, 2007a). Figure 3.4-1 identifies the counties within the state that lie within or

adjacent to the Study Area. These counties are highlighted and their particular AQCR affiliation is also noted.

Florida's statewide air quality monitoring network is operated by both state and local environmental programs. The air is monitored for CO, lead, NO_2, O_3, $PM_{2.5}$, PM_{10} and SO_2. Not all pollutants are monitored in all areas (FDEP, 2007b). Florida has over 200 air quality monitoring stations throughout the state (FDEP, 2006).

3.4.2.2 Alabama Air Quality

The Alabama portion of the proposed action Study Area includes offshore waters (W-155) adjacent to portions of the Alabama coast, as well as a small coastal Alabama SUA (R-2908), and portions of the Pensacola North and South MOAs, the Pine Hill East and Pine Hill West MOAs, and portions of the Meridian 1 East and Meridian 1 West MOAs. The Alabama counties nearest to the coastal portions of the proposed action Study Area are: Baldwin County, Escambia County, and Mobile County. These counties are part of the Mobile (Alabama)-Pensacola-Panama City (Florida)-Gulfport (Mississippi) Interstate Air Quality Control Region (AQCR) (40 CFR Part 81.68). Other southwest Alabama counties located in proximity to the MOAs include: Choctaw, Marengo, Clarke, Wilcox, Perry and Dallas Counties. These counties are part of the Alabama and Tombigbee River Intrastate AQCR (40 CFR Part 81.266). The Alabama counties of Lamar, Fayette, Pickens, Sumter, Greene, and Tuscaloosa are the closest counties to the Meridian 1 East MOA in west central Alabama. These counties are part of the Metropolitan Birmingham Intrastate AQCR (40 CFR Part 81.41). Pursuant to 40 CFR Part 81.301, the Alabama counties bordering the Study Area are designated as being in attainment for all criteria pollutants. Figure 3.4-1 identifies the counties within the state which lie within or adjacent to the Study Area. These counties are highlighted and their particular AQCR affiliation is also noted.

The ADEM Air Division continues to monitor fine particulates in Alabama through the particulate matter ($PM_{2.5}$) multi-year grant. Particulate emissions are generated from large sources such as utilities, pulp and paper mills, refineries, and lime plants as well as small emission sources such as automobiles and open burning (ADEM, 2007). Alabama currently has two $PM_{2.5}$ nonattainment areas, however there have been recent revisions to the $PM_{2.5}$ standard (ADEM, 2007). These two locations are Jefferson and Shelby Counties, located east of the GOMEX EIS Study Area. Alabama has achieved attainment for all areas in relation to ozone under the NAAQS (ADEM, 2007).

3.4.2.3 Mississippi Air Quality

The Mississippi portion of the proposed action Study Area does not include offshore waters, but does include portions of the Meridian 1 East and Meridian 1 West MOAs, and R-4404 around the Noxubee County Range. The nearest Mississippi counties to the MOAs and land target include: Kemper, Neshoba, Leake, Attala, Winston, Noxubee, Lowndes, Oktibbeha, Choctaw, Montgomery, Webster, Holmes, Carroll, and Clay. These counties are part of the Northeast Mississippi Intrastate AQCR (40 CFR Part 81.62). Yazoo County also borders the Study Area portion around the Noxubee County Range. Yazoo County is part of the Mississippi Delta Intrastate AQCR (40 CFR Part 81.122). Pursuant to 40 CFR Part 81.325, the Mississippi counties bordering the Study Area are designated as being in attainment for all criteria pollutants. Figure 3.4-1 identifies the counties within the state which lie within or adjacent to the Study Area. These counties are highlighted and their particular AQCR affiliation is also noted.

3.4.2.4 Louisiana Air Quality

The Louisiana portion of the proposed action Study Area includes no offshore waters and no SUA. Terrebonne, Lafourche, and Plaquemines Parishes are the nearest Parishes to the New Orleans OPAREA

and W-92. They are part of the Southern Louisiana-Southeast Texas Interstate AQCR (40 CFR Part 81.53). Fort Polk is a training area considered under Alternative 2. Fort Polk is a Joint Readiness Training Center located in Vernon Parish, Louisiana. This Parish is located within the Shreveport-Texarkana-Tyler Interstate AQCR (40 CFR Part 81.94). Pursuant to 40 CFR Part 81.319, these two Louisiana Parishes nearest to GOMEX Range Complex Study Area are designated as being in attainment for all criteria pollutants. Figure 3.4-1 identifies the counties within the state which lie within or adjacent to the Study Area. These counties are highlighted and their particular AQCR affiliation is also noted.

3.4.2.5 Texas Air Quality

The Texas portion of the proposed action Study Area includes counties adjacent to offshore waters (Corpus Christi OPAREA) and SUA (W-228), as well as interior land targets and SUA (Kingsville MOAs, Brownwood MOAs, and R-6312 at the McMullen County Range).

The nearest Texas counties to the Corpus Christi OPAREA, Kingsville MOAs and McMullen County Range are part of several AQCRs. The first AQCR is the Brownsville-Laredo Intrastate AQCR, which consists of Cameron County, Hidalgo County, Jim Hogg County, Starr County, Webb County, Willacy County, and Zapata County (40 CFR Part 81.135). The second AQCR is the Corpus Christi-Victoria Intrastate Air Quality Control Region, which consists of the Texas counties: Aransas County, Bee County, Brooks County, Calhoun County, De Witt County, Duval County, Goliad County, Gonzales County, Jackson County, Jim Wells County, Kennedy County, Kleberg County, Lavaca County, Live Oak County, McMullen County, Nueces County, Refugio County, San Patricio County, and Victoria County (40 CFR Part 81.136). All counties except Gonzales County are located in proximity to the Study Area. The third AQCR is the Metropolitan San Antonio Intrastate AQCR (40 CFR Part 81.40). The only counties in this AQCR within the GOMEX Range Complex Study Area are La Salle County and Karnes County, which overlap partially with the McMullen County Range and the Kingsville MOA. Pursuant to 40 CFR Part 81.344, each of the Texas counties nearest the Corpus Christi OPAREA and Kingsville MOAs is designated as being in attainment for all criteria pollutants.

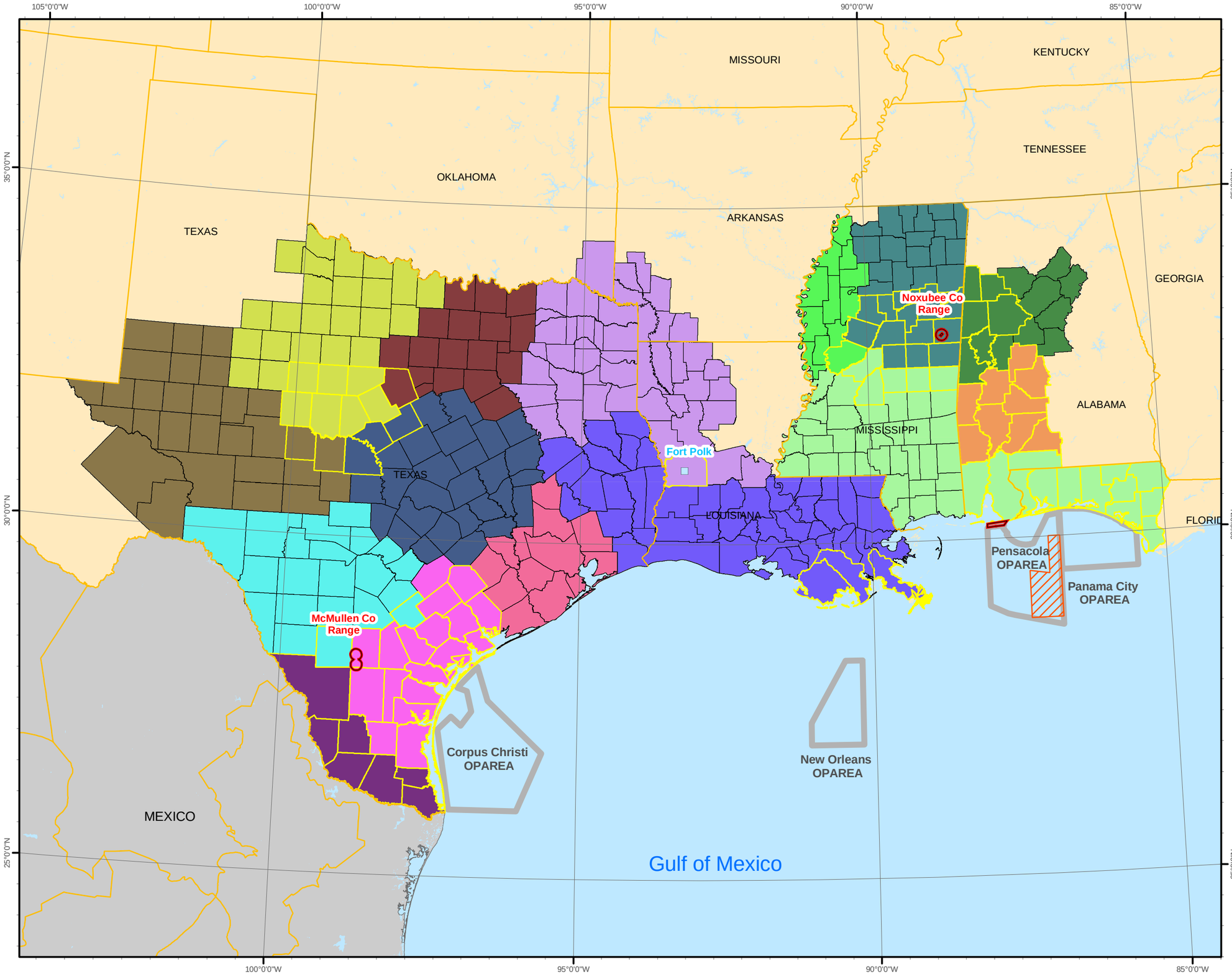
The Brownwood MOAs in north-central Texas are located within a few different AQCRs. The Brownwood MOAs partially overlie the Abilene-Wichita Falls Intrastate AQCR (40 CFR Part 81.132). The counties within this AQCR, which are collocated with the Study Area, include: Brown County, Callahan County, Coleman County, Comanche County, Eastland County, Runnels County, and Taylor County. Other proximate counties to the Brownwood MOAs include: Concho and McCulloch Counties (Midland-Odessa-San Angelo Intrastate AQCR [40 CFR Part 81.137]); San Saba, Mills and Hamilton Counties (Austin-Waco Intrastate AQCR [40 CFR Part 81.134]); and Erath County (Metropolitan Dallas-Fort Worth Intrastate AQCR [40 CFR Part 81.39]). Pursuant to 40 CFR Part 81.344, each of the Texas counties nearest the Brownwood MOAs is designated as being in attainment for all criteria pollutants. Figure 3.4-1 identifies the counties within the state which lie within or adjacent to the Study Area. These counties are highlighted and their particular AQCR affiliation is also noted.

3.4.3 Environmental Consequences:

Evaluation of potential air quality impacts includes two separate analyses. Effects of air pollutant emissions from GOMEX Range Complex operations occurring within the U.S. Territory (overland or within 12 nm of the coastline) are assessed under NEPA. Effects of air pollutant emissions from GOMEX Range Complex operations occurring outside the U.S. Territory are assessed under EO 12114.

Air Quality Control Regions within the GOMEX Study Area

Figure 3.4-1

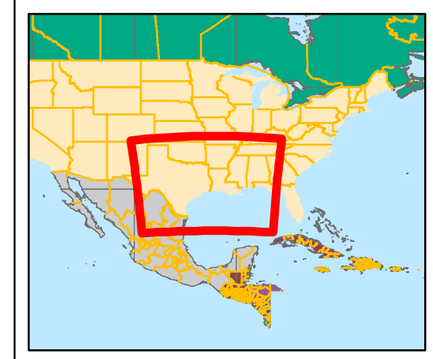


Legend

- Eastern GOMEX BOMBEX HotBox
- Restricted Airspace (R-)
- Counties within Study Area
- County Boundaries
- Operating Areas (OPAREA)

Air Quality Control Regions

- Abilene-Wichita Falls
- Alabama and Tombigbee Rivers
- Austin-Waco
- Brownsville-Laredo
- Corpus Christi-Victoria
- Metropolitan Birmingham
- Metropolitan Dallas-Fort Worth
- Metropolitan Houston-Galveston
- Metropolitan San Antonio
- Midland-Odessa-San Angelo
- Mississippi Delta
- Mobile-P'cola-Panama City-Southern Miss
- Northeast Mississippi
- Shreveport-Texarkana-Tyler
- Southern Louisiana-Southeast Texas



N

1:6,113,837

50 25 0 50 100 NM

50 25 0 50 100 150 200 Kilometers

Coordinate System:
WGS 1984 UTM Zone 15 (Meters)

Sources:
National Geospatial Intelligence Agency (NGA) Database; Special Use Airspace Document AP/1A; CLF 3120.26E; 40CFRSec81

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For the purposes of assessing air quality effects under EO 12114, only those aircraft, vessels, and missiles/targets operations occurring at or below 3,000 feet and outside U.S. territorial waters were considered in the evaluation. These are discussed in Section s 3.4.3.1 through 3.4.3.3.

For the purposes of assessing air quality effects under NEPA, all operations involving the use of aircraft and vessels at or below 3,000 feet in areas within U.S. territorial waters or overland were included in the assessment. Inland training areas are also discussed in Section s 3.4.3.1 through 3.4.3.3.

The NEPA analysis involves evaluating emissions generated from the proposed activities and assessing potential impacts on air quality, including an evaluation of potential exposures to toxic air pollutant emissions. Trace amounts of air toxics emissions would be generated from combustion sources and use of ordnance.

The NEPA analysis does not include a CAA General Conformity Analysis because all adjacent AQCRs are designated in attainment for all criteria pollutants. Pursuant to 40 CFR Part 81, each of the counties within the proposed action Study Area is designated as being in attainment for all criteria pollutants. Thus, the proposed action is not subject to the General Conformity Rule.

3.4.3.1 No Action Alternative

The No Action Alternative consists of maintaining the current levels of training and RDT&E in the GOMEX Range Complex. Thus, there would be no change in current levels of emissions associated with training or RDT&E operations. The Study Area cities/counties in Florida, Alabama, Mississippi, Louisiana, and Texas are currently designated as in attainment for all criteria pollutants. Included within this characterization of regional air quality are the existing Navy aircraft, surface ship, target, and weapon emissions. A continuation of baseline training and RDT&E levels would not require a General Conformity Rule determination because the training occurs in areas designated as attainment for all criteria pollutants. This EIS/OEIS was provided to USEPA in accordance with Section 309 of the CAA. Copies were provided to the state regulatory authorities to ensure conformity of the proposed action with state implementation plan, in accordance with Section 176c of the CAA and the state's air quality regulations

The evaluation of potential air quality impacts under the No Action Alternative are discussed by training area below.

GOMEX OPAREAs and Associated Special Use Airspace

The GOMEX offshore OPAREAs and associated SUA (warning areas) are predominantly located more than 12 nm from shore. However, small slivers of the Corpus Christi OPAREA, Panama City OPAREA and Pensacola OPAREA are located within 12 nm of the shoreline. The air quality stressors associated with Navy training and RDT&E can be grouped into three categories: 1) emissions from surface ships, 2) emissions from aircraft; and 3) emissions from ordnance. These were listed in summary form in Table 3.4-1 and are further described here.

Surface Ship Operations

Marine vessel traffic in the OPAREAs is composed of military ship and boat traffic, including support vessels providing services for military training exercises and RDT&E. A number of non-military commercial vessels and recreational vessels are regularly present within the OPAREAs. See Figure 3.14-1 for the location of the numerous shipping lanes that traverse the Gulf of Mexico. These shipping vessels were not evaluated in the air quality analysis as they are not part of the Navy's proposed action.

Evaluating marine vessel emissions typically involves examining the types of operation for each vessel type, the number of hours of operation for each vessel type, the type of propulsion engine in each vessel,

and the type of generator used onboard each vessel type. Operational estimates of ship steaming days and hours were obtained based on current and future Navy training vessel movements within the Gulf of Mexico. Detailed estimates of operations for baseline and future operations were obtained based on discussions with fleet Subject Matter Experts (SME). Given the number of ships involved in GOMEX Range Complex training exercises, an estimated 180 steaming days are needed to complete the proposed training.

Because no time is spent by surface ships within a non-attainment AQCR, it was not necessary to investigate in detail the time spent within particular locations, at what power level, or the path taken by the boat or ship within the Range Complex. Furthermore, as presented in Table 3.4-1, very little surface boat or ship training operations occur within 12 nm of the shoreline (*e.g.*, FIREX and GUNEX [S-S] events occur greater than 12 nm from shore). Mine Warfare ships and smaller explosive ordnance disposal (EOD) boats traditionally transited through U.S. territorial waters and into the offshore Corpus Christi and Panama City OPAREAs. During major exercises, large Navy ships are not likely to transit through state waters on their way to training areas located beyond 12 nm from shore. Only minor ship engine emissions are expected given the estimated combined 180 steaming day total[41]. Other surface craft emissions can come from support craft used in training events, small boats used to transport participants to small arms training areas, or small powered target craft. Support craft may be used for target setup or retrieval (*e.g.*, set up of the IMPASS system of buoys, or retrieval of inert mine shapes).

Aircraft Emissions

Evaluating aircraft emissions involves evaluating the type of operations for each type of aircraft, the number of hours of operation for each aircraft type, the type of engine in each aircraft, and the mode of operation for each type of aircraft engine. Aircraft emit the following CAA criteria pollutants: volatile organic compounds (VOC), nitrogen oxides (NOx), CO, SO_2 and $PM_{10.}$ Emissions occurring above 3,000 feet are considered to be above the atmospheric inversion layer and, therefore, without impact on local air quality. Aircraft flights, for the most part, originate from onshore air stations (*e.g.*, Naval Air Station Joint Reserve Base [NASJRB] New Orleans, NAS Meridian, NAS Kingsville), but some originate from aircraft carriers offshore during major exercises (*i.e.*, Joint Task Force Exercises [JTFEX] and Carrier Strike Group Composite Training Unit Exercises [CSG COMPTUEX]). It was assumed that fixed wing aircraft would be traveling from their home air station or carrier to the GOMEX offshore SUA at an elevation above 3,000 feet, and that transit to and from these warning areas would not affect local air quality. The vast majority of aircraft emissions in the SUA above the GOMEX OPAREAs occur above 3,000 feet. Such high-altitude aircraft emissions are associated with training events such as BOMBEX (Air-to-Surface), Chaff and Flare Exercises, and Mission Area Flight Training.

Aircraft operating in the GOMEX Range Complex offshore SUA generally have jet engines. Most of these aircraft use JP-5 (Navy) or JP-8 (Air Force) as a standard fuel. Emissions of concern are primarily hydrocarbons that disperse readily in the atmosphere. A portion of those emissions may be VOCs, which are associated with the generation of ground level ozone. However, the volume of aircraft operations in the GOMEX Range Complex offshore SUA is relatively small in comparison to the vast expanse of SUA, and adjacent land areas are in attainment for O_3 levels.

[41] For example, if 8 ships participate in major exercises, a total of 22.5 steaming annual days is estimated per ship.

Emissions from Weapons and Explosives

Other common chemical emissions associated with Navy training are explosive compounds and oxidation products. For example, MK3A2 grenades are dropped under water in small arms training in the Corpus Christi UNDET Area E3. The MK3A2 grenade contains 8 ounces of trinitrotoluene (TNT) filler. EOD Mine Neutralization training utilizes C4 explosives. Oxides of carbon, nitrogen and water are formed during the explosive process, thus reducing the likelihood of parent chemicals (TNT and cyclonite [RDX]) entering surrounding environments. Other nitroaromatic compounds such as octogen (HMX), tetryl, and picric acid (used in fuzes and primers) produce the same reactions.

Practice ordnance does not carry an explosive charge; it carries only a smoke or marking charge, and thus, the incidence of emission particles is negligible. The detonation of the marking charge or of the explosive bomb consumes approximately 98 to 99 percent of the explosive filler. The one to two percent of explosive filler not consumed is generally dispersed, with most falling to the water in the immediate vicinity of the splash point and the balance being dispersed in the air subject to wind currents and weather conditions.

Many of the smokes and fumes given off by pyrotechnics and screening devices are considered nontoxic and only mildly irritating to the eyes and nasal passages when encountered in relatively light concentrations. Heavy concentrations in closely confined spaces, however, are dangerous and may be lethal because they reduce the amount of oxygen in the air (NAVSEA, 1996). Because smoke floats and flares are used infrequently and at great distances from land during at–sea training events, associated air emissions would be considered non-toxic to residents in the GOMEX Range Complex.

Underwater detonations associated with EOD Mine Neutralization training utilize C4, which consists of RDX plus a small amount of polyisobutylene binder. The principle explosive byproducts are water, carbon dioxide, carbon monoxide, nitrogen, and hydrogen. Like other underwater explosions, it creates a cavity filled with high-pressure gas, which pushes the water out radially against the opposing external hydrostatic pressure. At the instant of explosion, a certain amount of gas is instantaneously generated at high pressure and temperature, creating a bubble. In addition, the heat causes a certain amount of water to vaporize, adding to the volume of the bubble. This action immediately begins to force the water in contact with the blast front in an outward direction. It is estimated that 90 percent of the gaseous explosion products would become airborne (DoN, 2001). Airborne explosion products are assumed to stabilize in a spherical form and move downwind, with concentrations remaining for the first 30 m (100 feet). This “cloud” would not be visible. Then, the airborne cloud would continue to move at the speed of the wind and become diluted and dispersed by atmospheric turbulence (DoN, 2001).

The air quality impacts of chaff were evaluated by the Air Force in “Environmental Effects of Self-Protection Chaff and Flares” (USAF, 1997). The study concluded that most chaff fibers maintain their integrity after ejection. Although some fibers are likely to fracture during ejection, it appears this does not result in the release of particulate matter. Although not significant, tests indicated that the explosive charge in the impulse cartridge results in minimal releases of particulate matter.

Summary of Emissions in OPAREAS and Assoicated SUA

Under the No Action Alternative, OPAREA emissions would be insignificant, consisting of minor boat and ship emissions over few steaming days (180) per year. Aircraft emissions within the offshore SUA would be primarily above the atmospheric mixing layer, thus minimizing impact to regional air quality. Ordnance related emissions within the OPAREA would also be insignificant, consisting of short-lived smoke float and flare emissions.

The offshore reaches of the GOMEX OPAREAs (beyond 12 nm) are not classifiable for priority pollutants under the Clean Air Act. Therefore, the Clean Air Act General Conformity Review is not

applicable. Initial concentrations of air emissions over the ocean would disperse rapidly in the atmosphere. Because of the low initial concentrations and rapid dispersion of exhaust and explosion byproducts, there would not be any risk to human health. Therefore, there would be no significant harm to air quality in non-territorial waters from implementing the No Action Alternative. Emissions from aircraft, surface vessels and ordnance would cause no significant impact to air quality under the No Action Alternative.

McMullen County and Noxubee County Ranges

Aircraft operating in the SUA above the McMullen County Range (*i.e.*, T-45s, T-38s, F-15 and F-16) and the Noxubee County Range (*i.e.*, AT-38s and T-45s) use JP-5 (Navy) or JP-8 (Air Force) fuel as a standard fuel. Emissions of concern are primarily hydrocarbons that disperse readily in the atmosphere. A portion of those emissions may be VOCs, which are associated with the generation of ground level ozone. However, the volume of aircraft operations in the over land SUA is relatively small and adjacent areas are in attainment for O_3 levels. Furthermore, nearly all time spent in the sorties flown here during training is spent above the mixing layer. Only a brief time is spent below the mixing layer during the actual bombing or gunfire release.

Another potential stressor to air quality from bombing operations at the McMullen County Range and Noxubee County Range would be from the release of bomb constituents. High explosive ordnance is not permitted at either range. Bombs used at the McMullen County Range and Noxubee County Range are NEPM with a small spotting charge attached to the bomb. The spotting charge is a small smoke charge activated by a mechanical fuze when the bomb hits the ground to readily see where the bomb hits the target for scoring purposes. Detonation of the spotting charge consumes approximately 98 to 99 percent of the explosive component (DoN, 2002). The 1 or 2 percent of explosive component not consumed is generally dispersed, with most falling to the soil in the immediate vicinity of the impact and the balance being dispersed in the air subject to wind currents and weather conditions. At some times of the year, the spotting charge may not be used. Depending on the burn index, the use of the MK-4 signal charge may be restricted (NAVFAC SE, 2007).

In addition to by-products of the spotting charge, the impact of NEPM disturbs particulate matter in the form of organics, dust, and sand resulting in short-term clouds of particulate matter. Depending on the size and mass of the particulate matter and local wind conditions, it either settles out in the immediate vicinity or may be carried an unknown distance.

Air impacts from prescribed burns and wildfires in the vicinity of the McMullen County Range would remain consistent with current levels under the No Action Alternative. Brush fires, including prescribed fires and wildfire, may result in temporary air pollution in the region. The major pollutants for brush fires are particulate, carbon monoxide and volatile organic compounds. The amount of air pollution that results from any brush fire can be highly variable.

Aircraft operations in the SUA immediately over the GOMEX Range Complex land ranges are relatively light and adjacent areas are in attainment for O_3 levels. Nearly all time spent in the sorties flown in SUA over land ranges is spent above the mixing layer. Based on the near complete consumption of spotting charge constituents and dispersion of smoke within the target area, ordnance dropped at the McMullen County Range and Noxubee County Range imposes a short-term insignificant impact on air quality. Therefore, emissions related to aircraft training activities at the McMullen County Range and Noxubee County Range are not anticipated to have a negative impact on the Study Area environment. Emissions from aircraft and ordnance use at the GOMEX Range Complex land ranges would cause no significant impact to air quality under the No Action Alternative.

NSA Panama City Demolition Pond Area

Air emissions associated with Navy training at the NSA Panama City Demolition Pond are the byproducts of detonation materials. For example, the byproducts of TNT, in descending order of concentration are: carbon dioxide, carbon monoxide, nitrogen, water, ethane, propane, ammonia, methane, hydrogen, hydrogen cyanide, methyl alcohol, formaldehyde, nitrogen oxide, and carbon solid. The first four of these byproducts account for nearly all the gaseous byproducts of the detonation (O'Keefe and Young, 1984).

The percentage of explosion gases released to the atmosphere during an underwater detonation varies based on the reduced depth, which is a function of the depth of the explosion and the type and weight of explosive (see Table 3.4-2). Most Demolition Pond charges are detonated between 5 and 7 feet below the water surface. Therefore, at least 80 percent of the gaseous byproducts are released to the atmosphere.

TABLE 3.4-2
ESTIMATED AMOUNTS OF EXPLOSION GASES THAT ESCAPE TO THE ATMOSPHERE

Reduced Depth (ft)	Estimated Amount of Product Gases that Escape to the Atmosphere (%)
0.2 to 1	Almost All
1 to 4	90 %
4 to 7	>80 %
7 to 25	>50 %
25 to 40	<50 %
Greater than 40	Negligible Amount
Source: O'Keefe and Young 1984	

Given the small charge sizes, relatively infrequent detonations, and byproducts proportions, no significant impacts to air quality are expected under the No Action Alternative at the NSA Panama City Demolition Pond.

Military Operating Areas

The vast expanse of the GOMEX Range Complex includes a number of large MOAs in Florida, Alabama, Mississippi and Texas. The overland MOA areas are blocks of airspace used for basic flight instruction and mission area flight training. Thousands of sorties are flown in these MOAs every year by a variety of aircraft types. Emissions of concern are primarily hydrocarbons that disperse readily in the atmosphere. A portion of those emissions may be VOCs, which are associated with the generation of ground level ozone. However, from an air quality perspective, these flights do not have an impact on local air quality due to the altitude that such training takes place. The floors of the MOAs range from 7,000 feet to 13,000 feet in some cases. The floor of the MOA is the lowest altitude that flight training would take place within these MOAs. Emissions occurring or that would occur above 3,000 feet are considered to be above the atmospheric inversion layer and are, therefore, without impact on the local air quality. Defensive flares used within the Brownwood MOAs by USAF and USMC aircraft are released at high altitude (above 7,000 feet); and therefore are not expected to have an impact on overland air quality. Magnesium flare pellets typically burn for a short period of time (less than 10 seconds).

USAF research on chaff and flares indicates that chaff fracture and impulse cartridge charges release minimal particulate matter. Therefore, chaff deployment would not result in an exceedance of the NAAQS. Chaff Exercises in the GOMEX Range Complex are conducted relatively infrequently, and are typically conducted beyond 12 nm from shore (with the exception of high altitude USAF and USMC chaff release within the Brownwood MOAs). These facts further reduce any potential for impacts to

NAAQS. Air quality impacts within the overland MOAs are expected to be minimal because these events occur at over 3,000-foot altitude (above the mixing layer). Emissions from aircraft and chaff ordnance use within the MOAs would cause no significant impact to air quality under the No Action Alternative.

3.4.3.2 Alternative 1

Under Alternative 1 there would be minor increases in air pollutants associated with fixed wing aircraft sorties within the Study Area (*i.e.*, BOMBEX [A-S] and GUNEX [A-S]). Some events conducted within the Study Area would not increase under Alternative 1 (*e.g.*, MIW training, FIREX, BOMBEX [A-G], GUNEX [A-G], Air Intercept Control, Chaff and Flare exercises) and thus no increase in emissions would be expected from these events. Helicopter sorties and associated emissions within the Study Area would decrease under Alternative 1. As shown in Table 2.2-7, there is no anticipated change in vessel steaming days from current use to future use under Alternative 1, and therefore little to no change in surface vessel emissions.

Aircraft emissions under Alternative 1 would increase due to BOMBEX [A-S] and GUNEX [A-S] training (approximately 100 additional sorties above baseline levels). Air quality impacts, however, are expected to be minimal because these events typically occur at least 12 nm from shore and over 3,000-foot altitude (above the mixing layer).

The CAA General Conformity Rules do not apply to the proposed Navy actions conducted within the Study Area, as all Study Area counties are designated in attainment for all criteria pollutants. The air quality impacts from Navy training and RDT&E operations would be primarily from aircraft emissions. These impacts would be minor, dispersed, and short-term in nature. Most of these training events take place above 3,000 feet. Air emissions above 3,000 feet are not addressed in accordance with USEPA guidance (USEPA, 1992). Many of the training events also occur beyond 12 nm from shore, which substantially reduces the likelihood that any of the associated emissions would mix with over land airsheds.

Therefore, the actions considered under Alternative 1 are not likely to significantly impact the existing air quality of the GOMEX EIS/OEIS Study Area. Furthermore, the actions considered under Alternative 1 are not likely to significantly harm the existing air quality of the GOMEX EIS/OEIS Study Area.

3.4.3.3 Alternative 2 (Preferred Alternative)

Under Alternative 2 there would be minor increases over No Action levels in air pollutants associated with fixed wing aircraft sorties within the Study Area (*i.e.*, BOMBEX [A-S] and GUNEX [A-S]). Some events conducted within the Study Area would not increase under Alternative 1 (*e.g.*, MIW training, FIREX, BOMBEX [A-G], GUNEX [A-G], Air Intercept Control, Chaff and Flare exercises) and thus no increase in emissions would be expected from these events. Helicopter sorties and associated emissions within the Study Area would decrease under Alternative 2. As shown in Table 2.2-7, there is no anticipated change in vessel steaming days from current use to future use under Alternative 2, and therefore little to no change in surface vessel emissions.

Aircraft emissions under Alternative 2 would increase due to BOMBEX [A-S] and GUNEX [A-S] training (approximately 100 additional sorties above baseline levels). Air quality impacts, however, are expected to be minimal because these events typically occur at least 12 nm from shore and at over 3,000-foot altitude (above the mixing layer). Under Alternative 2, there would be a decrease in emissions associated with explosive ordnance used during BOMBEX (A-S) training.

The air quality impacts from Alternative 2 operations would be primarily from aircraft emissions. These impacts would be minor, dispersed, and short-term in nature. As shown in Table 3.4-1, many proposed events take place beyond the U.S. territorial waters, and associated emissions would not affect air quality ashore. Aircraft sorties overland under Alternative 2 would continue to occur at baseline levels and above the mixing layer with no impact to regional air quality.

In conclusion, the actions evaluated under Alternative 2 generally take place either:

(i) within areas designated in attainment (Florida, Mississippi, Alabama, Louisiana, and Texas) for all criteria pollutants, and therefore the CAA General Conformity Rule does not apply; or

(ii) within offshore areas unclassified for priority pollutants, where surface ship emissions are minimal and fixed wing aircraft typically produce emissions above the mixing layer.

Therefore, there would be no significant impact to air quality from implementing Alternative 2. Furthermore, there would be no significant harm to the air quality over non-territorial waters from implementing Alternative 2.

3.4.4 Unavoidable Significant Environmental Effects

Under either proposed action alternative, participation of additional aircraft in Navy training within the GOMEX Range Complex would result in minor, short-term effects, such as minor increases of aircraft air emissions within the airsheds, but would have no unavoidable significant environmental effects.

3.4.5 Summary of Environmental Effects (NEPA and EO 12114)

Emissions associated with implementation of Alternatives 1 and 2 would result in minor increases in air emissions above baseline (No Action Alternative) conditions. Within U.S. Territory, no increase in emissions is expected as proposed training within U.S. Territory is not expected to increase. Outside U.S. Territory, emission increases are associated with contributions from aircraft operations. In conclusion, although Alternatives 1 and 2 would result in increases in emissions of air pollutants, all air impacts would be less than significant in scope and intensity for the following reasons:

- All training and RDT&E events analyzed in this GOMEX EIS/OEIS occur within areas designated by the USEPA as being in attainment for all criteria pollutants. Therefore, the General Conformity Rule does not apply.
- The proposed training event types and the training event operations/sorties occur more than 12 nm from the shore and would not affect air quality for ashore. Furthermore, the majority of aircraft training emissions occur above 3,000 feet (above the atmospheric inversion layer), and would have no impact on local air quality or that above non-territorial waters.

As shown in Table 3.4-3, implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant adverse impacts to regional air quality. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to the air quality above non-territorial waters.

TABLE 3.4-3
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON AIR QUALITY IN THE GOMEX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Surface ship Emissions	Minor localized emissions. Study Area counties are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Fixed wing aircraft emissions	Minor localized emissions. Study Area counties are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Weapon and target emissions	Negligible effects.	Negligible harm to air quality.
Impact Conclusion	No significant impacts to Study Area air quality.	No significant harm to Study Area air quality.
Alternative 1		
Surface ship Emissions	Minor localized emissions. Study Area counties are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Fixed wing aircraft emissions	Minor localized emissions. Study Area counties are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Weapon and target emissions	Negligible effects.	Negligible harm to air quality.
Impact Conclusion	No significant impacts to Study Area air quality.	No significant harm to Study Area air quality.
Alternative 2		
Surface ship Emissions	Minor localized emissions. Study Area counties are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Fixed wing aircraft emissions	Minor localized emissions. Study Area counties are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Weapon and target emissions	Negligible effects. Study Area counties are in attainment for all criteria pollutants.	Negligible harm to air quality.
Impact Conclusion	No significant impacts to Study Area air quality.	No significant harm to Study Area air quality.

3.5 AIRBORNE NOISE

3.5.1 Introduction and Methods

Sound is a physical phenomenon and a form of energy that can be described, measured, and represented with mathematical expressions. Noise, on the other hand, is not a physical process, but rather an implicit social value, defined generally as unwanted sound. Recognition of sound is based on the receptor's objective and reproducible response to sound's primary physical attributes: intensity (perceived by the receptor as loudness), frequency (perceived as pitch), frequency distribution and variation over time, and duration (whether continuous, sporadic, or impulse). Perception of sound, however, is subjective and circumstantial. Sounds that are soothing to some are annoying to others, and sounds barely noticed and generally ignored in one circumstance, may be considered highly objectionable in another circumstance.

Beyond subjective effects, however, sound at higher intensities or power levels can have physical consequences. The range of such impacts have been defined as falling into three categories as sound pressure levels increase: subjective effects (*e.g.*, annoyance, nuisance, dissatisfaction), interferences with activities (*e.g.*, communication, sleep, learning, behavioral changes), and physiological effects (*e.g.*, anxiety, hearing impacts, loss of hearing).

Sound Fundamentals

Sound is typically described by its magnitude (otherwise referred to as amplitude), intensity, and frequency and the changes in those values over time (*e.g.*, sudden impulse vs. continuous vs. repetitive). The physical phenomenon of sound is generated by mechanical vibrations traveling through an elastic medium (*i.e.*, air or water), resulting in a rapid change in pressure (high and low pressure fluctuations or waves) in the medium.

Sound waves are characterized by parameters such as amplitude, intensity, wavelength, frequency, and velocity. The amount of energy contained in a sound pressure wave is referred to as its amplitude, while the amount of energy passing through a unit area per unit of time is the sound wave's intensity. The units of sound intensity are watts per square meter (energy per unit of time per unit of area). Amplitude and intensity are directly and linearly related. Higher amplitude sounds are perceived to be louder than lower amplitude sounds. Sound pressures are usually represented in Pascals (Pa). A Pa is equal to one Newton of force distributed over one square meter. The maximum noise pressure level of a noise event is referred to as the "peak noise level."

The frequency of sound represents the rate at which the source produces sound waves (a complete cycle of high and low pressure waves) or the rate at which the sound-producing body completes one vibration cycle. Frequency is a precisely measurable quantity representative of a particular sound. Sounds are produced throughout a wide range of frequencies, including frequencies beyond the audible range of a given receptor. Most of the sounds heard in the environment do not consist of a single frequency, but rather a broad band of frequencies differing in sound level. The intensities of each frequency add to generate perceptible sound.

The speed of sound is not affected by its intensity, amplitude, or frequency, but rather is dependent wholly on the characteristics of the medium through which it is passing. Sound generally travels faster as the density of the medium increases. Speeds of sound through air are primarily influenced by air temperature, and negligibly by the air's relative humidity and pressure, averaging about 1,115 feet per second (ft/s) (340 meters per second [m/s]) at standard barometric pressure. Sound speeds in air increase as air temperature increases. Speed of sounds in liquid is similarly influenced primarily by the liquid's density and temperature. Thus, the speed of sound in 32ºF water is 4,600 ft/s and in 68ºF water is 4,862 ft/s.

The mathematical relationship between sound stimulus and sound perception by a receptor is logarithmic. This logarithmic relationship between magnitude and perception is the basis for the decibel (dB) scale used to express sound intensity. The decibel scale measures relative sound intensities rather than absolute intensities; specifically, it measures the ratio of a given intensity (of sound) to the threshold sound intensity of human hearing (by definition 0 dB). For most humans, a sound wave pressure of 20 micro Pascals (μPa) represents the hearing threshold. As sound stimuli increase geometrically (*i.e.*, multiplied by a fixed factor), the corresponding perception changes arithmetically (*i.e.*, additive by constant amounts). Thus, a tenfold increase in sound stimulus over the threshold of hearing is assigned a value of 10 dB but is perceived as a doubling of loudness; a hundredfold increase to 20 dB is perceived as sound four times louder, and so forth.

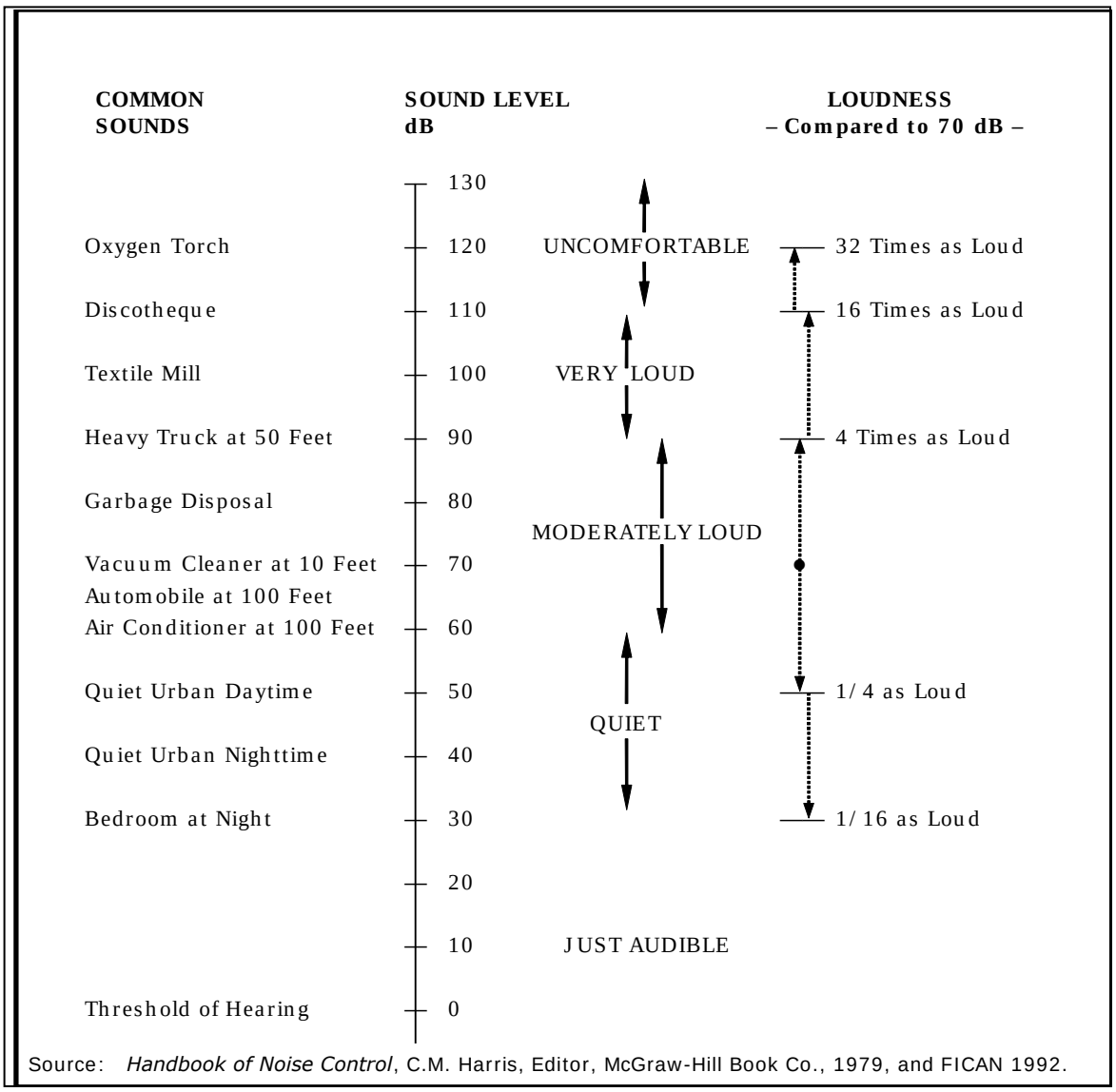
Although sound is a physical phenomenon that can be represented by mathematical expressions and measured with precision, perception of sound pressure levels (SPL) is the result of physiological responses as well as subjective factors, each influenced by current circumstances and past exposures. The SPL is the perception of a sound wave's pressure by a single receptor at a specified distance and direction from the sound source.

SPLs are measured by sound level meters, which typically contain filters that reduce the meter's sensitivity to frequencies of little or no relevance to the receptor. The method commonly used to quantify environmental sounds consists of determining all frequencies according to a weighting system that reflects the nonlinear response characteristics of the human ear. A meter that filters very low and very high frequency sounds thus acts as a general approximation of the human ear's response to sounds of medium intensity. This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (dBA). In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve.

Sound meters also can be used to measure loud high- and middle-frequency sound (B-weighted), very loud low-frequency sound (C-weighted), very loud sounds associated with aircraft (D-weighted), and infrasound (<20 hertz [Hz]), or low-frequency sound including frequencies below the lower limit of human auditory response (10 to 200 Hz (G-weighted)). Infrasound propagates farther than sound of higher frequencies, and typically is perceived not only as sound, but as tactile sensation such as vibration.

A closely related value to the SPL is the sound power level, expressed as PWL or LW. The sound power level represents the total sound power emanating from a source in all directions. While each individual receptor is experiencing the sound's pressure level, the overall impact of a sound source on the environment is properly represented by the sound power level because, in most circumstances and discounting the effects of reflection and absorption, sound waves propagate spherically from a point source to impact many receptors at different pressure levels, depending on their distance from the source.

A common method of describing SPLs is by comparing commonly experienced sounds. Typical sound sources and their corresponding environments are listed below in Figure 3.5-1. The sound levels indicated are for single events. Such events are discrete, and two or more events cannot simply be added together. Integrating varying noise levels and sources over a given period requires complex calculations or modeling.



Source: *Handbook of Noise Control*, C.M. Harris, Editor, McGraw-Hill Book Co., 1979, and FICAN 1992.

Figure 3.5-1 Sound Levels of Typical Airborne Noise Sources and Environments

To describe the time-varying character of environmental noise, the statistical noise descriptors L_{10}, L_{50}, and L_{90} are commonly used. They are the noise levels equaled or exceeded during 10 percent, 50 percent, and 90 percent of a stated period, respectively. L_{10} values reflect transient or short-term events, while L_{90} values describe the most prevalent noise conditions. The acoustic range of the noise source is determined by measuring the maximum (L_{max}) and minimum (L_{min}) sound levels. The L_{min} value obtained for a particular monitoring location is the "acoustic floor" for that location.

A sound measure employed by federal agencies is known as the Day-Night Average Sound Level (L_{dn}). The L_{dn} is defined as the A-weighted average sound level for a 24-hour day. It is a calculated noise metric derived from measurements, but includes a 10-dB penalty for late-night (*i.e.*, 10:00 p.m. to 7:00 a.m.) sound levels. This penalty accounts for the increased sensitivity of humans to noise at night.

Sound Propagation

Understanding the impact of sound on a receptor requires a basic understanding of how sound propagates from its source. Sound propagation follows the inverse square law: the intensity of a sound wave deceases inversely with the square of the distance between the source and the receptor. Thus, doubling the distance between the receptor and a sound source results in a reduction in the intensity of the sound of one fourth of its initial value; tripling the distance results in one ninth of the original intensity, and so on. In spherical propagation, sound pressure levels drop an average of 6 dB for every doubling of distance from the source.

Measuring Public Annoyance

Public annoyance is often the most common effect associated with exposure to elevated noise levels; thus, in-air noise is most applicable to activities occurring over U.S. territorial waters or over land. When subjected to day-night average sound level (L_{dn}) of 65 dBA, approximately 12 percent of persons so exposed will be "highly annoyed" by the noise. At levels below 55 dBA, the percentage of annoyance is correspondingly lower (less than 3%). The percentage of people annoyed by noise never drops to zero, but at levels below 55 dBA, it is reduced enough to be essentially negligible (Finegold *et. al.*, 1994).

The Navy has adopted criteria that integrate land use guidelines with predictions of percentages of the population that would be "highly annoyed" when exposed to given L_{dn}. These sound levels have been categorized into "noise zones," and are shown in Table 3.5-1. It is desirable that Noise Zone 1 criteria not be exceeded (DoN, 2002).

TABLE 3.5-1
NOISE ZONES AND CORRESPONDING POPULATION ANNOYANCE

Noise Zone	Noise Type/Criteria L_{dn} / L_{dnmr}	Percentage Population "Highly Annoyed"
1	65	<15 %
2	65-74	15-39 %
3	75 for greater	>39 %
34 L_{dn} = day-night average sound level; L_{dnmr} = onset-rate adjusted monthly day-night average sound level Source: : USAF, 2001 *citing* Finegold *et al.*, 1994.		

Regulatory Framework

The Navy meets its noise management obligations at air-to-ground training ranges (*i.e.*, on-land targets) through the Range Air Installations Compatible Use Zones (RAICUZ) program. RAICUZ program implementation includes developing current and future Range Compatibility Zones (RCZ) and current and prospective noise analysis for the range, partnering with appropriate federal, state, and local government agencies (working with these agencies for compatible land use near and around the ranges), considering operational alternatives as necessary, implementing a complaint response program in the surrounding communities, and developing strategies to protect the long term viability of the range while maintaining a high degree of public safety (DoN, 2008a). According to Appendix C of OPNAVINST 3550.1A, the only air-to-ground ranges within the GOMEX Range Complex, wherein the RAICUZ program requirements must be implemented are the McMullen County Range and the Noxubee County Range (DoN, 2008a). The RAICUZ studies for the McMullen County Range and the Noxubee County Range are discussed further in Section 3.5.4.2.

The RAICUZ program is inapplicable to the offshore GOMEX OPAREAs. The GOMEX OPAREAs are distant from any noise receptors and no recurring noise studies are required for these vast ocean areas.

The DoD has a similar program for air stations, called the Air Installations Compatible Use Zones (AICUZ) program (DoN, 2008c). The foundation of the AICUZ program is an active local command effort to work with local, state, regional, other federal agencies, and community leaders to encourage compatible development of land adjacent to military airfields. The Navy is particularly susceptible to such encroachment with many of its installations located in high growth urban areas. The AICUZ process involves four basic steps:

1. Develop, and periodically update, a study for each air installation to quantify aircraft noise zones and identify accident potential zones; develop a noise reduction strategy for impacted lands, both on and off the installation; prepare a compatible land use plan for the installation and surrounding areas; and develop a strategy to promote compatible development on land within these areas.
2. Develop a prospective long-term (5 to 10 years) AICUZ analysis to illustrate impact on known future missions and how it will be implemented by the AICUZ program.
3. Implement the AICUZ plan for the installation including coordination with federal, state and local officials to maintain public awareness of AICUZ.
4. Identify and program property rights acquisition and sound suppression projects when appropriate in critical areas, where action to achieve compatibility within AICUZ program guidelines through local land use controls is either impossible or has been attempted and proven unsuccessful.

The Navy's AICUZ Instruction lists numerous air stations in the Gulf of Mexico region with AICUZ Programs. These include: NAS Meridian; Outlying Landing Field (OLF) Joe Williams; NAS Kingsville; Auxiliary landing Field (ALF) Orange Grove; NAS Corpus Christi; ALF Waldron; ALF Cabaniss; NAS Whiting Field; Navy Outlying Field (NOLF) Brewton; NOLF Holley; NOLF Evergreen; NOLF Santa Rosa; NOLF Spencer; NOLF Choctaw; NOLF Saufley; NOLF Wolf; NOLF Site 8; NOLF Barin; NOLF Pace; NOLF Harold; NOLF Silverhill; NOLF Summerdale; NAS Pensacola; NASJRB Fort Worth; NASJRB New Orleans. These AICUZ programs are mentioned here due to their proximity to the Complex, and because the aircraft may utilize the complex airspace from time to time. The installations themselves are not part of the GOMEX Range Complex Study Area and are not further analyzed in this Final EIS/OEIS.

3.5.1.1 Assessment Methods and Data Used

The method used in this Final EIS/OEIS to assess noise impacts associated with existing and proposed Navy training and testing within the GOMEX Range Complex includes following the below steps:

- Analyze existing federal noise management regulations applicable to the proposed action;
- Consider existing Navy policies affecting noise production levels (*e.g.*, the RAICUZ Program and range Standard Operating Procedures);
- Analyze the natural ambient or background noise levels in the range complex;
- Analyze the various types of noise sources associated with training and testing within the GOMEX Range Complex (*e.g.*, continuous versus impulsive noises);
- Review existing noise studies performed in connection with previous relevant Navy NEPA documentation;
- Determine the noise impacts associated with existing Navy training and testing within the range complex given the regulatory/procedural framework and sensitive receptor locations; and
- Determine the noise impacts associated with the proposed Navy training and testing within the range complex given the regulatory/procedural framework and sensitive receptor locations.

The analysis presented in this section is limited to impacts of airborne sound on humans. The impacts of military-generated noise (including underwater noise) on natural resources are addressed in

Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), 3.9 (Fish), and 3.10 (Seabirds and Migratory Birds). Impacts on terrestrial biological resources are addressed in Section 3.11.

3.5.1.2 Warfare Areas and Associated Noise Stressors

Table 3.5-2 lists the various training events that occur within the GOMEX Range Complex and the noise sources. For context, the general noise location is also listed (*e.g.*, distance from shore-based receptors, and altitude).

TABLE 3.5-2
WARFARE AREAS AND ASSOCIATED NOISE STRESSORS

		Stressors			Location			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Surface Vessel Noise**	**Aircraft Noise**	**Ordnance Noise**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**	**Below 3,000 ft Altitude**	**Above 3,000 ft Altitude**
Mine Warfare (MIW)								
Mine Countermeasures (MCM) – Airborne	Corpus Christi and Panama City OPAREAs		✓	✓	✓	✓	✓	
MCM-Surface	Corpus Christi and Panama City OPAREAs	✓		✓	✓	✓	✓	
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi and Panama City OPAREAs	✓		✓	✓	✓	✓	
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi and Panama City OPAREAs	✓		✓	✓	✓	✓	
Surface Warfare (SUW)								
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓		✓		✓
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B		✓	✓		✓		✓
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓			✓		✓
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓		✓		✓	✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Panama City OPAREA	✓		✓	✓		✓	

TABLE 3.5-2 (Continued)
WARFARE AREAS AND ASSOCIATED NOISE STRESSORS

		Stressors			Location			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Surface Vessel Noise**	**Aircraft Noise**	**Ordnance Noise**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**	**Below 3,000 ft Altitude**	**Above 3,000 ft Altitude**
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Corpus Christi UNDET Area E3	✓		✓	✓		✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓			✓	✓	✓	
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓		✓	✓	✓	
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓		✓	✓			
Air Warfare (AW)								
Air Intercept Control (AIC)	W-151; W-155		✓			✓		✓
Strike Warfare (STW)								
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓	✓	✓		✓	✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓	✓	✓		✓	✓
Amphibious Warfare (AMW)								
Firing Exercise (FIREX) with IMPASS	W-151A/B; W-155A	✓		✓		✓	✓	
Electronic Combat (EC)								
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓	✓		✓		✓
Chaff Exercises (CHAFFEX)	Brownwood MOAs		✓		✓			✓
Flare Exercises (FLAREX)	W-155A/B		✓	✓		✓		✓
Flare Exercises (FLAREX)	Brownwood MOAs		✓	✓	✓			✓
Mission Area Training								
Mission Area Flight Training	W-92; W-54; Brownwood MOAs		✓	✓	✓	✓		✓

TABLE 3.5-2 (Continued)
WARFARE AREAS AND ASSOCIATED NOISE STRESSORS

		Stressors			Location			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Surface Vessel Noise**	**Aircraft Noise**	**Ordnance Noise**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**	**Below 3,000 ft Altitude**	**Above 3,000 ft Altitude**
Basic Flight Instruction	W-228; R-4404; Meridian, Pine Hill, Pensacola, Kingsville MOAs; R-2908; R-6312		✓		✓	✓		✓
Salvage Diver Training	NSA Panama City Demolition Pond			✓	✓		✓	
Underwater Demolitions	NSA Panama City Demolition Pond			✓	✓		✓	
Security Force Training	NSA Panama City Demolition Pond			✓	✓		✓	
Diver Training	NSA Panama City Demolition Pond			✓	✓		✓	

3.5.2 Affected Environment

Various activities and processes, both natural and anthropogenic, contribute to the sound profile of the ocean environment. This Airborne Noise section focuses on sound above the water's surface and its potential impacts to human receptors. Section 3.5.2.1 describes the affected sound environment offshore, while Section 3.5.2.2 and Section 3.5.2.3 describes the affected sound environment nearshore and overland. Later sections of this Final EIS/OEIS describe the potential impacts of underwater sound on human divers and marine species.

3.5.2.1 GOMEX OPAREAS and Associated Special Use Airspace

Ambient Sound in the Ocean Environment

Except for sounds generated by some marine mammals, most natural ocean sound is broadband (composed of a spectrum of numerous frequencies without a differentiating pitch) (MMS, 2007). Virtually the entire frequency spectrum is represented by ambient sound sources. Earthquakes and explosions produce sound signals from 1 Hz to 100 Hz; marine species can produce signals from 100 to more than 10,000 Hz; and commercial shipping, industrial activities, and naval ships have signals between 10 and 10,000 Hz (Office of Marine Programs [OMP] of the University of Rhode Island, 2006). Spray and bubbles associated with breaking waves are the major contributions to the ambient sound in the 500 to 100,000 Hz range (OMP, 2006). At frequencies greater than 100,000 Hz, "thermal noise" caused by the random motion of water molecules is the primary source. Ambient

sources, especially from wave and tidal action, can cause coastal environments to have particularly high ambient sound levels.

Other factors, such as water depth, can affect ambient sound levels. Because waves break in the shallow waters of the nearshore environment, contributions from these sources generally predominate in such locations. In general, ambient airborne sound levels tend to be greatest in relatively shallow nearshore environments and appear to be directly related to wind speeds and indirectly related to sea-state (Willie and Geyer, 1984).

While the above sources represent relatively continuous contributions to ambient sound in the ocean environment, intermittent sources such as lightning strikes, underwater volcanoes, earthquakes, and hydrothermal eruptions can also represent major contributions. The impacts of these intermittent events can be substantial. For example, lightning striking the surface of the water can have sound power levels of as much as 260 dB underwater at 1-m, and heavy rain can add as much as 35 dB over a broad frequency range (OMP, 2006).

Intermittent airborne noise sources in the GOMEX OPAREAs also include those from man-made sources. In addition to sound from shipping, other manmade sources of airborne noise include military, general aviation, and commercial aircraft; dredging; nearshore construction activities; military explosive use; oil and gas exploration and extraction; mineral exploration and extraction; and geophysical surveys.

Sound from Military Sources

Airborne noise attributable to military activities in the GOMEX OPAREAS (Corpus Christi, New Orleans, Pensacola, and Panama City OPAREAs) emanates from multiple sources including naval ship power plants, military aircraft, surface or airborne targets or support aircraft, gunfire, bomb explosions (HE), bomb splashes (NEPM), small arms, and underwater detonations. Noise from military sources in the GOMEX Range Complex is virtually all transitory, and can be widely dispersed or concentrated in small areas for varying periods.

Military Aircraft

Aircraft flying through the GOMEX Range Complex warning areas contribute sound to the ocean environment. Motors, propellers, or rotors provide the major contributions, while aerodynamic turbulence also can contribute. As with most manmade sounds, most aircraft sounds involve low frequencies. The angle of incidence of a sound wave propagating from an aircraft must enter the water at an angle of incidence of 13º from the vertical or less for the wave to continue propagating under the water's surface. At greater angles of incidence, the water surface acts as an effective reflector of the sound wave and very little penetration of the wave below the water occurs (Urick, 1972). Military activities involving aircraft generally are dispersed over large expanses of the open ocean, but can be highly concentrated in time and location near aircraft carriers during major training events (*e.g.*, Composite Training Unit Exercises and Joint Task Force Exercises). According to a 2002 Air Force study, the average noise level from all airspace users in W-151 was measured at 54.6-61.8 L_{dnmr} and in W-155 it was measured at 30 L_{dnmr} (USAF, 2000). Representative airborne sound levels associated with military aircraft are depicted in Table 3.5-3.

TABLE 3.5-3
REPRESENTATIVE AIRCRAFT AND ORDNANCE SOUND SOURCES IN THE GOMEX RANGE COMPLEX

Noise Source	Sound Level (dBA) (*unless otherwise stated*)	Typical Noise Environment
Jet Aircraft under Military Power	144 @ 50 ft.	Pensacola and Panama City OPAREAs at Aircraft Carrier, W-151 and W-155
Jet Aircraft under Afterburner	148 @ 50 ft.	Pensacola and Panama City OPAREAs at Aircraft Carrier, W-151 and W-155
H-60 Helicopter Hovering	90 @ 50 ft. (or 106 in the cockpit)	W-151, W-155 and W-228
Smoke Marker MK-58	60 @ 50 ft.	Pensacola and Panama City OPAREAs
Chaff Packets (Aircraft ALE-37)	90 @ 50 ft.	W-151 and W-155
Aircraft Defensive Flares	65 @ 50 ft.	Pensacola and Panama City OPAREAs, W-151 and W-155
NEPM Bombs 25 lb (e.g., BDU-33 or MK-76), spotting charge	60 @ 50 ft.	McMullen County Range, Noxubee County Range, Pensacola and Panama City OPAREAs
NEPM Bombs 500 lb (e.g., BDU-45) (at impact)	105 @ 50 ft.	McMullen County Range, and Pensacola and Panama City OPAREAs
HE Bombs 500 lb (at impact)* (NEW = 192.2 lbs)	136dBP @ 1,000 ft.	Pensacola OPAREA (BOMBEX Hotbox)
HE Bombs 1,000 lb (at impact)* (NEW = 415.8 lbs)	138dBP @ 1,000 ft.	Pensacola OPAREA (BOMBEX Hotbox)
NEPM Naval Gun Ammunition five in/54	110 @ 50 ft.	Pensacola and Panama City OPAREAs
Cannon Shells 20mm (at source)	105 @ 50 ft.	Pensacola and Panama City OPAREAs
Cannon Shells 25mm (at source)	110 @ 50 ft.	Pensacola and Panama City OPAREAs
7.62mm M60 Machine Gun	155 dBP	Pensacola, Panama City and Corpus Christi OPAREAs
.50 cal Machine Gun	(or 153dBP)	Pensacola, Panama City and Corpus Christi OPAREAs

Notes: 50 feet and 1,000 feet are standard reference distances. BDU - Bomb Dummy Unit; cal - caliber; dBA - decibels, A-weighted; ft - feet; lb - pound; mm - millimeters; NEPM: Non-explosive practice munition; HE: high explosive; dBP (peak sound level).
Source: Investigative Science and Engineering 1997; Ewbank 1977; CDR Solberg 2008; http://chppm-www.apgea.army.mil/HCP/NoiseLevels.aspx.
* Noise levels predicted using U.S. Army Corps of Engineers BNOISE2 Model.

Sonic Boom Noise

Supersonic aircraft flights can occur from time to time in the SUA over the GOMEX OPAREAs. Such supersonic flights are usually limited to altitudes above 30,000 feet (9,100 m) and/or locations more than 30 nm (56 km) from shore (CINCLANTFLT, 1993). Several factors influence sonic booms: weight, size, shape or aircraft or vehicle; altitude; flight paths; and atmospheric conditions. A larger and heavier aircraft must displace more air and create more lift to sustain flight, compared with small, light aircraft. Therefore, larger aircraft create sonic booms that are stronger and louder than those of smaller, lighter aircraft. Consequently, the larger and heavier the aircraft, the stronger the shock waves.

Of all the factors influencing sonic booms, increasing altitude is the most effective method of reducing sonic boom intensity. The width of the boom "carpet" or area exposed to a sonic boom beneath an aircraft is about 1 mile (1.6 km) for each 1,000 feet (300 m) of altitude. For example, an aircraft flying supersonic straight and level at 50,000 feet (15,000 m) can produce a sonic boom carpet about 50 miles (80 km) wide. The sonic boom, however, will not be uniform. Maximum intensity is directly beneath the aircraft, and decreases as the lateral distance from the flight path increases until shock waves refract away from the ground and the sonic boom attenuates. The lateral spreading of the sonic boom depends only on altitude, speed, and the atmosphere, and is independent of the vehicle's shape, size, and weight. The ratio of the aircraft length to maximum cross sectional area also influences the intensity of the sonic boom. The longer and more slender the aircraft, the weaker the shock waves. The wider and more blunt the vehicle, the stronger the shock wave can be.

Sonic booms are generated as aircraft reach Mach 1.0 (speed of sound) and increase in intensity as the Mach number increases. Increasing speeds above Mach 1.3 result in only small changes in shock wave strength. The direction of travel and strength of shock waves are influenced by wind, speed, direction, air temperature, and pressure. At speeds slightly greater than Mach 1.0, the effect of wind, speed, direction, air temperature, and pressure can be influential, but their influence is less at speeds greater than Mach 1.3. Therefore, supersonic flight activity has been characterized for aircraft capable of supersonic flight at a fixed speed of Mach 1.3 and at various altitudes in standard atmospheric conditions.

Ordnance Use

Impulsive noise results from ordnance use within the Panama City and Pensacola OPAREAs. Representative airborne noise levels associated with ordnance are depicted in Table 3.5-3.

Non-Explosive Impact Noise and Impulsive Gunfire Noise

Non-explosive impact noise in the Panama City OPAREA and Pensacola OPAREA is generally from high-velocity "dummy" projectiles, NEPM training bombs, or machine gun fire. Sounds associated with the splash of NEPM training bombs are produced by the kinetic energy transfer of the object with the target surface, and are highly localized to the area of disturbance. Sound associated with the impact event is typically of low frequency (less than 250 Hz) and of a short enough duration (*i.e.*, impulsive sound) that it produces negligible amounts of acoustic energy. These events occur far offshore (>12 nm) and are restricted from the public, so they often go unobserved and unheard. The impacts may be scored by remote observers - participants in the exercise who are at a safe distance from the source. The airborne noise associated with NEPM ordnance (25 lb and 500 lb bombs) is set forth in Table 3.5-3. The airborne noise associated with machine gun fire (7.62 mm and .50 cal) is set forth in Table 3.5-3. As distance from the machine gun approaches the operator, the dB levels increase. Studies indicate that a .50 caliber machine gun produces sound of 160 dBA at the operator; and 7.62 mm machine gunfire produces sound at 155 dBA at the operator position (U.S. Army 1975). These small arms gunfire events occur far offshore (at the Harbor Security Group Machine Gun Area and the Corpus Christi UNDET

Area E3), are cleared of non-participants prior to use, and therefore often go unobserved and unheard by the public.

Explosives

Explosives detonated at the water surface or underwater introduce loud, impulsive, broadband sounds into the marine environment. Table 3.5-3 lists the sound levels associated with representative HE bombs used in the GOMEX Range Complex. The acoustic energy of an explosive is generally greater than that of sonar. The maritime environmental affects of explosives detonated at the water surface or underwater are discussed later in individual EIS/OEIS sections on marine communities, sea turtles, marine mammals, and essential fish habitat. Three source parameters influence the effect of an explosive: the weight of the explosive warhead, the type of explosive material, and the detonation depth. The net explosive weight (NEW) accounts for the first two parameters. The NEW of an explosive is the weight of the explosive material in a given round, referenced to the explosive power of TNT.

The detonation depth of an explosive is important due to a propagation effect known as surface-image interference. For sources located near the sea surface, a distinct interference pattern arises from the coherent sum of the two paths that differ only by a single reflection from the pressure-release surface. As the source depth and/or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface reflection scattering loss). Since the HE bombs used in the Pensacola OPAREA are munitions that detonate essentially upon impact, the effective source depths are quite shallow and therefore the surface-image interference effect can be pronounced. Table 3.5-4 identifies explosive ordnance types used, corresponding NEWs, and expected detonation depths.

TABLE 3.5-4
EXPLOSIVE SOURCES IN THE GOMEX OPAREAS UNDER ALL ALTERNATIVES

Ordnance	Net Explosive Weight	Detonation Depth		
		No Action	Alt 1	Alt 2
MK-82 HE bomb	192.2 lbs	1 meter	1 meter	N/A
MK-83 HE bomb	415.8 lbs	1 meter	1 meter	1 meter
MK-84 HE bomb	945 lbs	N/A	1 meter	N/A
EOD Underwater Detonation Charges[42]	5 lbs, 10 lbs, 20 lbs and 60 lbs	Mid-Column to Bottom	N/A	N/A
MK3A2 Grenades	0.5 lbs	Mid-Column	Mid-Column	Mid-Column

The airborne noise dB level associated with the MK-82, and MK-83 bombs are set forth in Table 3.5-3. The EOD MIW training that has traditionally occurred in the Panama City and Corpus Christi OPAREAs can involve various detonation sizes at mid-column to bottom of the water column. Due to surface reflection, the airborne sound is muffled. Personnel on support craft near the exercise may hear a muffled sound and feel a thump on their boat as the sound wave propagates. The same holds true for the underwater grenade training in the Corpus Christi UNDET Area E3.

[42] These charges occur within designated mine warfare boxes within the Corpus Christi OPAREA and Panama City OPAREA.

3.5.2.2 McMullen and Noxubee County Ranges

Ambient Sound of the Air-to-Ground Bombing Range Areas

The ambient sound environment within the inland portions of the Range Complex varies depending on location. For the most part, the MOAs and inland air-to-ground practice bombing ranges are located in rural areas. The ambient sound environment consists of noises that may be intermittent or continuous, steady or impulsive. Transient noise sources move through the environment, along relatively established paths (*e.g.*, highways, railroads, and aircraft flying a specific flight track). The rural average ambient noise levels would be between 40-55 dB. In 1974, the USEPA recommended 55 dB as the "level requisite to protect health and welfare with an adequate margin of safety." (USEPA, 1974).

Sound from Military Sources

Aircraft Overflight

Fixed wing aircraft activities at the McMullen and Noxubee County Ranges are in the form of aircraft overflights associated with Air-to-Ground Bombing events (both ranges) and Air-to-Ground Gunnery events (Yankee Target only). RAICUZ Studies have been completed for the McMullen County Range (DoN, 2008b) and the Noxubee County Range (DoN, 2005). The most recent noise contours for the McMullen County Range are shown in Figure 3.5-2, and the most recent noise contours for the Noxubee County Range are shown in Figure 3.5-3. As shown on these figures, aircraft noise levels can reach 75 dB at the center of the ranges where aircraft descend toward the targets. Sound levels taper off toward the range boundaries along flight paths.

Analyses of aircraft noise exposure around DoD range facilities are normally accomplished using a computer-based program called the MOA and Range NOISEMAP (MR_NMAP). For the purpose of the McMullen RAICUZ Study, MR_NMAP Version 2.2 was utilized to model the noise exposure resulting from aircraft weapons delivery operations and strafing at the McMullen County Range (DoN, 2008b).

The MR_NMAP suite of computer programs consists of MR_OPS Version 1.0, OMEGA10R, MR_NMAP Version 2.2, NMPLOT Version 4.93, and NOISEFILE Version 6.4. The MR_OPS program allows for entry of airspace information, the horizontal distribution of operations, flight profiles (average thrust settings, altitude distributions, and speeds), and numbers of operations. "Horizontal distribution of operations" refers to the modeling of airspace utilization via three general representations: broadly distributed operations for modeling of MOA and range events, operations distributed among parallel tracks for modeling of Military Training Route (MTR) events, and operations on specific tracks for modeling of unique MOA, range, MTR, or target area activity. OMEGA10R extrapolates/interpolates the reference Sound Exposure Level (SEL) for each model of aircraft from the NOISEFILE database, taking into consideration the specified speeds, engine thrust settings, and environmental conditions appropriate to each flight operation, and generates tables of SEL for increasing altitude. The modeling of strafing operations also utilizes the same concept (DoN, 2008b).

At the SEARAY Target, aircraft noise levels were also modeled using computer simulation of typical range operations that reflect site-specific operational data including the type and number of aircraft using the range, flight tracks, frequency and time of operations, and the number and types of operations (DoN, 2005).

Table 3.5-5 provides additional information on individual aircraft noise levels for various aircraft at certain altitudes.

TABLE 3.5-5
AIRCRAFT NOISE LEVELS AT VARIOUS ALTITUDES

Aircraft	Power	Speed (KIAS)	Altitude in feet Above Ground Level							
			2000 ft		3000 ft		4000 ft		5000 ft	
			SEL	Lmax	SEL	Lmax	SEL	Lmax	SEL	Lmax
AV-8B	83% RPM	360	96	91.5	92	86.1	88	81.9	86	78.5
S-3	85% NC	350	81	77.5	75	70.1	70	64.2	66	59.4
P-3A	1400 ESHP	210	-	73.3	-	68.8	-	65.4	-	62.9
F/A-18E/F	83% NC	360	97	90.1	93	84.6	89	80.3	86	76.8
T-45	85.5% RPM	250	76	68.4	72	63.5	69	59.7	67	56.7

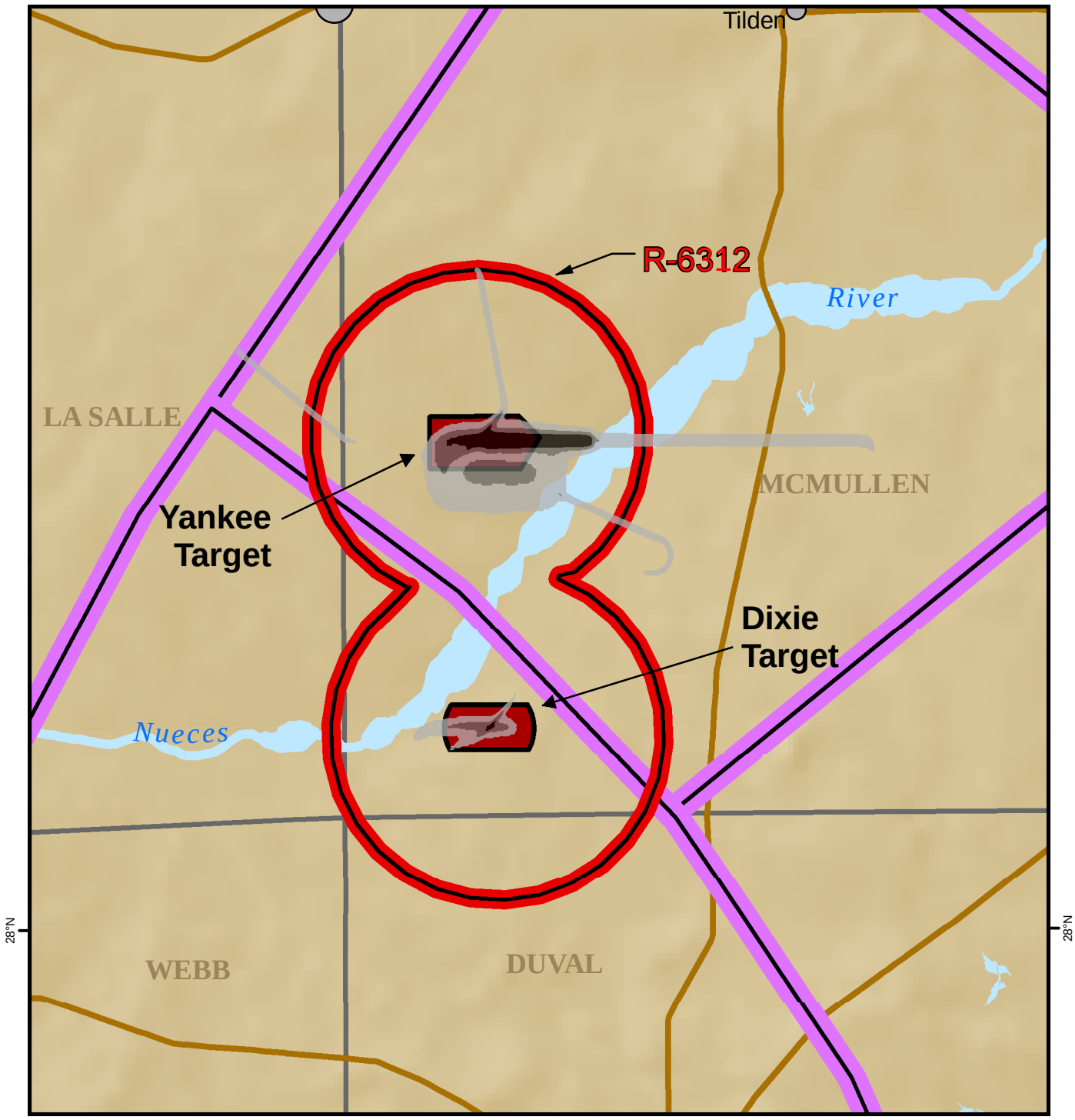
Notes: SEL: Sound Exposure Level-total noise energy produced from a single noise event; Lmax: Represents the maximum noise level that occurs during an event and is the noise level actually heard during the event; Temp: 70 F; Humidity: 59% relative humidity;
Source: Flyover Noise Calculator, Version 1.0.2, beta, USAF/AFRL/HECB, Wright-Patterson AFB, OH, May 2002.

Table 3.5-5 is illustrative of how noise levels decrease as aircraft reach higher altitudes. Flights in the MOAs are all above 7,000 feet and would produce noise below even the lowest of the numbers shown in Table 3.5-5. These low noise levels would be associated with the Navy basic flight instruction and mission area flight training that take place within the GOMEX Range Complex MOAs.

Aircraft following air traffic routes and procedures normally do not significantly influence the noise environment of underlying land uses (FAA, 2000). Air traffic procedures for operations over 3,000 feet AGL are normally categorically excluded from environmental assessment requirements delineated in FAA Order 1050.1 (FAA, 2000).

Sound from Ordnance

Sound attributable to ordnance at the McMullen and Noxubee County Ranges results from bombing with NEPM ordnance. The types and quantities of ordnance expended, and thus the sound levels generated, depend on the training objectives and the range used. Table 3.5-3 depicts sound levels for representative ordnance types utilized in military training at the McMullen County Range (Yankee Target and Dixie Target) and the Noxubee County Range (SEARAY Target). Like the NEPM ordnance used in the Pensacola OPAREA, the non-explosive ordnance used at the inland ranges produces sound by the kinetic energy transfer of the object with the target surface, and are highly localized to the area of disturbance. Sound associated with the impact event is typically of low frequency (less than 250 Hz) and of a short enough duration (*i.e.*, impulse sound) that it produces negligible amounts of acoustic energy. These events occur on remote ranges that are restricted from the public, so they often go unobserved and unheard. The impacts may be scored by remote observers - participants in the exercise who are at a safe distance from the source. The sound the ordnance makes at these inland ranges is masked by the sound of the aircraft overflight during the bomb or gunfire release event. According to the Noxubee County RAICUZ Study, since only inert ordnance is permitted at the SEARAY Target, no impulse noise or ordnance blasts was associated with the noise analysis for the target range (DoN, 2005).



Legend

- Towns
- Roads
- County Boundaries
- Restricted Airspace (R-)
- Kingsville 3 MOA

Aircraft Noise Contours, FY 2007

- 55 dB Ldnmr
- 60 dB Ldnmr
- 65 dB Ldnmr

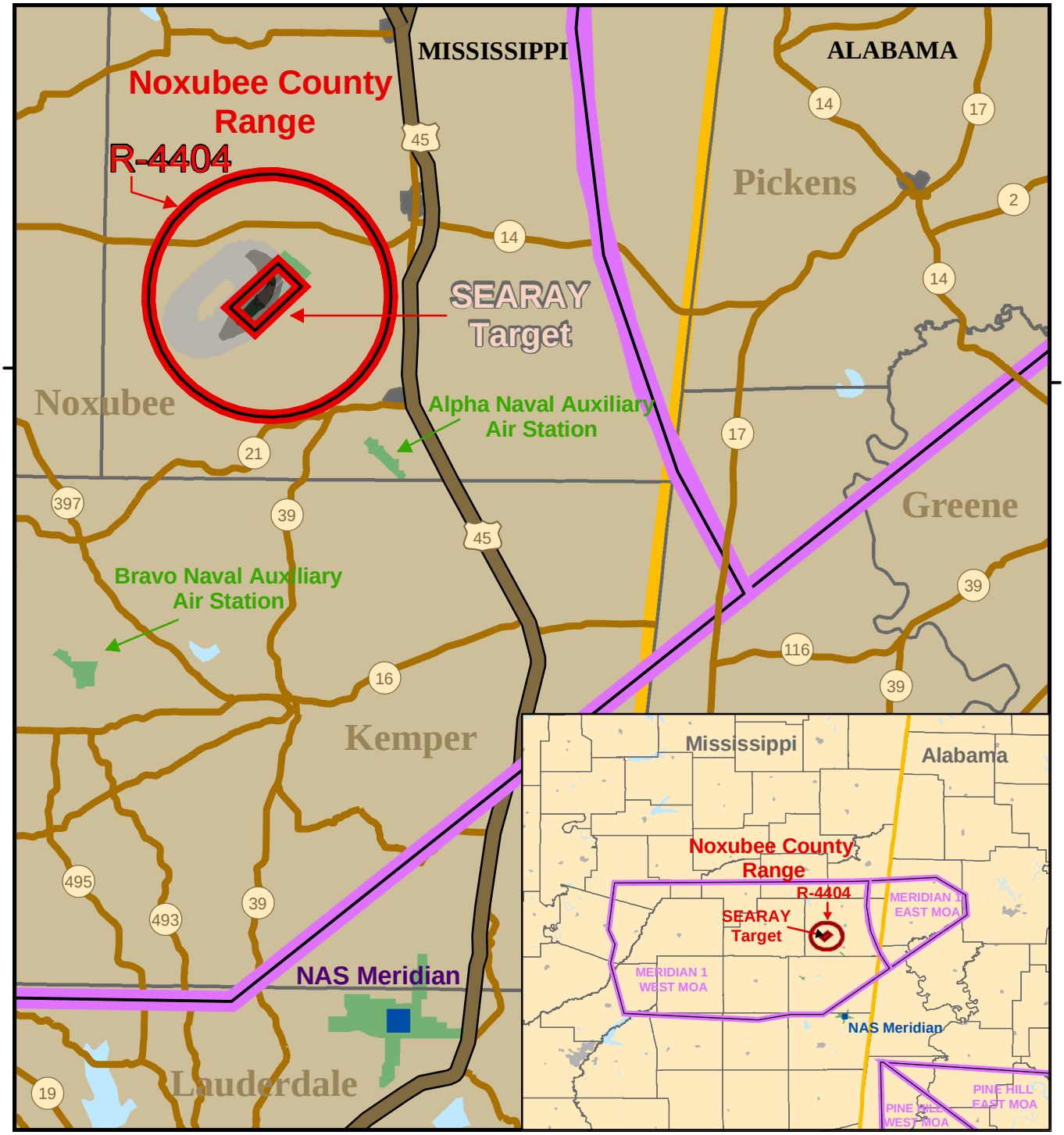
0 1 2 4 6 8 10

Nautical Miles

Coordinate System: WGS 1984 UTM Zone 14 (Meters)

Figure 3.5-2

McMullen County Range Noise Contours for 2007



Legend

- Roads
- Primary Roads
- County Boundaries
- Cities
- Military Installations
- SEARAY Target Footprints

Special Use Airspace

- Military Operating Areas (MOA)
- Restricted Airspace (R-)
- 60 dB Ldnmr
- 65 dB Ldnmr
- 70 dB Ldnmr

0 2.5 5 10 15

Nautical Miles

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Figure 3.5-3

Noxubee County Range Noise Contours for 2005

3.5.2.3 NSA Panama City Demolition Pond

Ambient Sound at NSA Panama City

Around the NSA Panama City Demolition Pond area, ambient noise currently exists as a result of aircraft overflights, both military and commercial aircraft, and marine vessels operating on the surface in the vicinity of the near shore Gulf of Mexico or St. Andrew Bay. Aircraft noise typically occurs during daylight hours. Automobile traffic noise also exists around NSA Panama City on US 98, Thomas Drive and Magnolia Beach Road and other secondary roads.

Sound from Military Sources

Sound from Ordnance

Demolition noise at the NSA Panama City Demolition Pond is analogous to the demolition noise produced offshore during mine warfare training, but on a smaller scale. The airborne noise associated with underwater explosions is minimal. A characteristic phenomena of the difference in acoustic impedance between air and water is that the air/water interface acts as a very good reflector, the so-called Lloyd mirror. Therefore, little noise energy passes this reflector, meaning that little explosive noise generated in the water passes over to the air, and vice versa. No noise studies have been performed at the NSA Panama City Demolition Pond, but the muffled airborne noise associated with the Demolition Pond training has been described as similar to a rumble of thunder as heard from a distance (Willows, 2008).

3.5.2.4 Sensitive Receptors

Sensitive receptors are those noise-sensitive areas, including developed and undeveloped areas for land uses such as residences, business, schools, churches, libraries, hospitals, and parks. Military personnel are not considered to be sensitive receptors of airborne noise for purposes of environmental impact analyses. While persons on recreational or fishing vessels within the GOMEX OPAREAs might be exposed to sound generated by military activities, the likelihood of such exposure is quite low, due to extensive standard operating procedures (SOP) employed by the Navy to ensure civilians do not interfere and are not inadvertently affected by military activities. The nearest sensitive receptors to OPAREA training are located in such cities as Pensacola, FL, Panama City, FL, and Corpus Christi, TX, but are located at least 9 to 12 nautical miles from Navy training noise sources. Given ambient noise levels in these locations, the likelihood of exposure to any Navy training-related airborne noise is very low.

The nearest sensitive receptors to the NSA Panama City Demolition Pond are located in residential areas east of the Demolition Pond, and across Magnolia Beach Road and Thomas Drive from the installation. The nearest church is located approximately 1 mile distant from the Demolition Pond. The nearest school is located approximately 1.5 miles from the Demolition Pond. The nearest parks, businesses, and residences are located at least ½ mile from the Demolition Pond. Most of these sensitive receptors are well insulated from Demolition Pond noise by a grove of trees and are more likely to hear automobile traffic from nearby roads than noise generated at the Demolition Pond.

According to NSA Panama City personnel, approximately 1 or 2 complaints are received each year related to Demolition Pond training (Willows, 2008). The complaints are received from the residential area east of the Demolition Pond and relate more to vibration than to airborne noise (Willows, 2008). No vibration or airborne noise complaints are received from other locations. Demolition Pond training minimizes its disturbance by limiting charge sizes and adhering to typical operational time restraints (8 AM-3 PM).

The nearest sensitive receptors to the SEARAY Target are: Mashulaville Church, Mount Mariah Church, Mount Olive Church, New Salem Church, Salem Church, Macedonia Church, Upper Running Water Church, Little Member Church, and Brush Fork Church. The nearest towns to the SEARAY Target are Mashulaville, Macedonia, New Salem, Shuqualak, and Macon. All these churches and towns are located outside the year 2005 60 dB contour line (DoN, 2005). Table 3.5-6 lists the population and acreage within certain DNL contour bands around the SEARAY Target.

A noise complaint response and abatement program has been implemented at NAS Meridian to log and track noise complaints, analyze complaint locations and times, and identify the flights/operations that generated the complaints. Possible adjustments to operational procedures are discussed, and may be implemented to avoid future conflicts. Based on NAS Meridian personnel and the noise complaints log, very few noise complaints are attributed to operations at the SEARAY Target (DoN, 2005).

The following describes NAS Meridian's response process when a noise complaint is made. Persons with noise complaints generated in the operational environs of NAS Meridian, OLF Joe Williams, SEARAY Target, and the NAS Meridian SUA can call (601) 679-2505 to place a complaint. Assigned air operations (AIROPS) personnel answer the call and record pertinent information such as the location and time and a description of the noise generating event. After the noise complaint is logged, it is passed through AIROPS and air traffic control (ATC) to COMTRAWING ONE where it is reviewed, the responsible squadron identified, and any flight violations identified. The noise complaint is then discussed and commented on at the squadron level. Comments are than passed back to AIROPS and ATC. AIROPS personnel may return the complainant's call, and provide an explanation as to what caused the noise (DoN, 2005).

TABLE 3.5-6
CALENDAR YEAR 2005 ESTIMATED OFF-RANGE LAND AREA AND POPULATION WITHIN LDNMR NOISE EXPOSURE CONTOURS FOR THE SEARAY TARGET

DNL Contour Band	Item	Calendar Year 2005
60-65 dB	Acres	13,478
	Population	79
65-70 dB	Acres	2964
	Population	20
70-75 dB	Acres	475
	Population	0
Summary of Exposure		
65-75 dB	Acres	3439
	Population	20

Note: Calendar Year (CY); Source: DoN, 2005, citing Noise Study for NAS Meridian, OLF Joe Williams, and Target Range SEARAY, Mississippi, 2002, Wyle Laboratories.

The 149th FW has a formalized noise and airspace complaint program that covers flight operations at the McMullen County Range. Residents can call 210-925-6048 and state a concern regarding any noise or aircraft issue. The information is recorded on the Noise/Airspace Complaint Form to document the date and time of the alleged incident, as well as the nature of the complaint and the identification of the complainant. The form also allows for the documentation of follow-up action taken by the 149th FW. In over eight years the 149th FW has only received three complaints and mainly regarding issues related to MTRs. NAS Kingsville does not have a formal noise complaint program for the McMullen County Range. Because of the rural environment and the low number of residents living in the vicinity of the

McMullen County Range, noise and airspace are not significant issues that have caused concerns with the Navy and apparently with local residents (DoN, 2008b).

3.5.3 Environmental Consequences:

3.5.3.1 No Action Alternative

Under the No Action Alternative, noise levels at all locations through the Study Area would remain at current levels. Navy training and testing in the Study Area, especially live firing of weapons and aircraft operations, are sources of intrusive noise in the immediate vicinity. But the only receptors of that noise are typically military personnel. Military personnel who might be exposed to noise from these activities are required to take precautions, such as the wearing of personal protective equipment, to reduce or eliminate potential harmful effects of such exposure (military personnel are not considered sensitive receptors for purposes of impacts analysis). With regard to potential exposure of non-military personnel in ocean areas (such as fishermen in the Study Area) precautions are taken pursuant to SOPs to prevent such exposure (see Section 3.19). Much Navy training in the Study Area occurs either at least 12 nm from shore or at high altitudes (*e.g.*, basic flight training), and is likely to be beyond the hearing of human receptors.

Noise levels near shore would continue as they are today under the No Action Alternative. Sensitive receptors may experience occasional noise from aircraft overflights. High altitude overflights associated with mission area flight training (in MOAs and at-sea SUA) may not generate noise that reaches ambient levels at the receptors. Because sound-generating events are intermittent; and the vast majority occur in remote areas or off-limits areas, they do not expose a substantial number of human receptors to high noise levels. The impact on the human noise environment therefore is less than significant. Navy training and testing under the No Action Alternative is not likely to produce significant harm to the noise environment above non-territorial waters.

As shown on the RAICUZ Study maps for the McMullen and Noxubee County Ranges, noticeable noise levels are closely tied to the training range boundaries, and therefore, do not present a significant impact to human receptors outside of the range boundaries. Because sound-generating events are intermittent, occur in remote areas or off-limits areas, they do not expose a substantial number of human receptors to high noise levels. Few off-range sensitive receptors are likely to be exposed to sound from such military activities.

Airborne noise from helicopter training at NAS Whiting Field and associated training airspace was previously analyzed in the Environmental Assessment for Replacement of the T-34C at NAS Whiting Field. No significant impacts to the airborne noise environment were identified. This document is incorporated herein by reference (See Section 1.7).

Airborne noise levels at the NSA Panama City Demolition Pond are attenuated to insignificant levels by surface reflection. Although no noise studies have been conducted at the NSA Panama City Demolition Pond, the muffled airborne noise associated with the Demolition Pond training has been described as similar to a rumble of thunder as heard from a distance (Willows, 2008). Few complaints regarding training are received each year (Willows, 2008). Therefore, there would be no significant impact on the human noise environment from implementing current Navy training and testing. Furthermore, there would be no significant harm to the human noise environment from implementing the No Action Alternative.

3.5.3.2 Alternative 1

Under Alternative 1, the number of noise generating training events would be similar to current levels. Under Alternative 1, there would be an increase in fixed wing aircraft sorties within the Pensacola

OPAREA (*i.e.*, 90 additional sorties) above current levels. Offsetting this increase, though in different areas, would be a decrease in MIW training (*e.g.*, decrease in helicopter sorties and surface ship noise). These lowered noise levels would be experienced in the Corpus Christi OPAREA and the Panama City OPAREA.

In the Pensacola OPAREA, the increase in fixed wing training events would not be expected to result in substantial increases of overall Study Area noise levels. Slightly more than 100 additional fixed wing aircraft sorties per year are proposed to occur under Alternative 1 than under the No Action Alternative. The aircraft types conducting the additional proposed sorties are F/A-18s. According to Table 3.5-5, sorties at 3,000 feet altitude produce an Lmax sound level of 84.6 dBA. This decreases to an Lmax sound level of 76.8 dBA at 5,000 feet altitude. Portions of sorties would occur at even higher altitudes, thus further decreasing the sound level produced. Extensive precautions are taken to eliminate exposure of non-military personnel to unwanted sound from military activities. As with the No Action Alternative, sound-generating events under Alternative 1 are intermittent, occur in remote areas or off-limits areas, and do not expose a substantial number of human receptors to high noise levels. As mentioned in Section 3.5.4.4, no sensitive receptors are likely to be exposed to sound from the proposed Navy training events in the OPAREAs.

Under Alternative 1, no additional training events are proposed at the McMullen County Range or the Noxubee County Range over current levels. As mentioned in Section 3.5.4.4, few sensitive receptors are present nearby these ranges. Therefore, the fixed wing aircraft noise produced under Alternative 1 is not expected to produce significant impacts at the McMullen County Range or the Noxubee County Range. Aircraft flight training within the GOMEX MOAs is expected to remain at current levels under Alternative 1. This flight training occurs at high altitude, thus attenuating noise levels at noise receptors below. This flight training also does not involve release of sonic booms or release of explosive ordnance. Only NEPM ordnance is released during air-to-ground training events at the GOMEX land ranges.

Airborne noise from helicopter training at NAS Whiting Field and associated training airspace was previously analyzed in the Environmental Assessment for Replacement of the T-34C at NAS Whiting Field. No significant impacts to the airborne noise environment were identified. This document is incorporated herein by reference (See Section 1.7).

No increase in training frequency or explosive size is expected at the Demolition Pond under Alternative 1. Few complaints regarding training are received each year. Due to surface reflection, underwater detonations at the pond do not generate significant airborne noise impacts.

Therefore, there would be no significant impact on the human noise environment from implementing the Navy training and testing considered under Alternative 1. Furthermore, there would be no significant harm to the human noise environment from implementing Alternative 1.

3.5.3.3 Alternative 2 (Preferred Alternative)

The types of effects on humans from sound generated by military activities under Alternative 2 would be similar to those under Alternative 1. Like Alternative 1, there would be no increase in noise levels from Demolition Pond training, flight training offshore, Air-to-Ground ordnance training at the McMullen County Range and Noxubee County Range, or from flight training within the overland MOAs. There would also be a decrease in MIW training noise, as those events would no longer occur under Alternative 2.

In the Pensacola OPAREA, fixed wing training events under Alternative 2 would not be expected to result in measurable increases to overall Study Area noise levels. The use of high explosives during

BOMBEX (A-S) training would decrease under Alternative 2 compared to baseline levels, thus leading to a decrease in impulsive noise.

Extensive precautions are taken to eliminate exposure of non-military personnel to unwanted sound from military activities. As with the No Action Alternative, sound-generating events under Alternative 2 are intermittent, occur in remote areas or off-limits areas, and do not expose a substantial number of human receptors to high noise levels. No sensitive receptors are likely to be exposed to sound from the proposed Navy training events in the OPAREAs.

Airborne noise from helicopter training at NAS Whiting Field and associated training airspace was previously analyzed in the Environmental Assessment for Replacement of the T-34C at NAS Whiting Field. No significant impacts to the airborne noise environment were identified. This document is incorporated herein by reference (See Section 1.7).

Under Alternative 2, the Navy would participate in Navy or joint training opportunities afforded by proximity to the Army's Joint Readiness Training Center (JRTC) and its JNTC infrastructure. This participation would not increase the number of training events or associated noise. Thus, no significant impacts are expected.

Therefore, there would be no significant impact on the human noise environment from implementing the Navy training and testing considered under Alternative 2. Furthermore, there would be no significant harm to the human noise environment from implementing Alternative 2.

3.5.4 Unavoidable Significant Environmental Effects

Increases in operational activity in the GOMEX Range Complex Study Area would increase airborne noise levels. However, because Navy training takes place in remote and cleared areas, airborne noise levels primarily affect military personnel operating the equipment/weapon systems producing the noise. Military personnel wear personal protective equipment and are not considered sensitive receptors as such term is used in this Final EIS/OEIS analysis. Underwater noise impacts to aquatic life are addressed in Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), 3.9 (Fish), and 3.10 (Seabirds and Migratory Birds). There are not expected to be any unavoidable significant environmental effects associated with proposed action-generated noise.

3.5.5 Summary of Environmental Effects (NEPA and EO 12114)

Airborne noise levels generated by the proposed action under the No Action Alternative and Alternatives 1 and 2 would be less than significant because:

- Noise from training activities in the OPAREAs would be dispersed and intermittent, which would not contribute substantially to long-term noise levels, and few or no sensitive receptors (non-participants) would be exposed to these noise events;
- Training areas at the McMullen County Range and Noxubee County Range are remote, and isolated from the general public, and few or no sensitive receptors (non-participants) would be exposed to these noise events;
- No new public areas would be exposed to noise from training and testing activities.
- No high explosives are used at the McMullen County Range or Noxubee County Range;
- The incremental increase in BOMBEX Air-to-Surface training sorties would not substantially increase long term average noise levels in the GOMEX OPAREAs; hourly average equivalent noise levels are and would remain relatively low; and
- At the McMullen County Range and Noxubee County Range, noise levels under both Alternatives 1 and 2 are expected to remain constant with baseline levels.

- Airborne noise associated with MIW training (*e.g.*, helicopter and ship engine noise) decreases under Alternative 1 and Alternative 2 versus baseline noise levels.

Table 3.5-7 summarizes noise effects and protective measures for the No Action, Alternative 1, and Alternative 2.

TABLE 3.5-7
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE SOUND ENVIRONMENT IN THE GOMEX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Surface ship noise	Minor localized engine noise impacts. Few to no sensitive receptors present.	Minor at-sea noise. Few to no sensitive receptors present.
Aircraft noise	Short-term noise impacts during transits to and from range areas.	Short-term harm to airborne noise environment, including sonic booms. Few to no sensitive receptors present.
Weapon and target noise	Very short-term noise impacts. Few to no sensitive receptors present.	Very short-term harm to the airborne noise environment. Few to no sensitive receptors present.
Impact Conclusion	No significant impacts to the airborne noise environment.	No significant harm to the airborne noise environment above non-territorial waters.
Alternative 1		
Surface ship noise	Minor localized engine noise. Few to no sensitive receptors present.	Minor at-sea noise. Few to no sensitive receptors present.
Aircraft noise	Short-term noise impacts during transits to and from range areas.	Short-term harm to airborne noise environment, including sonic booms. Few to no sensitive receptors present.
Weapon and target noise	Very short-term noise impacts. Few to no sensitive receptors present.	Very short-term harm to the airborne noise environment. Few to no sensitive receptors present.
Impact Conclusion	No significant impacts to the airborne noise environment.	No significant harm to the airborne noise environment above non-territorial waters.
Alternative 2		
Surface ship noise	Minor localized engine noise. Few to no sensitive receptors present.	Minor at-sea noise. Few to no sensitive receptors present.
Aircraft noise	Short-term noise impacts during transits to and from range areas.	Short-term harm to airborne noise environment, including sonic booms. Few to no sensitive receptors present.
Weapon and target noise	Very short-term noise impacts. Few to no sensitive receptors present.	Very short-term harm to the airborne noise environment. Few to no sensitive receptors present.
Impact Conclusion	No significant impacts to the airborne noise environment.	No significant harm to the airborne noise environment above non-territorial waters.

3.6 MARINE COMMUNITIES

3.6.1 Introduction and Methods

3.6.1.1 Regulatory Framework

A community is an assemblage of plants and/or animal populations sharing a common environment and interacting with each other and with the physical environment. This section specifically addresses the following marine communities occurring within the GOMEX Study Area: plankton and macroalgae, benthic communities, and artificial habitats. This section also addresses Marine Protected Areas, including National Marine Sanctuaries. Seagrasses/submerged aquatic vegetation communities are not addressed in detail in this section because they are not expected to occur in the Study Area. Marine mammals are addressed in Section 3.7, sea turtles are addressed in Section 3.8, fish and essential fish habitat are addressed in Section 3.9, and seabirds and migratory birds are addressed in Section 3.10 of this Final EIS/OEIS. Marine species listed under the Endangered Species Act (ESA) are addressed in Sections 3.7 through 3.10, as applicable.

The various federal laws and regulations that afford protection and management of marine communities are primarily aimed at specific community components such as ESA-listed species and designated critical habitat; marine mammals; federally managed fish species and essential fish habitat; and migratory birds. Regulatory frameworks for these marine community components, as well as the National Marine Sanctuaries Act and Executive Order (EO) 13089, *Coral Reef Protection*, are discussed in Appendix K. In accordance with EO 13089, all federal agencies whose actions may affect U.S. coral reef ecosystems shall: (1) identify their actions that may affect U.S. coral reef ecosystems; (2) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (3) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

3.6.1.2 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this Final EIS/OEIS includes several warfare areas (*e.g.*, Mine Warfare, Air Warfare, etc.) and most warfare areas include multiple types of training operations (*e.g.*, Mine Neutralization, Air-to-Surface Missile Exercise, etc.). Likewise, several activities (*e.g.*, ship maneuver, aircraft overflights, weapons firing, etc.) are accomplished under each operation, and those activities typically are not unique to that operation. For example, many of the operations involve Navy ship maneuvers and aircraft overflights. Accordingly, the analysis for biological resources is organized by specific activity and/or stressors associated with that activity, rather than warfare area or operations.

The following general steps were used to analyze the potential environmental consequences of the alternatives to marine communities and biological resources as a whole:

- Identify those aspects of the proposed action likely to act as stressors to biological resources by having a direct or indirect effect on the physical, chemical, and biotic environment of the Study Area. As part of this step, the spatial extent of these stressors, including changes in that spatial extent over time, were identified. The results of this step identified those aspects of the proposed action that required detailed analysis in this Final EIS/OEIS and defined the Study Area.
- Identify resources that may occur in the Study Area.
- Identify the biological resources likely to co-occur with the stressors in space and time, and the nature of that co-occurrence (exposure analysis).
- Determine whether and how biological resources are likely to respond given their exposure and available data (response analysis).

- Determine the risks those responses pose to biological resources and the significance of those risks.

Study Area

The Study Area for marine communities addressed in this section includes those portions of the GOMEX Study Area located in the Gulf of Mexico (Figure 1.5-1), including the NSA Panama City Demolition Pond.

Data Sources

A comprehensive and systematic review of relevant literature and data has been conducted to complete this analysis for marine communities and to ensure that the best available information was used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, EISs, Range Complex Management Plans, and other technical reports published by government agencies, private businesses, or consulting firms. The scientific literature was also consulted during the search for geographic location data on the occurrence of marine resources within the Study Area. The primary sources of information used to describe the affected environment for marine communities were in the Navy's Marine Resources Assessment (MRA) report for Gulf of Mexico Operating Area (DoN, 2007). The MRA report provides a compilation of the most recent data and information on the occurrence of marine resources in the Study Area. Descriptions of literature and data searches conducted during preparation of the MRA are described in detail in that report.

Factors Used to Assess the Significance of Effects

The factors used to assess significance of the effects to marine communities include the extent or degree to which implementation of an alternative would result in permanent loss or long-term degradation of the physical, chemical, and biotic components that make up a marine community.

3.6.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to marine communities. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Final EIS/OEIS. As summarized in Table 3.6-1, potential stressors to marine communities include vessel movements (disturbance and collisions), aircraft overflights (disturbance), non-explosive practice munitions (strikes), underwater detonations and high explosive ordnance (explosions), military expended materials (ordnance related materials, targets, chaff, self-protection flares, and marine markers; ingestion and entanglement), and towed Mine Warfare devices (strikes). The potential effects of these stressors on marine communities are analyzed in detail in Section 3.6.3.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as a result of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on marine communities. Accordingly,

the effects of water and air quality changes on marine communities are not addressed further in this Final EIS/OEIS.

TABLE 3.6-1
SUMMARY OF POTENTIAL STRESSORS TO MARINE COMMUNITIES

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Mine Warfare (MIW)							
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓		✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Surface Warfare (SUW)							
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	✓	✓	
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155 B		✓	✓		✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓	✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓		✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Boat)	Panama City OPAREA	✓		✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Boat)	Corpus Christi UNDET Box E3	✓		✓	✓	✓	

TABLE 3.6-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE COMMUNITIES

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓					
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓				
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓			✓	✓	
Air Warfare (AW)							
Air Intercept Control (AIC)	W-151; W-155		✓				
Amphibious Warfare (AMW)							
FIREX (Surface-to-Surface) with IMPASS	W-151A/B; W-155A	✓		✓		✓	
Electronic Combat (EC)							
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓			✓	
Chaff Exercises (CHAFFEX)	Brownwood MOAs						
Flare Exercises (FLAREX)	W-155A/B		✓			✓	
Flare Exercises (FLAREX)	Brownwood MOAs						
Mission Area Training[43]							
Mission Area Flight Training	W-92; W-54		✓				
Basic Flight Instruction	W-228; R-2908		✓				
Salvage Diver Training	NSA Panama City Demolition Pond				✓	✓	

[43] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

TABLE 3.6-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE COMMUNITIES

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Underwater Demolitions	NSA Panama City Demolition Pond				✓	✓	
Security Force Training	NSA Panama City Demolition Pond				✓	✓	
Diver Training	NSA Panama City Demolition Pond				✓	✓	

3.6.2 Affected Environment

3.6.2.1 Plankton and Microalgae

Plankton are defined as organisms that float or drift and cannot maintain their direction against the movement of currents (Parsons *et al.*, 1984). For the most part, they are at the mercy of their aquatic environment, moving in the direction of the prevailing current. Many zooplankton migrate vertically in the water column, which may place them under the influence of different currents than occur at the surface, and allow them to indirectly control their lateral movement (Lalli and Parsons, 1997). Plankton include phytoplankton (plant-like organisms), zooplankton (animals), bacterioplankton (bacteria), and meroplankton (individual life stages of some organisms, like the eggs or larvae of certain fish species). In general, planktonic organisms are very small or microscopic, although there are exceptions. Jellyfish and pelagic *Sargassum*, for example, are unable to move against the surrounding currents and, therefore, are considered plankton even though some jellyfish can grow to approximately 10 feet in diameter.

Phytoplankton

Phytoplankton are single-celled organisms that are similar to plants because they photosynthesize using sunlight and chlorophyll. Phytoplankton are at the base of the marine food chain, and are essential to the overall productivity of the ocean. Phytoplankton growth and distribution are influenced by several factors, the most important of which are temperature (Eppley, 1972), light (Yentsch and Lee, 1966), and nutrient concentration (Goldman *et al.*, 1979). To a much lesser degree, other factors such as pH and salinity affect the growth and production of phytoplankton (Parsons *et al.*, 1984). Phytoplankton distribution is patchy, occurring in environments that have optimal light, temperature, and nutrient conditions. Whenever one of these factors essential to growth is in short supply, growth is said to be limited by that factor. In general, the concentration of phytoplankton is higher in nearshore areas where nutrients are discharged from land sources such as rivers and urban runoff. The major nutrients phytoplankton use for growth and photosynthetic processes are dissolved nitrogen (nitrate/nitrite/ammonia), phosphorus (phosphate), and silica (silicate). Phosphorus limitation is typical of freshwater systems whereas marine systems are more likely to be nitrogen limited. Important sources

of nutrients in the GOMEX include the discharge from the Mississippi River System into the northern Gulf and upwelled deep waters in the eastern and western Gulf. Upwelling of colder, nutrient-rich waters from the continental slope onto the shelf occurs throughout the Gulf as well as along the perimeter of warm-core eddies and at the center of cold-core eddies. Particularly in the western Gulf, warm-core and cold-core ring pairs develop near the continental shelf edge, causing shelf waters with higher concentrations of phytoplankton to be entrained into deeper continental slope waters with lower concentrations of phytoplankton. Cold-core, cyclonic eddies cause upwelling in waters over the shelf, introducing nutrients to the recently transported phytoplankton, sustaining growth in the deeper offshore waters (Biggs and Müller-Karger, 1994). This process can subsequently increase the biological production of higher trophic levels, such as the pelagic predators tuna, marlin, and sperm whales (Biggs and Müller-Karger, 1994).

Zooplankton

Zooplankton are aquatic animals ranging from the smallest protozoans to jellyfish. Although many are able to move sizable distances at moderate speeds and thus can perform diel vertical migrations of hundreds of meters, ocean currents and the suitability of the physical, chemical, and biological components of the hydrographic regimes they encounter determine their large-scale horizontal distributions. For instance, zooplankton will be concentrated in areas of increased primary productivity such as along frontal boundaries and eddy peripheries in the GOMEX (Biggs and Ressler, 2001). Zooplankton biomass is influenced by seasonal fluctuations in hydrography and phytoplankton abundance; however, regardless of season, zooplankton biomass in cold-core (cyclonic) eddies and at the confluence of cold-core and warm-core (anticyclonic) eddies consistently exceeds that in warm-core eddies (Wormuth *et al.*, 2000). It is hypothesized that this effect on the distribution of zooplankton is not caused by passive entrainment, but rather by an influx of nutrient-rich deep water to the base of the mixed layer, and the subsequent growth of phytoplankton stocks, which in turn supports increased zooplankton growth.

Ichthyoplankton (a subset of the meroplankton consisting of the larvae and eggs of fish) abundance, especially in species known to occur near sharp gradients in sea temperature, is much greater at the northern periphery of the Loop Current and in other areas of the Gulf of Mexico where ocean fronts occur (Biggs *et al.*, 1997).

Zooplankton of the deep water Gulf of Mexico are similar in taxonomic composition to other low-latitude oceans, while the ichthyoplankton are grouped with those of the tropical Atlantic Ocean and Caribbean Sea (Biggs and Ressler, 2001). Overall, oligotrophic conditions persist in the deep waters of Gulf seaward of the shelf break; however, sporadic increases in zooplankton biomass occur both spatially and temporally that exceed levels in the Caribbean Sea by over three fold (Biggs and Ressler, 2001). The presence of large populations of apex predators in the deep water of the Gulf of Mexico supports the theory that secondary production (*i.e.*, zooplankton abundance) is significant in deeper water. The larvae of numerous fish species, including several commercially valuable species such as tuna, swordfish, and mackerel, are found in the ichthyoplankton of the deep Gulf of Mexico waters (Biggs and Ressler, 2001).

Pelagic *Sargassum*

Pelagic *Sargassum*, or gulfweed, is a type of large, brown seaweed (algae) characterized by a brushy, highly branched structure with numerous leaf-like blades and berry-like gas-filled floats (pneumatocycts). These floats, containing mostly oxygen, maintain its pelagic existence. *Sargassum* often occurs in extensive floating mats on the surface. These mats are valuable habitat as they provide shelter and a food source for a diverse community of attached and swimming organisms.

Aggregations of *Sargassum* can be found nearly anywhere in the GOMEX at any time (Wells and Rooker, 2001). The occurrence of pelagic *Sargassum* is dependent on the action of currents and fronts in the North Atlantic Ocean, Caribbean Sea, and GOMEX. Some exchange of *Sargassum* occurs between these bodies of water (Dooley, 1972). Information on and understanding of the seasonal distribution and a real abundance of pelagic *Sargassum* within the U.S. Exclusive Economic Zone is limited. After traveling across the Caribbean Sea, *Sargassum* enters the GOMEX entrained in the Yucatan Current. *Sargassum* mats are then transported and entrained in the Loop Current, to be further transported by Loop Current eddies into the northwestern Gulf (Dooley, 1972). Unfortunately, there are no studies that track local occurrences of pelagic *Sargassum* in the GOMEX and current remote sensing technology cannot distinguish aggregations of planktonic *Sargassum* at sea. The GOMEX is second only to the Sargasso Sea in *Sargassum* abundance (Crowson, 1997). Newly growing patches of *Sargassum* in the southeastern Gulf are occasionally reported (Settle, 2002). Figure 3.6-1 shows historic reports of *Sargassum* within the GOMEX Study Area.

No regular or organized harvesting of pelagic *Sargassum* currently takes place in the GOMEX Study Area. However, both commercial and recreational fishermen target *Sargassum* weed lines for pelagic fish associated with floating ocean debris.

3.6.2.2 Benthic Communities

Benthic or bottom-dwelling communities are strongly dependent on the type of bottom habitat or substrate that exists in an area. While some benthic organisms burrow into soft bottom sediments, others attach themselves to any hard substrate available. As shown in Figure 3.1-4, most of the Study Area consists of soft bottom substrates such as sand and clay. Common benthic animals found in soft bottom habitats in the Gulf of Mexico include polychaetes (worms), amphipods, isopods, tanaid shrimps, bivalve molluscs, and asteroids (star fish). Factors affecting distribution and abundance can include depth, sediment type, grain size, temperature, salinity, and oxygen content.

Live/hard bottom communities are typically areas of low, rough, or broken relief consisting of naturally occurring hard or rocky outcroppings. The geological and biological architecture of these three-dimensional substrates provide shelter and substrate for benthic and demersal organisms (Cahoon *et al.*, 1990). Live/hard bottom communities can sometimes contain rich sessile biological assemblages (sea fans, sea whips, ascidians, bryozoans, hard/soft corals, hydroids, anemones, and sponges) and favor relatively dense aggregations of turtles, commercial/recreational fish, and other fauna (Thompson *et al.*, 1999). It is important to note that not all hard bottom habitats support a live bottom community (Kirby-Smith and Ustach, 1986; SAFMC, 1998).

Within the GOMEX Study Area, benthic communities are found on the continental shelf and slope and consist of hard bottom substrate and associated biological assemblages (live/hard bottom) (Figure 3.6-2). Parker *et al*. (1983) estimated there was 38 percent of live/hard bottom habitat between Pensacola, Florida and Key West, Florida, 3 percent between Pensacola and Pass Cavallo, Texas, and 1 percent between Pass Cavallo and the Rio Grande in water depths of 60 and 300 feet. These hard bottoms are isolated rocks, patch coral reefs, flat-topped coral reefs, reef-like mounds, rock outcroppings, and pinnacles (Jaap and Hallock, 1990; MMS, 2001, 2002a). The numerous hard bottoms found in the Study Area may support associations of hearty corals and other tropical coral reef biota. Shallow-water coral reefs are nonexistent in the Gulf north of the Dry Tortugas except at the Flower Garden Banks in the northwestern GOMEX, on the Texas shelf (MMS, 2002a). The predominant lack of shallow-water, more tropical coral reefs in the GOMEX north of the Dry Tortugas is probably due to: (1) the winter recurrence of cold and nutrient-rich upwelled water flowing from the Florida Panhandle onto the West Florida shelf as far down as the Florida Keys (Müller-Karger *et al.*, 2000), (2) the winter heat loss of shelf waters caused by cold fronts and strong winds (November through February) (Hsu,

2000; Müller-Karger *et al.*, 2000), and (3) large volume of fresh and nutrient-rich river water flowing on to the continental shelf in the Gulf (Jochens *et al.*, 2000; Müller-Karger *et al.*, 2000). Marine communities in the vicinity of the Hotbox and Panama City MINEX Boxes are shown in Figure 3.6-3. Marine communities in the vicinity of the Corpus Christi MINEX Boxes are shown in Figure 3.6-4.

Coral

Coral Reefs

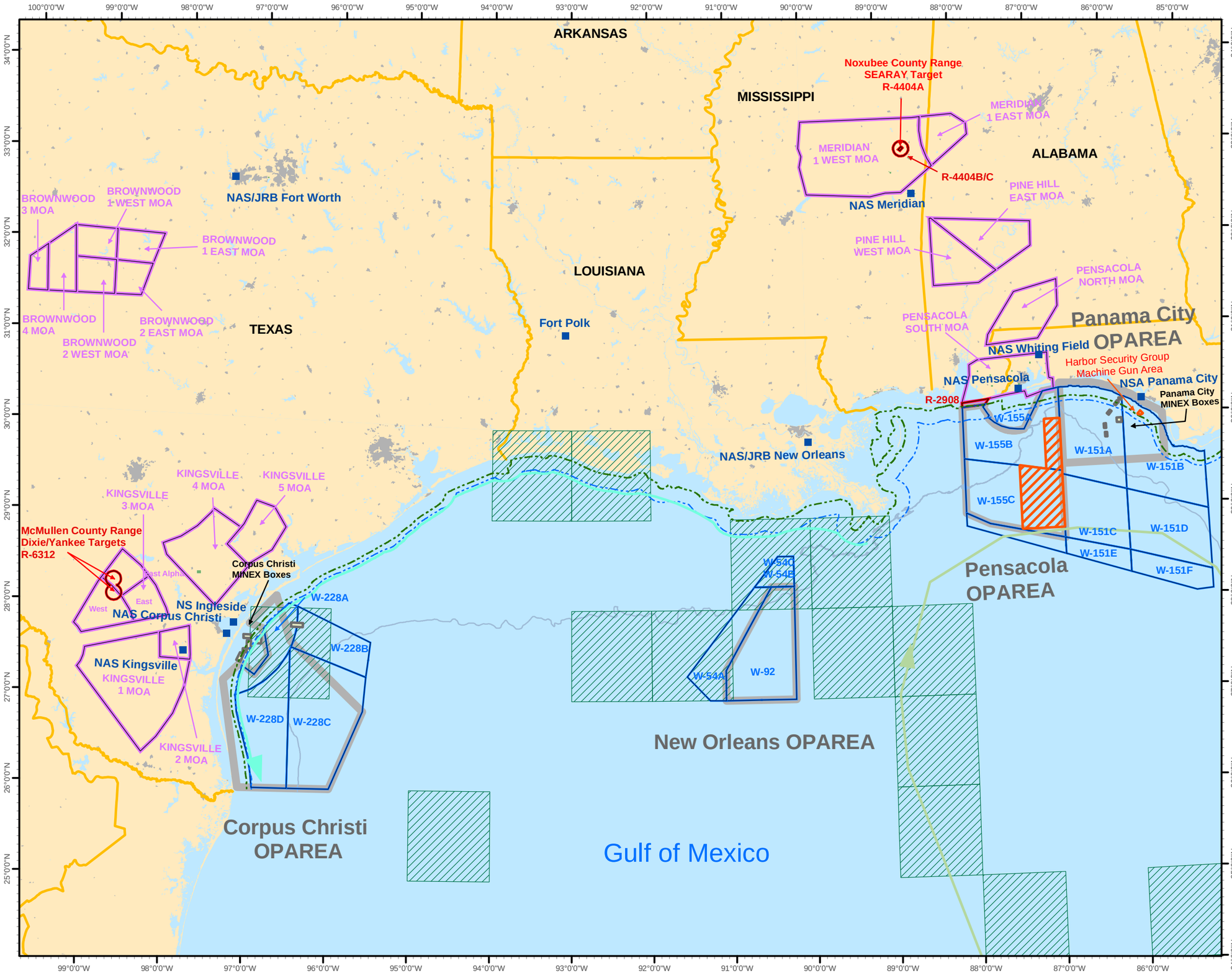
Coral reefs are tropical, mostly shallow ecosystems largely restricted to the area between 30°N and 30°S (UNEP/IUCN, 1988). Coral reefs, as marine ecosystems in which "a prominent ecological functional role is played by scleractinian (stony) corals" (McManus, 2001), occur mostly off Florida in U.S. waters of the Gulf; however, coral reefs are documented at the Flower Gardens Banks (on the Texas shelf). The Flower Garden Banks are located outside the GOMEX Study Area, over 100 nm west of the New Orleans OPAREA and over 100 nm east of the Corpus Christi OPAREA (Figure 3.6-2, feature numbers 48 and 49).

Deep Sea Corals

Deep water coral are most often ahermatypic (do not contain zooxanthellae) and can inhabit greater water depths (70 to 1,000 m) below the photic zone. Deep water or deep sea coral species prefer cool water temperatures (15º to 20ºC) and usually occur in regions of the ocean bottom with steep topographic relief such as seamounts, pinnacles, plateaus, banks, continental shelf break, and the continental slope. Five taxa of deep water coral are found in U.S. waters, the stony corals (scleractinians); two groups of precious corals, black and gold corals; gorgonians; and hydrocorals. *Lophelia pertusa* and *Oculina varicosa* are two of the most well studied deep water stony corals.

Deep sea corals grow as solitary colonies or in thickets, coppices, and banks (Morgan *et al.*, 2006). These corals are slow-growing and can live thousands of years; *Lophelia* reefs in the Gulf of Mexico may be 40,000 years old (Morgan *et al.*, 2006). Communities of deep water coral support hundreds of species of invertebrates and fish and provide habitat for many commercially valuable species.

Although deep water coral have been known to occur in the Gulf of Mexico for decades, it is only recently that any information about their occurrences has begun to be collected; even now information about the distribution of deep water corals in the Gulf of Mexico is derived from sporadic observations and collections (NOAA, 2005a). The reef-building stony coral, *Lopehlia pertusa*, as well as black corals, gorgonians such as bamboo coral, and hydrocorals are known to occur in the deeper waters of the Gulf of Mexico; these species occur in association with banks and the topographic features of the northwestern Gulf and especially along the shelf edge and upper slope off Louisiana, Mississippi, Alabama, and western Florida (Oceana, 2004; Morgan *et al.*, 2006). Beds of deep water corals, *Lophelia pertusa* and *Madrepora oculata*, have been reported from the continental slope in the Gulf of Mexico in water depths of 200 to 850 m (Schroeder, 2002; Oceana, 2004). The association between the distribution of deep water corals in the Gulf of Mexico and hydrocarbon seeps (chemosynthetic communities) is currently unknown, but corals may occur in the vicinity of these sites because of the associated hard substrate (bottom) that is formed (NOAA, 2005a).



Historical Records of Sargassum within the GOMEX Study Area

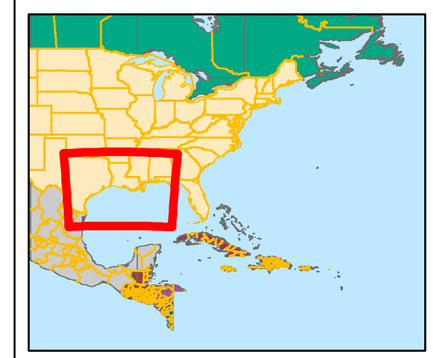
Figure 3.6-1

Legend

- loop current
- Louisiana Coastal
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Eastern GOMEX BOMBEX HotBox

Special Use Airspace

- Military Operating Areas (MOA)
- Restricted Airspace (R-)
- Warning Areas (W)
- Distribution of Sargassum 1982
- Shelf Break
- Operating Areas (OPAREA)



N

1:4,542,105

50 25 0 50 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 17 (Meters)
Sources:
National Geospatial Intelligence Agency (NGA) Database; Special Use Airspace Document AP/1A; COMLANTFLT 3120.26E Document.
Historic distribution of pelagic *Sargassum* as well as the major surface currents that function as a vector for *Sargassum* distribution. Source maps (scanned): Dooley (1972), Pickard and Emery (1982), Butler et al. (1983), and General Oceanics (1986).

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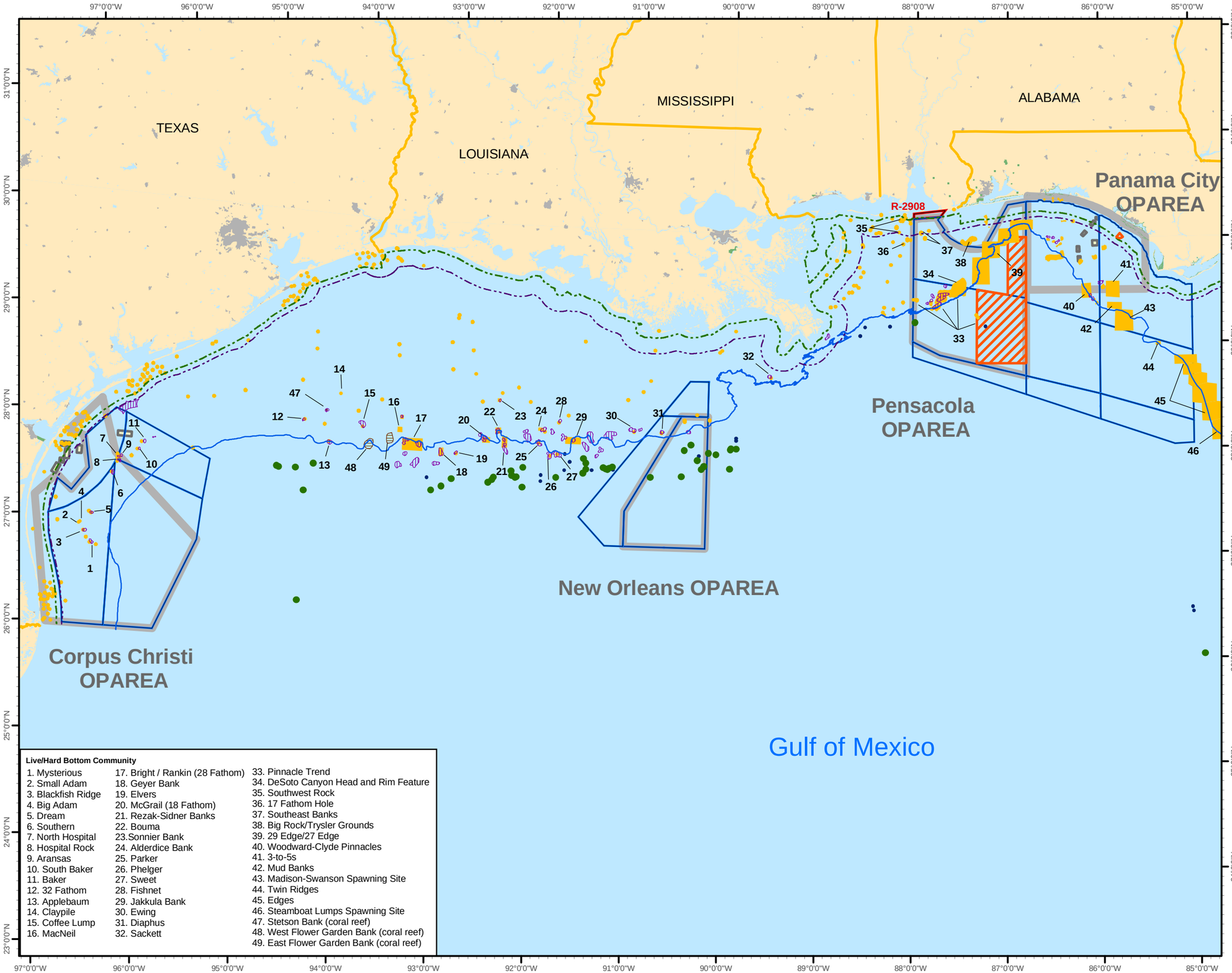
Benthic and Hard Bottom Communities within the GOMEX Study Area

Figure 3.6-2



Live/Hard Bottom Community

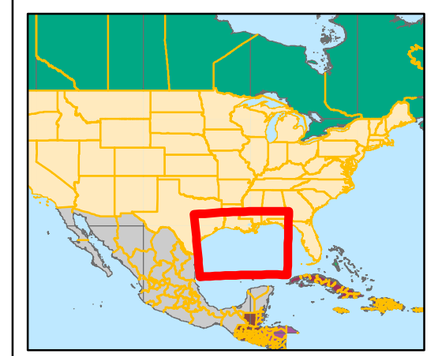
1. Mysterious
2. Small Adam
3. Blackfish Ridge
4. Big Adam
5. Dream
6. Southern
7. North Hospital
8. Hospital Rock
9. Aransas
10. South Baker
11. Baker
12. 32 Fathom
13. Applebaum
14. Claypile
15. Coffee Lump
16. MacNeil
17. Bright / Rankin (28 Fathom)
18. Geyer Bank
19. Elvers
20. McGrail (18 Fathom)
21. Rezak-Sidner Banks
22. Bouma
23. Sonnier Bank
24. Alderdice Bank
25. Parker
26. Phelger
27. Sweet
28. Fishnet
29. Jakkula Bank
30. Ewing
31. Diaphus
32. Sackett
33. Pinnacle Trend
34. DeSoto Canyon Head and Rim Feature
35. Southwest Rock
36. 17 Fathom Hole
37. Southeast Banks
38. Big Rock/Trysler Grounds
39. 29 Edge/27 Edge
40. Woodward-Clyde Pinnacles
41. 3-to-5s
42. Mud Banks
43. Madison-Swanson Spawning Site
44. Twin Ridges
45. Edges
46. Steamboat Lumps Spawning Site
47. Stetson Bank (coral reef)
48. West Flower Garden Bank (coral reef)
49. East Flower Garden Bank (coral reef)

Legend

- Deep Sea Corals
- Live Hard Bottom Community
- Chemosynthetic Communities
- State Seaward Extent
  - *TX & FL 9 nm; AL, MS & LA 3 nm*
- 12 nm U. S. Territorial Sea Limit
- Shelf Break
- Live Hard Bottom Community
- Coral Reefs
- Hard Bottoms
- Seagrass
- Eastern GOMEX BOMBEX HotBox

Special Use Airspace

- Restricted Airspace (R-)
- Warning Areas (W)
- Panama City Existing MINEX Boxes
  - *No Action Alternative*
- Corpus Christi MINEX Boxes
- Operating Areas (OPAREA)



N

1:3,900,000

25 12.5 0 25 50 75 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)
Sources:
National Geospatial Intelligence Agency (NGA) Database;
Special Use Airspace Document AP/1A;
COMLANTFLT 3120.26E Document.
Locations of hard bottom substrate and benthic communities such as coral reefs, seagrass beds, worm and vermetid reefs, and live/hard bottom in the GOMEX study area. Known large-scale regions of live/hard bottom communities are depicted here.
Source data/maps scanned/information: refer to Table 4-1.

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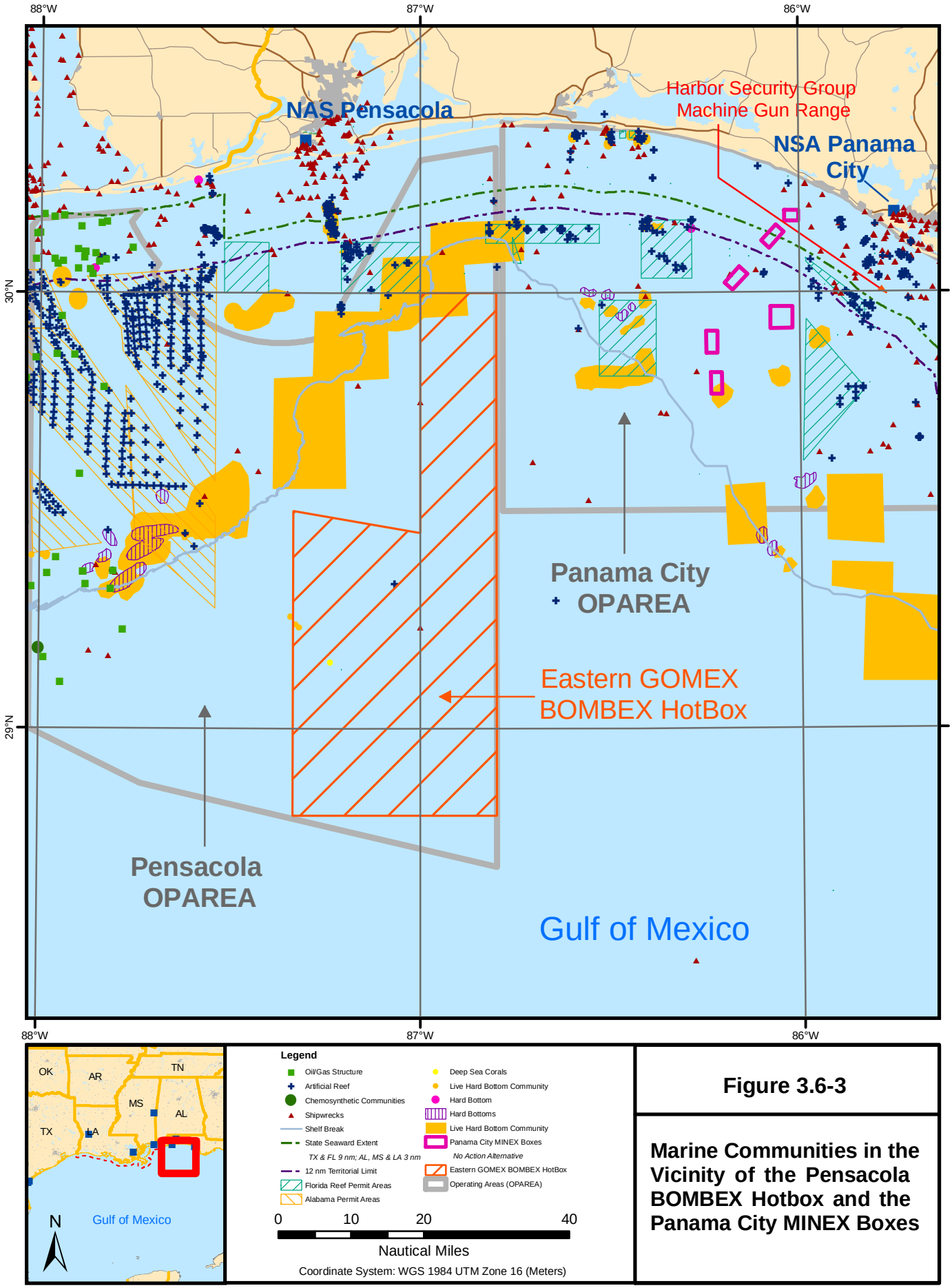

Figure 3.6-3

Marine Communities in the Vicinity of the Pensacola BOMBEX Hotbox and the Panama City MINEX Boxes

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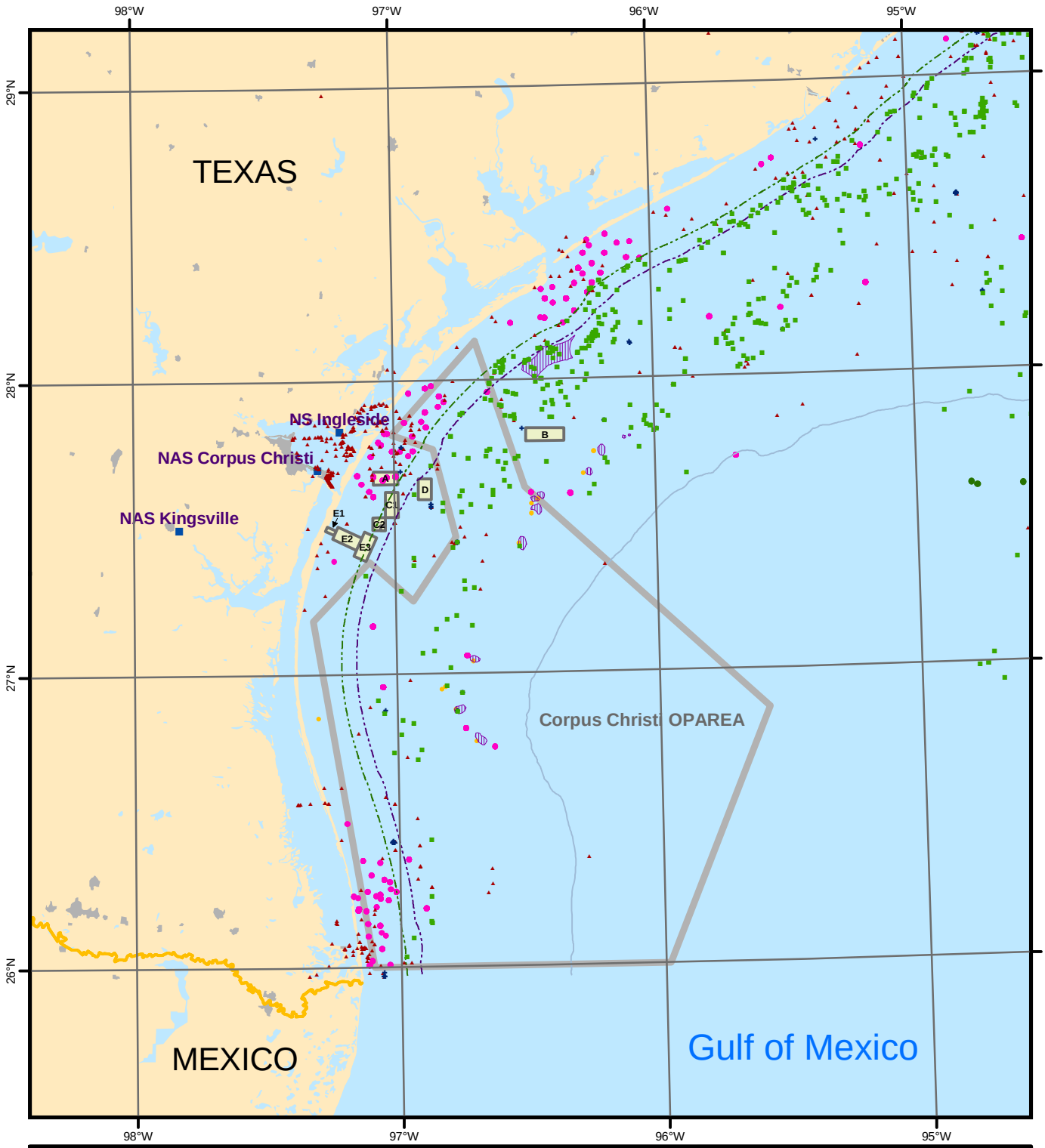

Legend

- Oil/Gas Structure
- Artificial Reef
- Chemosynthetic Communities
- Shipwrecks
- Shelf Break
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Live Hard Bottom Community
- Hard Bottom
- Hard Bottoms
- Live Hard Bottom Community
- Corpus Christi MINEX Boxes
- Operating Areas (OPAREA)

0 10 20 40 60

Nautical Miles

Coordinate System: WGS 1984 UTM Zone 14 (Meters)

Figure 3.6-4

Marine Communities in the Vicinity of the Corpus Christi MINEX Boxes

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Chemosynthetic Communities

Chemosynthetic communities are persistent, deep-sea aggregations of bacteria, sessile tubeworms, epibenthic and infaunal clams, and mussels. These communities are unusual because they use a carbon source for sustenance that is independent of sunlight and photosynthesis (MacDonald, 1992). Chemoautotrophic bacteria (usually symbionts) are the basis of these deep-sea trophic systems; chemosynthetic bacteria and their byproducts (carbon) support thriving assemblages of sessile invertebrates through symbiosis (MacDonald *et al.*, 1990). Chemosynthesis is a microbial pathway that generates organic carbon, in the absence of light, by use of energy from chemical reactions. Chemosynthetic communities typically occur where cracks in the seafloor form seeps that concentrate certain inorganic reducing compounds on the seafloor (bottom depths >1,300 feet) for utilization by opportunistic benthic biota. Hot water seeping from the subsurface transports methane, hydrogen sulfide, and organic matter to the sediment surface where chemosynthetic bacteria metabolize these compounds (Kennicut *et al.*, 1988; MacDonald, 2001).

Chemosynthetic fauna have been collected or observed at 43 locations on the continental slope south of Texas, Louisiana, and Alabama between 88°W and 95°W, in waters with a bottom depth as shallow as 950 feet and as deep as 7,200 feet (MacDonald, 2001; MMS, 2002a). This geographic and bathymetric range represents the limits of exploration to date, not necessarily the extent of the zoogeographic range. Chemosynthetic communities have not been documented on the continental shelf (MMS, 2002a).

Chemosynthetic communities have been documented at eight sites within the New Orleans OPAREA in water depths ranging from 1,400 to 3,400 feet (MMS, 2002a) (Figure 3.6-2). The densest aggregations of chemosynthetic organisms are located west of the New Orleans OPAREA at the Bush Hill site (1,600 feet) (Brooks *et al.*, 1989). Tube worms, clams, and mussels have been reported from the Viosca Knoll site south of Mobile, Alabama in waters with bottom depths ranging between 1,410 and 1,560 feet (MacDonald, 1992; MMS, 2002a). The macrofauna recorded for this Florida Escarpment first chemosynthetic site includes a seep mussel and vestimentiferan tubeworm (USAF, 1997a).

3.6.2.3 Artificial Habitats

Artificial habitats (human-made structures such as artificial reefs, shipwrecks, and oil/gas structures) represent physical alterations to the seafloor. Under the right conditions, these types of artificial habitats can benefit benthic communities and onshore economies. The benefits experienced by marine biological communities increase with time. When solid hard objects with numerous and varied surfaces are introduced to areas of the seafloor that are predominantly made up of soft sediments, they provide the appropriate substrates necessary for the settlement and colonization of epibenthic organisms such as algae, sponges, barnacles, soft corals, sea anemones, and hydroids among others (Bohnsack *et al.*, 1991). As more organisms assemble at an introduced site, an interrelated community develops, ultimately attracting larger predatory game fish that in turn bring recreational and commercial fishermen. The preservation of a successful artificial habitat can have a bearing on the biological productivity and economic value of offshore areas.

Although artificial in their origin and in their design, artificial reefs, shipwrecks, and other structures behave like natural hard bottom communities once established (Bohnsack *et al.*, 1991) and have been found to increase local biomass, attract a wide variety of demersal and pelagic fish, and locally increase the production of marine environment (CSA, 1997). Reef fish such as grouper, snapper, amberjack, and triggerfish, commonly aggregate around artificial habitats. Other fish such as grunts, porgies, and wrasses, also seek out artificial reef habitats for shelter and food (Smith, 1976). This is especially true of the red grouper, the most important commercial species off the west Florida coast, which aggregates around physical structures in offshore areas. The process of artificial reef and shipwreck colonization

and community building ultimately extends the potential range of some commercially and recreationally important fish and invertebrates by providing more habitat area. In addition to fish and invertebrates, sea turtles are attracted to these artificial habitats for food and shelter. Sea turtles forage for organisms that populate artificial reefs such as algae, anemones, sponges, and some crustaceans (Bjorndal, 1997). Chelonid sea turtles, notably loggerhead sea turtles, are associated with oil and gas platforms in the north-central GOMEX (Lohoefener *et al.*, 1990). Top ocean predators are also attracted to artificial reefs, shipwrecks, and other structures to feed on the aggregation of prey.

Unlike artificial reefs and shipwrecks that are deployed on the seafloor, other man-made structures (oil/gas structures and fish aggregating devices [FAD]) are anchored on the bottom and/or suspended throughout the water column and also function as artificial habitats. Offshore oil/gas structures, with their associated encrusting organisms and associated motile invertebrate fauna, provide food and shelter for numerous fish species (Hastings *et al.*, 1976; Sonnier *et al.*, 1976). FADs are also effective in attracting fish, predominately pelagic species (Bohnsack *et al.*, 1991). Artificial habitats, including oil/gas platforms and FADs, enhance fish aggregation and production (Seaman and Sprague, 1991).

Artificial Reefs

An artificial reef consists of one or more submerged structures of natural or human origin that is deployed purposefully on the seabed to influence the physical, biological, or socioeconomic processes related to living marine resources (Baine, 2001). Artificial reefs are defined physically by the design and arrangement of materials used in construction as well as functionally according to their purpose (Seaman and Jensen, 2000). A large number of items can and have been used for the creation of artificial reefs. Materials can include natural objects such as wood (weighted tree trunks), shells, and quarry rock or man-made objects like vehicles (automobile bodies, railroad cars, and Sherman tanks), aircraft, steel-hulled vessels (Liberty ships, landing ship tanks, barges, and tug boats), home appliances, discarded construction materials (concrete culverts), scrap vehicle tires, oil/gas platforms, ash byproducts (solid municipal incineration, and coal/oil combustion), and prefabricated concrete structures (reef balls) (Artificial Reef Subcommittee, 1997). Artificial reefs are deployed in the marine environment to enhance commercial fishery production/harvest and recreational activities (fishing, scuba diving, and tourism), to restore/enhance water and habitat quality, to provide habitat protection and aquaculture production sites, and to control fish mortality (Seaman and Jensen, 2000).

In 1984, the U.S. Congress, as it recognized the social and economic value in developing artificial reefs, passed the National Fishing Enhancement Act (NFEA) (Title II of PL 98-623). One of the primary directives of the NFEA was the preparation of a long-term National Artificial Reef Plan (NARP). Section 202 of the Act recognized the harmful effects of overfishing on fishery resources and proposed that properly designed, constructed, and located artificial reefs could enhance the habitat and diversity of these fishery resources. The NARP, which was updated in 2007 (NMFS, 2002e), was implemented in November 1985 to provide guidance and/or criteria on various aspects of artificial reef use, including types of construction materials and planning, citing, designing, permitting, installing, maintaining, and managing artificial reefs (Gordon, 1993).

In Texas, the Artificial Reef Act of 1989 directed the Texas Parks and Wildlife Department (TPWD) to promote and enhance artificial reef potential off the coast of Texas. The TPWD developed the Texas Artificial Plan, adopted by the Parks and Wildlife Commission on November 8, 1990 (TPWD, 2004). The reef program is guided by the Plan and by recommendations from a citizen-based Artificial Reef Advisory Committee. To date, the Texas Artificial Reef Program has permitted 74 former oil and gas structures, plus other materials, to be sunk at 49 reef sites. This includes 17 near-shore reefs to enhance fishing and diving opportunities. Reef materials at these near-shore sites include 12 Liberty ships (sunk as part of the U.S. Maritime Administration Fish Reef Program between 1973 and 1976), an obsolete

tugboat, a Navy YR-Barge, 44 concrete culverts, a welded pipe structure, 123 natural quarry rocks, 132 concrete reef balls, and 300 coal combination fly ash blocks (TPWD, 2004).

In response to the NFEA, the Louisiana Artificial Reef Initiative (LARI) developed an artificial reef program that was enacted in 1986 as the Louisiana Fishing Enhancement Act (Act 100). Subsequently, an artificial reef plan was written that contained the rationale and guidelines for implementation/maintenance of artificial reefs under the auspices of the Louisiana Department of Wildlife and Fisheries (Wilson *et al*., 1987). The LARI has approved nine artificial reef-planning areas and six special artificial reef sites where artificial reef complexes can be sited (LDWF, 2004). These artificial reef complexes are established on the basis of the best available information regarding bottom type, currents, bathymetry, and other factors affecting performance and productivity of reefs. Retired oil and gas structures are the primary materials used for Louisiana artificial reefs (MMS, 2002a; LDWF, 2004). Other materials, such as armored personal carriers, have been occasionally deployed in some planning areas along with the oil/gas structures (LDWF, 2004).

Efforts to deploy artificial reefs in Mississippi began in the early 1960s, when charter boat operators and recreational fishermen constructed a car-body reef site (MDMR, 2001). In 1972, the Mississippi Marine Conservation Commission (now the Mississippi Department of Marine Resources) acquired five surplus Liberty ships to create an artificial reef complex that was completed in 1978. Excess funds from this project and the reef permits were transferred to the Mississippi Gulf Fishing Banks, Inc. This private reef-building organization of conservationists, charter boat operators, and recreational fishermen is responsible for the creation of Mississippi's reef sites since that time. Mississippi's artificial reef sites have active permits which allow suitable material to be deployed in these areas when materials become available. As of May 2008, Mississippi had 53 nearshore artificial reefs and 15 "offshore" artificial reef sites (MDMR, 2009). The majority of offshore artificial reefs are located 10 to 15 miles from the shore (MMS, 2001).

Alabama was the first state in the nation to organize an artificial reef program (GMFMC, 1998). Efforts to deploy an artificial reef began in 1953 with the placement of 250 automobile bodies in water depths of 65 to 100 feet offshore of Baldwin County. The Alabama Department of Conservation and Natural Resources is the state agency responsible for the artificial reef program. It has been estimated that over 20,000 artificial reefs exist in waters off Alabama along with five general permit areas (ADCNR, 2004). Alabama's artificial reef permit areas encompass approximately 1,200 square miles off Baldwin and Mobile counties. The Oriskany Aircraft Carrier, which was recently sunk off the shores of Alabama, is the largest ship ever used for an artificial reef.

Florida's first artificial reef site was permitted in November 1918. The first recorded artificial reef in the GOMEX was established in 1932, off Gulf County, Florida (CSA, 1997). A rapid proliferation of artificial reef sites off Florida began in 1980. As of 1997, 274 permitted reef sites were reported in waters off Florida's west coast. Almost 499 separate deployments of artificial reefs have been recorded within these permitted sites. For the past 20 years, Florida's artificial reef program has been a cooperative effort of local governments and state agencies with additional input provided by non-governmental fishing and diving interests. The Florida Fish and Wildlife Conservation Commission, Division of Marine Fisheries manages Florida's artificial reef program.

Artificial reefs within the GOMEX Study Area are shown on Figure 3.6-5.

Shipwrecks

Shipwrecks in the GOMEX are the result of navigational hazards (storms, reefs, and/or shoals), human errors (nautical equipment breakdowns, fire/explosions, strandings, foundering, groundings, and collisions), and intentional sinking (armed conflicts [Civil War, World War II] and as artificial reefs)

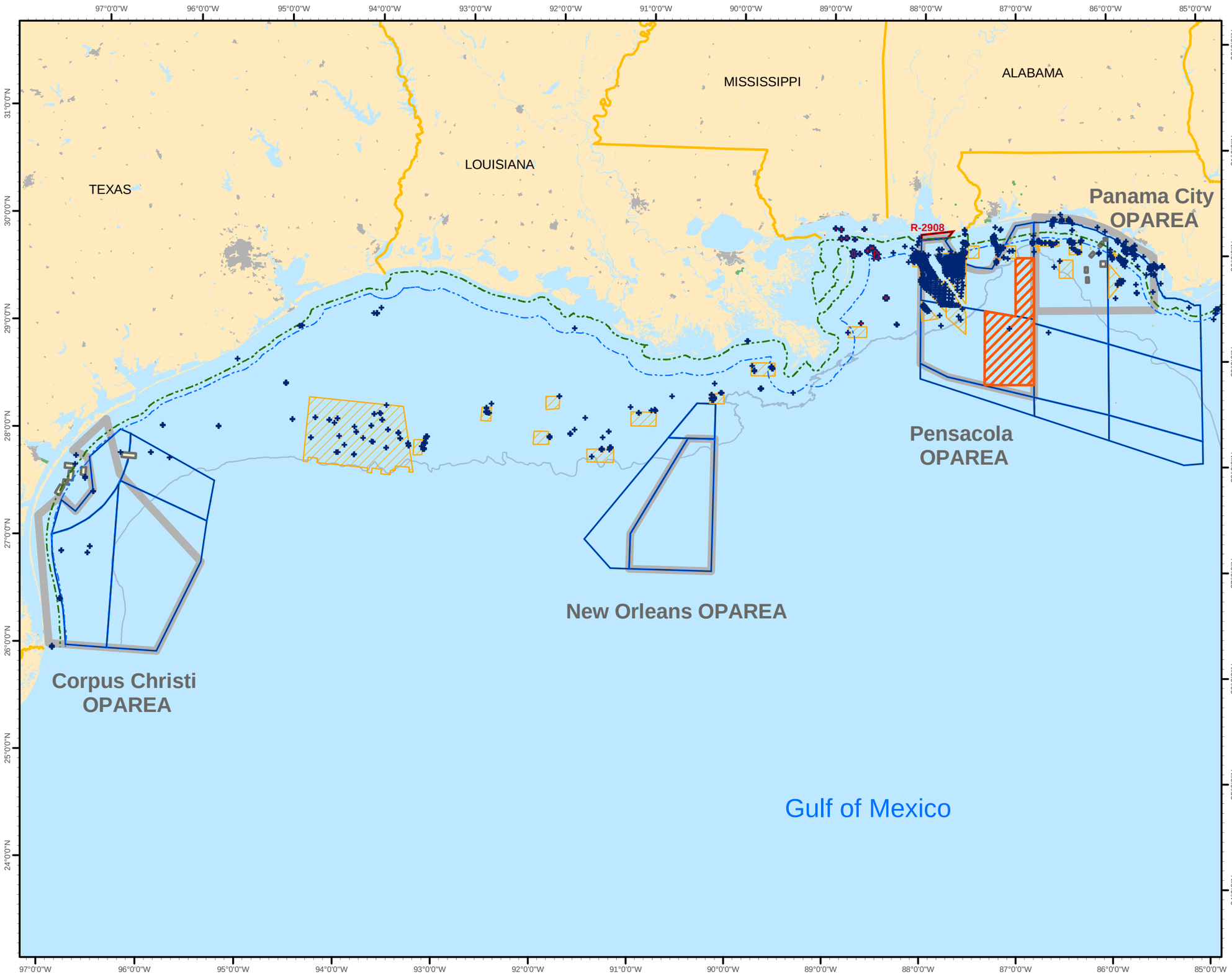
(Smith *et al.*, 1997; Pearson *et al.*, 2003). Over 400 ships have sunk on the outer continental shelf of the GOMEX since the period of Spanish exploration (fifteenth century) until the modern age of shipping and commerce (MMS, 2002a, 2002b). Thousands more have sunk closer to shore in state waters during the same time period. Archeological studies of the northern GOMEX found that two-thirds of the total number of shipwrecks lie within one mile of the shoreline, with the remaining number between 1 and 6 miles of the coast (USAF, 1997b; MMS, 2002a, 2002b). Changes in the late nineteenth and early twentieth century sailing routes increased the frequency of shipwrecks in the eastern Gulf of Mexico to nearly double those that occurred in the western and central GOMEX (MMS, 2001). Approximately 3,500 potential shipwreck locations in the Gulf of Mexico have been identified; many are known only through historic records and do not have coordinates (USAF, 1997b; MMS, 2002a).The most well known shipwrecks in the GOMEX come from a more recent time period (1800s and 1900s) (MMS, 2002b) (Figure 3.6-6). Shipwrecks of the sixteenth through the eighteenth centuries are less known because documentation of their exact locations is rarely accurate (*e.g.*, Padre Island Spanish shipwrecks of 1554, 1784 *El Cazador* site off Grand Isle, Louisiana) (MMS, 2002a, 2002b; TSHA, 2002).

Twenty-eight Confederate blockade-runners as well as Union and Confederate vessels were casualties of the Civil War, with most vessels being sunk in Florida state waters (*e.g.*, *Spitfire*, *Mary Jane*) (Singer, 1998), with the exception of the *U.S.S. Hatteras*, which was sunk by the *CSS Alabama* off Galveston, Texas (MMS, 2002b). Nineteenth century merchant side-wheel steamships also contributed to the list of vessels that foundered in the Gulf of Mexico (*e.g.*, *Josephine* off the barrier islands of Mississippi; *New York* off Galveston, Texas) (Smith *et al.*, 1997; Singer, 1998; MMS, 2002b).

During World War II (1942 and 1943) German submarines cruised the Gulf, seeking to disrupt the vital flow of oil carried by tankers from ports in Texas and Louisiana (MMS, 2002a). The Germans sank a total of 56 vessels; 39 of which are now believed to be located in state or federal waters off Texas, Louisiana, and Florida (MMS, 2002a, 2002b). The U-166 was the only German submarine sunk in the Gulf. It lies in 5,000 feet of water 52 miles from the mouth of the Mississippi River along with its victim, the passenger freighter S.S. *Robert E. Lee* (MMS, 2002a). Other historic as well as World War II shipwrecks (*e.g.*, steam yacht *Anona*) have been discovered at depths ranging from 2,650 feet to greater than 5,000 feet (MMS, 2002b).

Oil and Gas Structures

Since the first oil and gas structure was placed off the Louisiana coast in 1947, the largest artificial habitat complex in the world began across the continental shelf of the northern GOMEX (Bull and Kendall, 1994). Scientific investigations from the mid-1970s to the present have documented the utilization of both existing (standing) and retired (toppled/partially removed) oil/gas structures in attracting a diverse and abundant biota (Stanley and Wilson, 2003). In the northern GOMEX, oil and gas structures are an important component of the commercial and recreational fishing industries (Hastings *et al.*, 1976; Stanley and Wilson, 1989), contributing available habitat for reef fish (Rademacher and Render, 2002), coastal/oceanic species (CSA, 1997), and ichthyoplankton assemblages (Hernandez *et al.*, 2002). Utilizing deep water (1,000 to 5,000 feet) oil/gas structures as FADs is currently being investigated as an attractant for highly migratory and coastal pelagic fish species (Hueter and Childs, 2001; Edwards *et al.*, 2002). In addition to influencing fishery resources (Bull and Kendall, 1994), the 4,035 oil/gas structures also provide an increase in the hard substrate area (estimated 4.7 square miles) to an ecosystem dominated by a mud/sand substrate (Parker *et al.*, 1983). The additional hard substrate provided by the oil and gas structures acting as de facto artificial reefs increases the amount of hard bottom habitat by 4.1 percent from Destin, Florida to Brownsville, Texas. Off Louisiana, the contribution is greater, as the 3,600 oil and gas structures off the coast provide an estimated 4.2 square miles of habitat (Stanley and Wilson, 2003).



Artificial Reefs
within the GOMEX Study Area

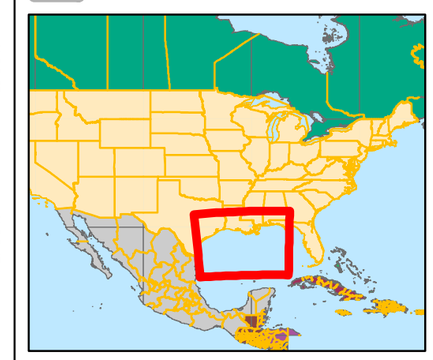
Figure 3.6-5

Legend

- Artificial Reef
- Shelf Break
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Artificial Reef Fish Haven
- Artificial Reef Permit Area
- Panama City Existing MINEX Boxes
  No Action Alternative
- Corpus Christi MINEX Boxes

Special Use Airspace

- Restricted Airspace (R-)
- Warning Areas (W)
- Eastern GOMEX BOMBEX HotBox
- Operating Areas (OPAREA)



N

1:3,882,792

25 12.5 0 25 50 75 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources: National Geospatial Intelligence Agency (NGA) Database;Special Use Airspace Document AP/1A; COMLANTFLT 3120.26E Document.
Artificial reefs, fish havens, and artificial reef permit-areas located in the GOMEX study area. Source data: TPWD (1999, 2003), MDMR (2001, 2003), FFWCC (2004, 2005), ACNR-MRD (2005a, 2005b), and LDWF (2005).
Source map (scanned): Wilson et al. (1987).

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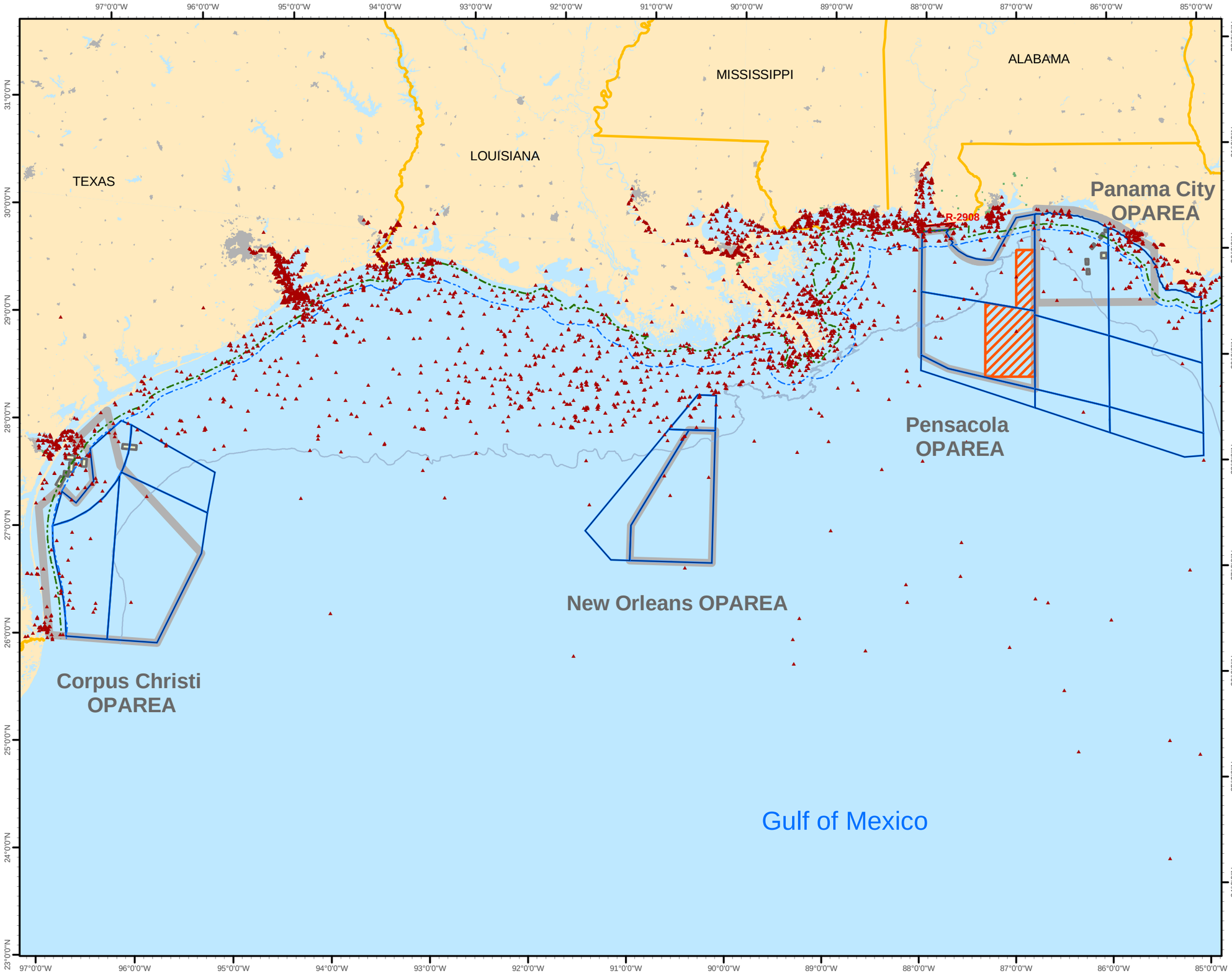


Known Shipwrecks
within the GOMEX Study Area

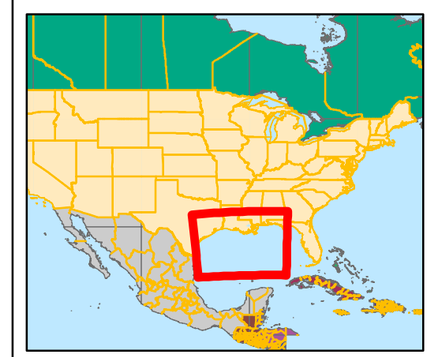
Figure 3.6-6

Legend

- Shipwrecks
- Shelf Break
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit

Special Use Airspace

- Restricted Airspace (R-)
- Warning Areas (W)
- Eastern GOMEX BOMBEX HotBox
- Corpus Christi MINEX Boxes
- Panama City Existing MINEX Boxes
  No Action Alternative
- Operating Areas (OPAREA)



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25 12.5 0 25 50 75 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources:
National Geospatial Intelligence Agency (NGA) Database;
Special Use Airspace Document AP/1A;
COMLANTFLT 3120.26E Document.
Shipwreck locations in the GOMEX study area.
Source data: Veridian (2001).

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In recognition of the benefits of artificial reefs to marine fisheries in the northern GOMEX, Louisiana became the first state to support the "Rigs-to-Reef" (RTR) program, which utilized retired oil and gas structures (Wilson *et al.*, 1987). This program converts obsolete, nonproductive offshore oil and gas structures to designed artificial reefs (Dauterive, 2000). More than 4,000 offshore oil and gas structures exist in the northern GOMEX beyond state territorial waters, with 90 percent occurring off Louisiana and Texas alone. Historically, eight percent of the decommissioned oil and gas structures in the Gulf have been used in the RTR program (MMS, 2002a).

The use of obsolete oil and gas platforms for reefs has been highly successful. Their availability, design profile, durability, and stability provide a number of advantages over the use of traditional artificial reef materials. To capture this recyclable and valuable fish habitat, the states of Louisiana, Texas, and Mississippi in 1986, 1989, and 1999, respectively, signed legislation into law establishing RTR plans for their respective states (MMS, 2001). Currently, Alabama and Florida have no RTR legislation (MMS, 2001).

As of 1999, 144 of the 151 RTR donations were located off the coasts of Louisiana (94) and Texas (50). All of Louisiana's RTR structure donations are part of the state's artificial reef program. At present, there are no RTR sites off the Mississippi coast, four off the Alabama coast, and three off the coast of Florida (MMS, 2002a). In 1983, sections of a retired Marathon Oil Company platform were donated to the State of Alabama and sunk by the ADCNR approximately 28 miles offshore in 260 feet of water (MMS, 2002a). In 2000, the State of Alabama was permitted by the USACE to use a partially removed platform as an artificial reef (MMS, 2002a).

Oil and gas structures within the GOMEX Study Area are shown on Figure 3.6-7.

Fish Aggregating Devices

FADs consist of single or multiple floating structures (Seaman and Sprague, 1991) such as buoys connected to the ocean floor by ballast or anchors. The materials required for these structures include: nylon and polypropylene rope, concrete anchors, galvanized steel connectors, and floats made of ethylene vinyl acetate or synthetic rubber. These devices are designed to provide surface area at a designated height above the ocean's floor or below the ocean's surface (depending on the ocean depth at the location where the FADs are deployed). Usually prefabricated, FADs are designed to attract pelagic fish species (Klima and Wickham, 1971). Deployment can be in pre-arranged alleys (rows) or in random patterns (Beets, 1989; Rountree, 1989). Two fundamentally different oceanic and coastal FADs have become established in the U.S. since the 1970s: large floating FADs and small mid-water FADs. Large floating FADs have been successfully deployed in water depths up to 6,000 feet for pelagic commercial and recreational fisheries. Small mid-water FADs have been used for coastal (3 miles offshore) recreational fisheries in waters ranging in depths from 45 to 100 feet (Rountree, 1990). Incorporation of FADs in the vicinity of artificial reefs or attached to artificial reefs have been reported to improve catches of pelagic sport fish (Stephan and Lindquist, 1989) and demersal finfish (Kellison and Sedberry, 1998). Mississippi has used FADs as part of its artificial reef materials (MMS, 2002a).

3.6.2.4 Marine Protected Areas

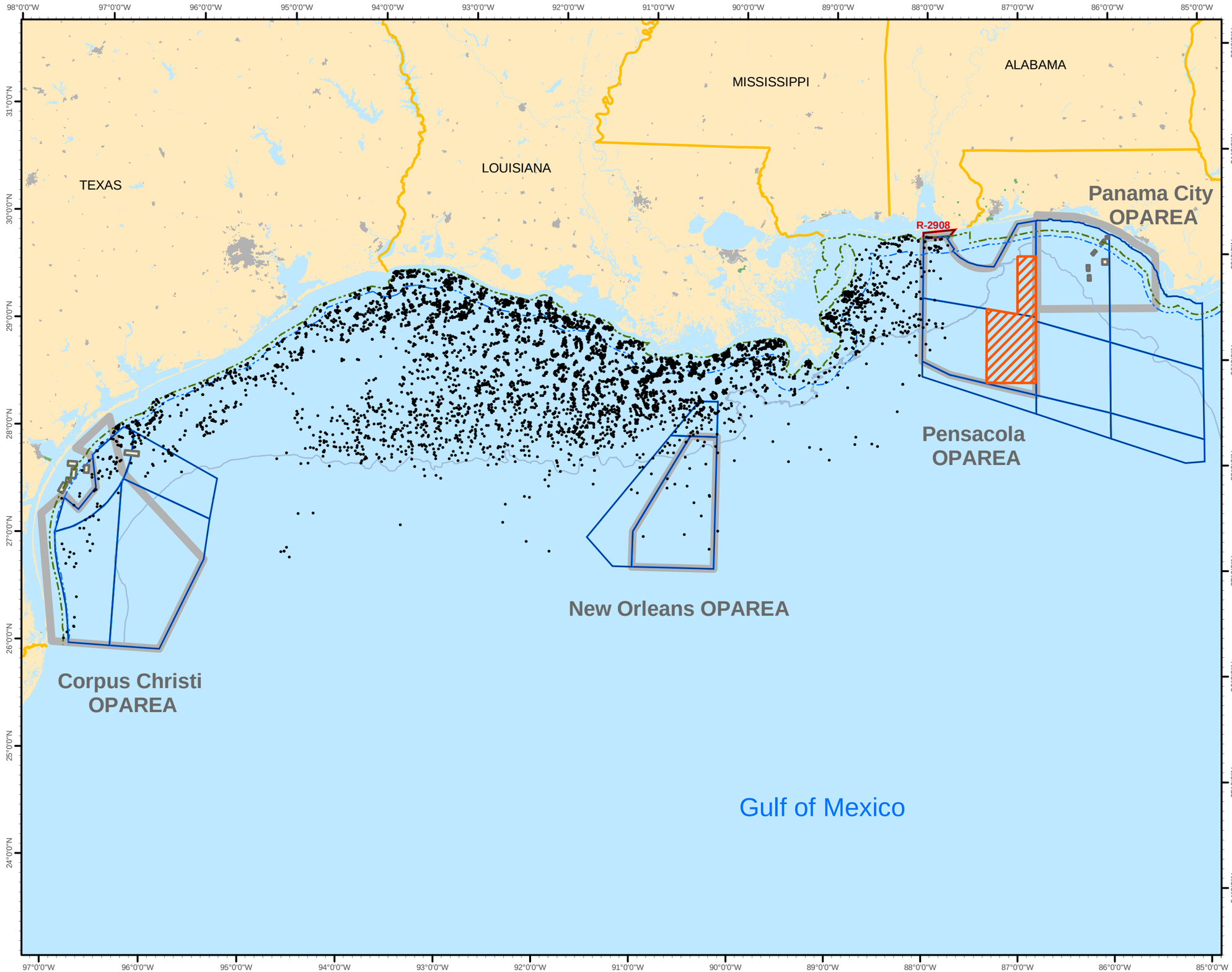
Marine protected areas (MPAs) are defined in EO 13158 *Marine Protected Areas* EO 13158 as "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." MPAs are designated and managed at all levels of government by a variety of agencies. They have been established by well over 100 legal authorities, with some federal and state agencies managing more than one MPA program, each with its own legal purpose. Similarly, the level of protection provided by these

MPAs ranges from fully protected or non-take marine reserves to sites allowing multiple uses. Examples of MPAs include National Marine Sanctuaries and National Wildlife Refuges (NMPAC, 2008).

Recognizing the significant role that MPAs play in conserving marine resources, EO 13158 calls for the development of a National System of Marine Protected Areas (national system). The National Marine Protected Areas Center, within NOAA's Office of Ocean and Coastal Resource Management, published a framework for the national system in November 2008 (NMPAC, 2008). This framework includes national system goals and priority conservation objectives; MPA eligibility criteria and other key definitions; and a process for MPAs to be included in the national system. An iterative process will be used to develop the National System of MPAs. Initially, existing MPAs that meet specified criteria and targeted conservation objectives will be included through the nomination and review process established in the framework. The framework also lays out the processes for identifying conservation gaps in the national system and developing recommendations for new or enhanced MPAs through collaborative ecosystem-based MPA. However, neither EO 13158 nor the framework provides authority to designate or establish new MPAs or alter protections afforded by existing MPAs. The first List of National System MPAs was published in April 2009 (NOAA, 2009).

Section 5 of EO 13158 calls for federal agencies to "avoid harm" to the natural and cultural resources protected by MPAs that become part of the national system. Specifically, EO 13158 stipulates, "each Federal agency whose actions affect the natural or cultural resources that are protected by MPAs shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA. In implementing this section, each federal agency shall refer to the MPAs identified under subsection 4(d) of this order."

Implementation of Section 5 is governed by existing authorities such as NEPA, Endangered Species Act, Marine Mammal Protection Act, and others. EO 13158 does not provide any new authority for any federal agency or the MPA Center to review activities of any other federal agency or alter standards for existing review. The thresholds and/or triggers for agency action under Section 5 are the same as those listed under any existing authority or authorities that normally require agency review of a proposed activity. Section 5 does, however, require agencies to ensure that their activities avoid harm to the natural and cultural resources as protected by the MPAs included in the national system (to the extent permitted by law and to the maximum extent practicable) when fulfilling their existing requirements for identifying, reviewing, and implementing activities. Pursuant to Section 5 of EO 13158, agency requirements apply only to the natural or cultural resources specifically afforded protection by the site as described on the List of National System MPAs. For example, within national system MPAs established for sustainable production, other resources not specifically protected by the MPA would not be subject to the "avoid harm" provision (NMPAC, 2008).



Oil and Gas Structures
within the GOMEX Study Area

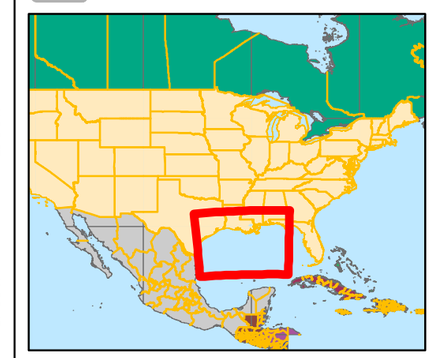
Figure 3.6-7

Legend

- Oil/Gas Structure
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Shelf Break
- Corpus Christi MINEX Boxes
- Panama City Existing MINEX Boxes
  No Action Alternative
- Eastern GOMEX BOMBEX HotBox

Special Use Airspace

- Restricted Airspace (R-)
- Warning Areas (W)
- Operating Areas (OPAREA)



N

1:3,882,792

25 12.5 0 25 50 75 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources:
National Geospatial Intelligence Agency (NGA) Database;
Special Use Airspace Document AP/1A;
COMLANTFLT 3120.26E Document.

Locations of oil and gas structures in the GOMEX study area. Source data: MMS (2006).

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Figure 3.6-8 shows 24 sites in the vicinity of the Study Area that are listed in the current MPA Inventory maintained by the National MPA Center. Of these, 14 are included on the official List of National System MPAs established in April 2009. The National System MPAs include 13 National Wildlife Refuges and the Flower Garden Banks National Marine Sanctuary. All of these National System MPAs are located outside of the GOMEX Study Area.

Flower Garden Banks National Marine Sanctuary

Flower Garden Banks National Marine Sanctuary, created in 1992, is located approximately 110 miles south of the Texas/Louisiana border. Measuring 42 nm^2 in area, the sanctuary includes three banks: East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank (NOAA, 2005b). The Flower Garden Banks harbors the northernmost coral reef ecosystem in the United States and serves as a major biological reservoir of Caribbean reef fish and invertebrate species. Stetson Bank, which was added to the Flower Garden Banks National Marine Sanctuary in 1996, is located mid-shelf, 30 miles northwest of the Flower Garden Banks (GulfBase, 2005). Water temperatures at Stetson Bank are a few degrees cooler in winter than at the Flower Garden Banks, which prevents coral reefs from thriving on the bank (GulfBase, 2005). Instead, sponge communities dominate the bank's fauna with scattered coral colonies (mainly fire corals) occurring; an extraordinary fish community occurs in the vicinity of Stetson Bank (Nipper *et al.*, 2005; TPWD, 2004). The Flower Garden Banks National Marine Sanctuary is located outside of the GOMEX Study Area, over 100 nm west of the New Orleans OPAREA and over 100 nm east of the Corpus Christi OPAREA (Figure 3.6-8).

Padre Islands National Seashore

Padre Island National Seashore, administered by the National Park Service is the longest remaining undeveloped stretch of barrier-island in the world. Encompassing 154 nm^2 of coastal habitat, it extends for 110 miles along southern-most Texas coast (NPS, 2005). Sea turtles, including the endangered Kemp's ridley and the threatened loggerhead, are known to nest on beaches throughout the seashore; thousands of neotropical migratory and shore birds, including the protected peregrine falcon and piping plover, also use the seashore's beaches as breeding, overwintering, or transitional habitats (NPS, 2005).

Gulf Islands National Seashore

Gulf Islands National Seashore, administered by the National Park Service, includes one 160-mile stretch of barrier islands and coastal mainland extending from Cat Island, Mississippi to the eastern tip of Santa Rosa Island, Florida (NPS, 2004). The seashore contains prehistoric shell mounds as well as fortifications dating from the 1820s to the 1940s. Federally listed sea turtles (loggerhead, green, Kemp's ridley, and leatherback) are known to nest on the seashore and endangered beach mice occur within the seashore boundaries of the Gulf Islands (Nicholas *et al.*, 1998; NPS, 2001). In 2004, large portions of Gulf Islands National Seashore experienced severe damage from Hurricane Ivan (NPS, 2004).

USFWS National Wildlife Refuges

The National Wildlife Refuge System, managed by USFWS, includes more than 176,900 nm^2, 550 national wildlife refuges (NWR) and other units of the refuge system, plus 37 wetland management districts. The National Wildlife Refuge System is responsible for 180 refuges with coastal, island, ocean or Great Lakes conservation responsibilities. The refuge system encompasses all types of habitat, including 180 refuges with coastal, island, ocean, or Great Lakes conservation responsibilities. These NWRs provide habitat for numerous species, including some endangered species that occur in the Study Area, such as the West Indian manatee and sea turtles (*i.e.*, Kemp's ridley). The refuge system also contains nearly 3,500 nm^2 of coral reefs and adjacent ocean habitat (USFWS, 2009).

A representative NWR is Bon Secour NWR in Alabama Endangered species such as sea turtles (*i.e.*, Kemp's ridley) and the Alabama beach mouse, occur in Bon Secour NWR, which is also a resting point for neotropical birds during their annual migration (USFWS, 2009b).

National Estuarine Research Reserves

The National Estuarine Research Reserve System (NERRS) is a partnership between the NOAA and the coastal states. The system is currently a network of 27 reserves, consisting of relatively pristine estuarine areas that contain key habitat and are protected from significant ecological change or developmental impacts (NERRS, 2005). The reserves provide reference sites for research, monitoring, and educational programs that focus on functional estuarine ecosystems. NERRs include a variety of rare, endangered, and threatened species. The DoD is not exempt from any NERR regulations (15 CFR 921).

Four NERRs are located in the general vicinity of the Study Area: Apalachicola, Weeks Bay, Mission-Aransas, and Grand Bay (Figure 3.6-8). The largest of the four existing NERRs, Apalachicola, located in the Panhandle of Florida, includes two barrier islands and a portion of a third barrier island, and encompasses nearly 272 nm^2 (NOAA and DoI, 2005). The reserve also includes the lower 52 miles of the Apalachicola River and its associated floodplain, small portions of adjoining uplands, and the Apalachicola Bay system. Lying on the fringe of the Mississippi Flyway, the reserve and surrounding drainage basin are among the most important bird habitats in the southeastern United States. The Apalachicola River drainage basin has the highest diversity of reptiles and amphibians in North America (north of Mexico) (NERRS, 2004). Four species of threatened or endangered sea turtles (loggerhead, green, Kemp's ridley, and leatherback) have been reported there (FDEP, 2004).

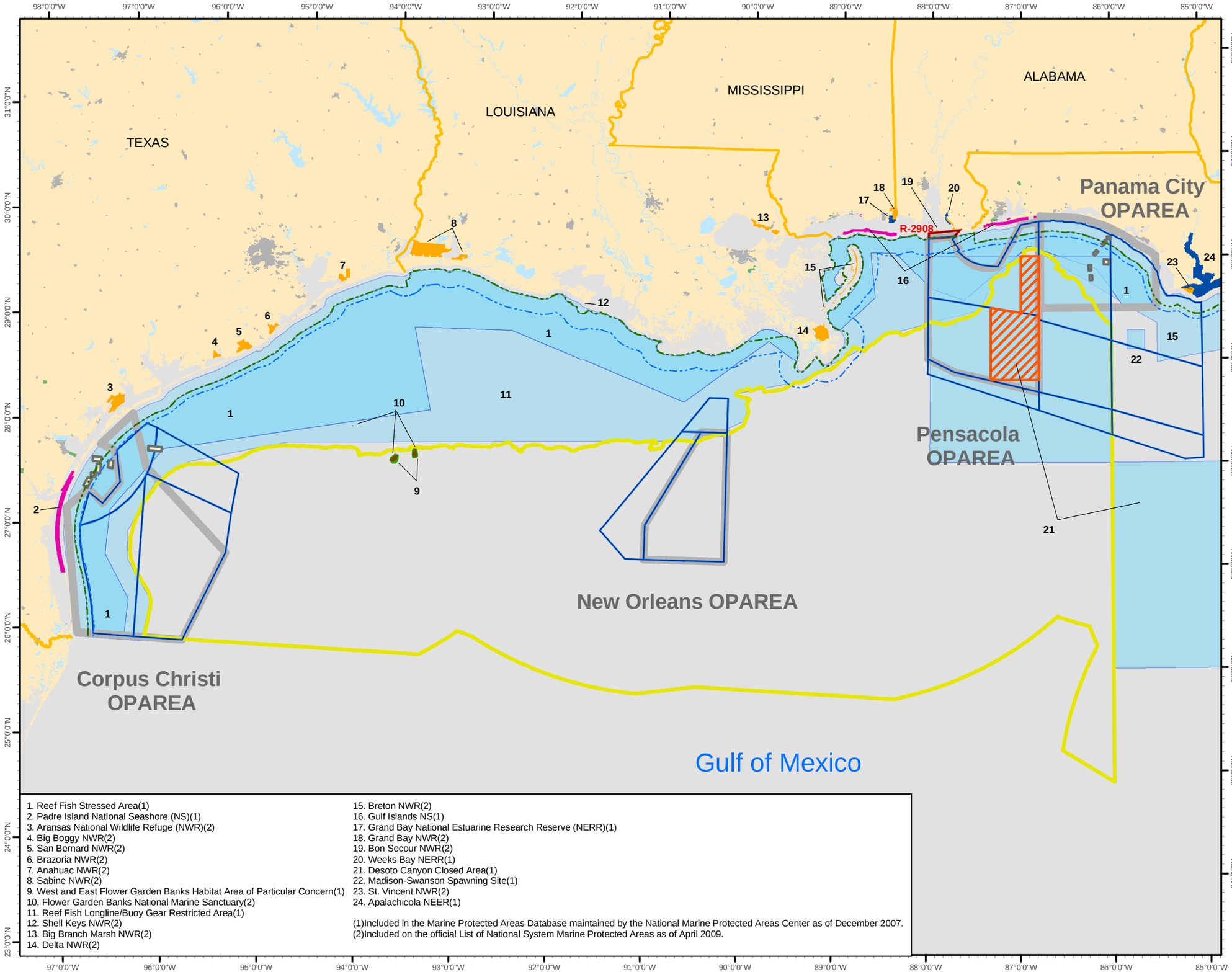
3.6.3 Environmental Consequences

3.6.3.1 No Action Alternative

Vessel Movements

Many of the ongoing and proposed activities within the GOMEX Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Currently, the number of Navy vessels operating in the GOMEX Study Area at any one time varies depending on the OPAREA and the training exercise being conducted. Ship sizes range from 362 feet for a nuclear submarine (SSN) to 1,092 feet for a nuclear powered aircraft carrier (CVN). During training speeds generally range from 10 to 14 knots (kts), but can be faster (see Section 3.7.3.3 for additional information). Training involving vessel movements occur intermittently and are variable in duration, ranging from a few hours to several weeks for major range events. These activities are widely dispersed throughout the GOMEX Study Area and may occur within any or all of the four OPAREAs at any time of the year. They range from typical exercises involving one or more warfare areas to major range events that consist of Navy and other allied forces using aspects of all warfare areas and the integration of surface, subsurface and air units. Consequently, the density of ships within the GOMEX Study Area at any given time varies and is dependent on the activity. The Navy would log about 180 total vessel steaming days in the Study Area during a typical year under the No Action Alternative (Table 2.2-7).

Vessel movements would have no direct effect on benthic communities or artificial habitats because Navy vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats. Vessel movements would result in short-term and localized disturbances to water column and *Sargassum* habitats. Phytoplankton, zooplankton, and ichthyoplankton in the upper portions of the water column could be displaced, injured, or killed by vessel and propeller movements. However, no measurable effects on plankton populations would occur because the number of organisms exposed to



1. Reef Fish Stressed Area(1)
2. Padre Island National Seashore (NS)(1)
3. Aransas National Wildlife Refuge (NWR)(2)
4. Big Boggy NWR(2)
5. San Bernard NWR(2)
6. Brazoria NWR(2)
7. Anahuac NWR(2)
8. Sabine NWR(2)
9. West and East Flower Garden Banks Habitat Area of Particular Concern(1)
10. Flower Garden Banks National Marine Sanctuary(2)
11. Reef Fish Longline/Buoy Gear Restricted Area(1)
12. Shell Keys NWR(2)
13. Big Branch Marsh NWR(2)
14. Delta NWR(2)
15. Breton NWR(2)
16. Gulf Islands NS(1)
17. Grand Bay National Estuarine Research Reserve (NERR)(1)
18. Grand Bay NWR(2)
19. Bon Secour NWR(2)
20. Weeks Bay NERR(1)
21. Desoto Canyon Closed Area(1)
22. Madison-Swanson Spawning Site(1)
23. St. Vincent NWR(2)
24. Apalachicola NEER(1)

(1)Included in the Marine Protected Areas Database maintained by the National Marine Protected Areas Center as of December 2007.
(2)Included on the official List of National System Marine Protected Areas as of April 2009.

Marine Protected Areas in the Vicinity the GOMEX Study Area

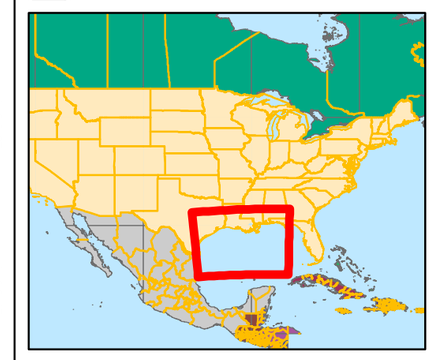
Figure 3.6-8

Legend

- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Bluefin Tuna Habitat Area of Particular Concern (HAPC)
- National Estuarine Research Reserve (NERR)
- National Marine Sanctuary (NMS)
- National Park System
- National Wildlife Refuge (NWR)
- Fisheries Habitat Conservation Zone (FHCZ)
- Fisheries Management Zone (FMZ)
- Corpus Christi MINEX Boxes
- Panama City Existing MINEX Boxes
  No Action Alternative
- Eastern GOMEX BOMBEX HotBox

Special Use Airspace

- Restricted Airspace (R-)
- Warning Areas (W)
- Operating Areas (OPAREA)



N

1:3,975,000

25 12.5 0 25 50 75 Nautical Miles

50 25 0 50 100 150 Kilometers

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources: National Geospatial Intelligence Agency (NGA) Database;Special Use Airspace Document AP/1A; COMLANTFLT 3120.26E Document.
Currently designated marine managed areas found in or adjacent to the GOMEX study area. Source data: NOAA and DoI (2005c).
Source map (scanned): Wilson et al. (1987).

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vessel movements would be low relative to total plankton biomass. The Navy's General Maritme Measures (Section 5.5) include monitoring for floating weeds, algal mats, and *Sargassum* rafts while ships are underway. Increased vigilance in watching for sea turtles and marine mammals is taken where these resources are present and avoidance measures are taken when possible. Vessel movements in territorial waters would have no significant impact on marine communities under the No Action Alternative. Similarly, in accordance with EO 12114, vessel movements in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Aircraft Overflights

Various types of fixed-wing aircraft and helicopters are used in training exercises throughout the Study Area (see Chapter 2 and Appendix D). These aircraft overflights would produce airborne noise and some of this energy would be transmitted into the water. The potential effects of aircraft noise on various marine community components are analyzed in detailed in Sections 3.7 – Marine Mammals, 3.8 – Sea Turtles, and 3.9 – Fish and Essential Fish Habitat. Based on the analyses presented in those sections, aircraft overflights over territorial waters would, in accordance with NEPA, have no significant impact on marine communities under the No Action Alternative. Further, in accordance with EO 12114, aircraft overflights over non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Non-Explosive Practice Munitions

Current Navy operations in the GOMEX Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, naval gunshells, cannon shells, and small caliber ammunition. NEPM use in the Gulf of Mexico is limited to W-151 A/B/C and the Harbor Security Group Machine Gun Area (Panama City OPAREA); W-155 A/B (Pensacola OPAREA); and MINEX Box E3 (Corpus Christi OPAREA). NEPM is not used in the New Orleans OPAREA (see Table 2.2-8 for a summary of ordnance use by training area).

NEPM and associated fragments have the potential to directly strike marine life and marine habitats as it travels through the water column and comes in contact with the sea floor. The potential effects of direct NEPM strikes at or near the sea surface and within the water column are analyzed in Sections 3.7.3 – Marine Mammals, Section 3.8.3 - Sea Turtles, and Section 3.9.3 – Fish and Essential Fish Habitat. This section analyzes the potential effects of NEPM strikes on benthic communities and artificial habitats.

The potential for NEPM strikes to adversely affect benthic communities depends on several factors, including the size and speed of the ordnance, water depth, the number of rounds delivered, the frequency of training, and the presence/absence of sensitive benthic communities. As described in Section 3.6.2.2, both soft bottom and hard bottom communities occur in the portions of the Study Area where NEPM use occurs. While a broad area of soft and hard bottom benthic habitat could be exposed to direct ordnance strikes, the training exercises are intermittent and widely dispersed, which decreases the likelihood that a given area would be subjected to repeated exposure. Most ordnance firing occurs in areas well offshore in waters over 30 m deep. NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, NEPM strikes would cause little or no physical damage to soft bottom benthic habitat and any damage would be localized.

Live hard bottom habitats would be vulnerable to damage from NEPM strikes. This is particularly true for areas that support coral because coral is fragile and could be easily broken by contact with larger objects such as non-explosive practice bombs. While large coral reefs are not known to occur in the Study Area, some hard bottom areas could support patches of coral. Repopulation and recovery of damaged hard bottom habitats would be relatively slow (*e.g.*, years to a decade or more) compared to soft bottom areas (*e.g.*, less than one year) (NRC, 2002).

Large, heavy items such as non-explosive practice bombs and naval gun shells (Table 3.6-2) could cause damage if they struck sensitive hard bottom habitat. Small caliber ammunition has little potential to disturb the bottom because these materials are relatively small and light and their velocity would decrease through the water column. A total of 180 non-explosive practice bombs would be dropped per year in W-151A/C and W-155B under the No Action Alternative. Assuming an even distribution within these areas, the relative concentration of non-explosive practice bombs would be 0.026/nm^2/year. Actual concentrations would vary based on specific training scenarios, but would nonetheless be extremely low. A total of 1,240 non-explosive naval gun shells (5 in and 76 mm) would be fired per year under the No Action Alternative in W-151A/B and W-155A.

The maximum area of benthic habitat affected by non-explosive practice bomb and naval gun shell strikes would be approximately 2,780 ft^2 (0.00008 nm^2) per year or 27,800 ft^2 (0.0008 nm^2) over a ten-year period for the No Action Alternative, assuming that the area affected by a single NEPM would be two times its footprint (Table 3.6-3).

TABLE 3.6-2
SIZE OF NON-EXPLOSIVE PRACTICE BOMBS AND NAVAL GUN SHELLS USED AT SEA IN THE GOMEX STUDY AREA

NEPM Type	Weight (pounds)	Length (inches)	Diameter (inches)	Footprint (ft^2)[(2)]
BDU-45	500	66	11	5.0
MK-76	25	25	4	0.7
MK-83(I)[(1)]	1,000	119	14	11.6
MK-84(I)[(1)]	2,000	129	18	16.1
5 in	70	26	5	0.9
76 mm	14	14	3	0.3

[(1)]Alternative 2 only.
[(2)]Length x diameter.

TABLE 3.6-3
ESTIMATES OF MARINE BENTHIC HABITAT THAT WOULD BE AFFECTED BY NON-EXPLOSIVE PRACTICE BOMBS AND NAVAL GUN SHELLS IN THE GOMEX STUDY AREA

NEPM Type	No Action Alternative		Alternative 1		Alternative 2	
	#/Yr	Area Affected/Yr (ft^2)[(1)]	#/Yr	Area Affected/Yr (ft^2)[(1)]	#/Yr	Area Affected/Yr (ft^2)[(1)]
Non-Explosive Practice Bombs – W-151A/C and W-155A/B[(2)]						
BDU-45	40	400	40	400	148	1480
MK-76	140	196	140	196	140	196
MK-83(I)	0	0	0	0	44	1,021
MK-84(I)	0	0	0	0	3	97
Subtotal =	**180**	**596**	**180**	**596**	**335**	**2,793**
Non-Explosive Practice Naval Gun Shells – W-151A/B and W-155A						
5 in	1,200	2,160	1,200	2,160	1,200	2,160
76 mm	40	24	40	24	40	24
Subtotal =	**1,240**	**2,184**	**1,240**	**2,184**	**1,240**	**2,184**
Total =		**2,780**		**2,780**		**4,977**

[(1)]Assumed that area of marine benthic habitat affected per year = footprint x 2 x #/yr.
[(2)]W-155A is for Alternative 2 only.

Given the dispersed nature of the training activities, often patchy distribution of community types, and relatively limited bottom mapping data, it is not possible to accurately determine the number of non-explosive practice bombs and naval gun shells that would strike soft bottom habitats versus more sensitive areas such as live hard bottom or artificial habitats. As shown in Figure 3.6-3, portions of W-

151 and W-155 are known to support live hard bottom and artificial habitats based on available data. However, most of W-151 and W-155 is expected to consist of soft bottom habitat. While non-explosive practice bombs and naval gun shells have the potential to strike and damage live hard bottom and artificial habitats, including areas that support coral, it is likely that most would strike areas of soft bottom habitat based on the abundance of this habitat type. As noted above, the maximum area of benthic habitat affected per year by non-explosive practice bombs and naval gun shells would be about 2,780 ft^2. This represents a very small percentage of the total area within W-151 and W-155 (0.000001%). The probability of a non-explosive practice bomb striking live hard bottom or artificial habitats is low given the number of bombs dropped and spatial distribution of the exercises and resources. If a non-explosive practice bomb were to strike live hard bottom or an artificial habitat, long-term damage could result, but the area affected would be small (*i.e.*, less than 2,780 ft^2 per year). As such, non-explosive practice bomb and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities or artificial habitats, but the effects would be localized and no long-term changes to community structure or function would be expected.

NEPM strikes in territorial waters would have no significant impact on marine communities under the No Action Alternative. Similarly, NEPM strikes in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Underwater Detonations and High Explosive Ordnance

Some of the training conducted under the No Action Alternative would involve underwater detonations and the use of HE ordnance. The potential effects of explosions on marine mammals, sea turtles, fish, and their habitat are analyzed in Sections 3.7.3, 3.8.3, and 3.9.3, respectively. This section analyzes the potential effects of underwater detonations and HE ordnance use on plankton, benthic communities, and artificial habitats.

Mine Countermeasures and Mine Neutralization exercises include underwater detonations that range in net explosive weight (NEW) from 0.00514-lb shots to 20-lb charges. These operations currently take place in the MINEX Boxes located in the Panama City OPAREA (Figure 2.1-1) and Corpus Christi OPAREA (Figure 2.1-3). Some charges would be detonated directly on the bottom and others would be detonated in the water column.

The Navy does not set explosive charges within 1,000 m of known live/hard bottom, artificial reefs, and shipwrecks. In addition, Navy mitigation measures require that no underwater detonations be conducted within 700 yards of *Sargassum* mats (see Chapter 5 for detailed description of Navy mitigation measures). Therefore, unconsolidated, soft bottom and water column habitats would be exposed to impacts from underwater detonations. Cratering of soft bottom sea floor and water column disturbance would result from underwater detonations. For a specific size of explosive charge, crater depths and widths would vary depending on depth of the charge and sediment type, but crater dimensions generally decrease as bottom depth increases. A 20-lb NEW charge detonated on the bottom can create depressions in the substrate up to 4 to 5 feet in diameter (12.6 to 19.6 ft^2) and 1-foot deep (DoN, 2000). Crater effects are usually temporary in sand and mud bottoms. Short-term increases in turbidity, resuspension of bottom sediments, and localized mortality to benthic organisms and plankton would be expected. Repopulation of displaced sediments should be relatively rapid compared to hard bottom areas (NRC, 2002). Underwater detonations associated with Mine Countermeasures and Mine Neutralization exercises under the No Action Alternative would not result in long-term population- or community-level effects.

The No Action Alternative includes the use of 20 MK3A2 anti-swimmer grenades (0.5-lb NEW) per year in the MINEX Box E3 within the Corpus Christi OPAREA. These grenades detonate about 10 feet under the water's surface within four to five seconds of being deployed. The training area where these

grenades are used is about 7 to 12 nm offshore in 72 to 85 feet of water. Based on information presented in Section 3.6.2 (Figure 3.6-4), no coral reefs, live/hard bottom habitats, or artificial habitats occur in this training area. While some *Sargassum* may occur in this relatively nearshore area, large rafts of *Sargassum* would be uncommon and they would be avoided in accordance with mitigation measures. Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by the explosion would be about 3 feet, which would not extend to the bottom based on the minimum water depth of the training area (72 feet) and a detonation depth of 10 feet. Therefore, these explosions are expected to have minimal effects on benthic habitat or benthic communities. Plankton in the immediate vicinity of explosions would be injured or killed. The number of organisms affected would be small based on the low NEW and the limited number of grenades used. No measurable effects on plankton populations would occur because the number of organisms affected would be low relative to the total plankton biomass.

The No Action Alternative also includes underwater detonations (up to 1.25-lb NEW) in the NSA Panama City Demolition Pond (Figure 2.1-6). Training activities within the Demolition Pond are conducted in accordance with a Wetland Resource Permit issued by the Florida Department of Environmental Protection. The permit covers charges up to 5-lb NEW. The Demolition Pond is located in a small (5,800 m^2) bayou of St. Andrew Bay with a maximum depth of 11 feet. Underwater detonations would result in disturbances to the water column and bottom substrate, which are expected to consist of sand, silt, and clay. The area affected would vary based on the NEW and location of the charge in relationship to the bottom. While the explosive charges used in the Demolition Pond have relatively low NEWs, the shallow depth of the pond increases the likelihood that benthic communities would be adversely affected. Based on the small size of the pond and the frequent use (90 days per year), it is possible that some bottom areas would be repeatedly exposed to impacts from explosions and that benthic communities would not fully recover after an explosion. Therefore, underwater detonations could result in long-term impairment of Demolition Pond's benthic community. Habitat quality could be degraded and reductions in species richness and abundance could occur. However, the effects would be localized and limited to the pond or a portion of the pond. Given the small size of the pond and the abundance of similar soft bottom habitats in the immediate area, the effects of underwater detonations would not be significant from a community or population perspective.

The No Action Alternative includes dropping 52 HE bombs per year in the Hotbox, which is located more than 12 nm offshore in the Pensacola OPAREA (Figure 2.1-1) (see Table 2.2-9 for a summary of explosions by training area). Explosions associated with HE bombs occur at or near the water's surface (about 3.3 feet below the surface) in the Hotbox where depths range from 320 feet to over 4,000 feet.

Mapped live hard bottom communities in the Hotbox are limited to the northwestern corner and along the western boundary (Figure 3.6-3). The hard bottom in the northwestern corner is part of an area known as 29 Edge/27 Edge and covers about 20 nm^2 within the 1,459 nm^2 Hotbox (1.4%). At least two shipwrecks (Gandy Dancer in 690 feet of water and an unknown wreck in 2,625 feet of water) and one artificial reef (Woodburn Reef, consisting of steel truck cabs in 2,165 feet of water) are located in the Hotbox (Figure 3.6-3). At least one point supporting deep sea corals has been identified in the Hotbox, but oil/gas structures are not present (Figure 3.6-3).

Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by MK-82 and MK-83 HE bomb explosions would be about 23 and 30 feet, respectively. The gas bubbles would not extend to the bottom based on the minimum water depth of the Hotbox (320 feet) and a detonation depth of 3.3 feet below the surface. Therefore, HE bomb explosions are expected to have minimal effects on benthic communities and artificial habitats. Plankton in the immediate vicinity of HE bomb explosions would be injured or killed. However, no measurable effects on plankton

populations would occur because the number of organisms affected would be low relative to the total plankton biomass. Effects of explosions on *Sargassum* would be minimal because Navy mitigation measures (see Chapter 5) include avoidance of *Sargassum* mats.

Underwater detonations and HE ordnance use in territorial waters would have no significant impact on marine communities under the No Action Alternative. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Military Expended Materials

The Navy uses a variety of military expended materials during training exercises conducted in the Study Area. The types and quantities of military expended materials used and information regarding fate and transport of these materials within the marine environment are discussed in Section 3.2. Soft and hard bottom benthic communities throughout the Study Area would be exposed to military expended materials because use is widely dispersed and a majority of the materials rapidly sink to the sea floor. The analysis presented in Section 3.2 indicates that military expended materials would become encrusted by natural processes and incorporated into the sea floor, with no significant accumulations in any particular area and no negative effects to water quality. Some of the materials are the same as those often used in artificial reef construction (*e.g.*, concrete and metal) and would be colonized by benthic organisms that prefer hard substrate. This colonization could result in localized increases in species richness and abundance, but no significant changes in community structure or function would be anticipated based on the limited amount and dispersed nature of the materials. Military expended material use in territorial waters would have no significant impact on marine communities under the No Action Alternative. Furthermore, military expended material use in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, the No Action Alternative includes the use of Mine Warfare devices towed through the water by helicopters and ships. These devices are currently used in the Panama City and Corpus Christi MINEX Boxes. The use of towed Mine Warfare devices would result in short-term and localized disturbances to the water column, but benthic or artificial habitats would not be affected because the devices are not towed on the bottom. *Sargassum* mats may occur in the training areas. While towed Mine Warfare devices could result in short-term and localized disturbances to *Sargassum* habitats, Navy mitigation measures specify that these exercises shall not be conducted within 250 yd of known or observed *Sargassum* mats. Air crews operating the helicopters are expected to be able to see and avoid most *Sargassum* mats. Therefore, any disturbance to *Sargassum* would be limited to very small patches that are not visible to the crew. Other types of plankton in the upper portions of the water column could be displaced, injured, or killed by towed devices. However, no measurable effects on plankton populations would occur because the number of organisms exposed would be low relative to total plankton biomass. In accordance with NEPA, towed Mine Warfare device use in territorial waters would have no significant impact on marine communities under the No Action Alternative. In accordance with EO 12114, towed Mine Warfare device use in non-territorial waters under the No Action Alternative would not cause significant harm to marine communities.

Marine Protected Areas

As discussed in Section 3.6.2.4, no National System MPAs are located within the GOMEX Study Area. The No Action Alternative would not affect the natural or cultural resources that are protected by National System MPAs, including the Flower Garden Banks National Marine Sanctuary. With the

exception of fisheries management zones, all MPAs on the MPA Inventory are located outside of the Study Area. Potential effects to fisheries management zones are discussed in Section 3.9.3.

3.6.3.2 Alternative 1

Vessel Movements

The total number of vessel steaming days for the GOMEX Study Area would not change under Alternative 1. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 1. Vessel movements in territorial waters would have no significant impact on marine communities under Alternative 1. Similarly, in accordance with EO 12114, vessel movements in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Aircraft Overflights

Alternative 1 includes approximately 5,316 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 93 sorties per year (1.8%) compared to the No Action Alternative. The additional sorties would be associated with bombing exercises in W-151 and W-155 and would involve flights below 3,000 feet. Helicopter sorties would decrease from 38 to 18 per year in the Study Area under Alternative 1. The potential effects of aircraft noise on various marine community components are analyzed in detailed in Sections 3.7 – Marine Mammals, 3.8 – Sea Turtles, and 3.9 – Fish and Essential Fish Habitat. Based on the analyses presented in those sections, aircraft overflights over territorial waters would have no significant impact on marine communities under Alternative 1. In addition, aircraft overflights over non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Non-explosive Practice Munitions

The number of 20 mm cannon rounds fired in W-151A/B and W-155A would increase from 0 to 24,000 per year under Alternative 1 (Tables 2.2-7 and 2.2-8). This change would result in increased potential for NEPM to strike benthic communities and artificial habitats compared to baseline conditions. As discussed for the No Action Alternative, small caliber ammunition, such as a 20 mm round, has little potential to disturb the bottom because these materials are relatively small and light and their velocity would decrease through the water column. A 20 mm projectile weighs about 3.6 ounces and its footprint is about 0.01 ft^2. The total footprint of 24,000 rounds per year would be about 283 ft^2, but this total footprint would be spread over a very large area because training activities are widely dispersed. For these reasons, 20 mm round strikes would have negligible effects on benthic communities.

The number of non-explosive practice bombs and naval gun shells, which are large forms of NEPM, would not change under Alternative 1. Therefore, the analysis presented for non-explosive practice bombs and naval gun shells under the No Action Alternative is applicable to Alternative 1. As discussed for the No Action Alternative, NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, NEPM strikes would cause little or no physical damage to soft bottom benthic habitat and any damage would be localized. Non-explosive practice bomb and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities and artificial habitats, but the effects would be localized and no long-term changes to community structure or function would be expected. NEPM strikes in territorial waters would have no significant impact on marine communities under Alternative 1. Similarly, NEPM strikes in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Underwater Detonations and High Explosive Ordnance

Alternative 1 would include changes in underwater detonations and HE ordnance use in the GOMEX Study Area. Underwater detonations associated with Mine Warfare exercises in the Panama City and

Corpus Christi MINEX Boxes would no longer occur under Alternative 1. As such, water column disturbances, benthic habitat disturbances, and plankton mortality described for these activities under the No Action Alternative would no longer occur.

The use of MK3A2 anti-swimmer grenades (0.5-lb NEW) would not change under Alternative 1. Therefore, the No Action Alternative analysis for anti-swimmer grenades is applicable to Alternative 1.

As summarized in Table 2.2-6, Alternative 1 includes changes in operations at the Demolition Pond. Some annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW and the number of 1.25-lb NEW charges would not change. Therefore, the effects of Alternative 1 at the Demolition Pond are expected to be the same as the No Action Alternative.

Alternative 1 would include an increase in the number of HE bombs dropped in the W-155 A/B Hotbox from 52 to 155 per year. The MK-84, which has a NEW of 945 lbs, would also be used under Alternative 1 (three per year). As discussed above for the No Action Alternative, explosions associated with HE bombs occur at or near the water's surface in the Hotbox where depths range from 320 feet to over 4,000 feet.

Mapped live hard bottom communities in the Hotbox are limited to the northwestern corner and along the western boundary (Figure 3.6-3). The hard bottom in the northwestern corner is part of an area known as 29 Edge/27 Edge and covers about 20 nm^2 within the 1,459 nm^2 Hotbox (1.4%). At least two shipwrecks (Gandy Dancer in 690 feet of water and an unknown wreck in 2,625 feet of water) and one artificial reef (Woodburn Reef, consisting of steel truck cabs in 2,165 feet of water) are located in the Hotbox (Figure 3.6-3). At least one point supporting deep sea corals has been identified in the Hotbox, but oil/gas structures are not present (Figure 3.6-3).

Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by MK-82, MK-83, and MK-84 HE bomb explosions would be about 23, 30, and 39 feet, respectively. The gas bubbles would not extend to the bottom based on the minimum water depth of the Hotbox (320 feet) and a detonation depth of 3.3 feet below the surface. Therefore, HE bomb explosions are expected to have minimal effects on benthic communities and artificial habitats. Plankton in the immediate vicinity of HE bomb explosions would be injured or killed. However, no measurable effects on plankton populations would occur because the number of organisms affected would be low relative to the total plankton biomass. Effects of explosions on *Sargassum* would be minimal because Navy mitigation measures (see Chapter 5) include avoidance of *Sargassum* mats.

Underwater detonations and HE ordnance use in territorial waters would have no significant impact on marine communities under Alternative 1. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Military Expended Materials

The amount of military expended materials entering the marine environment would increase in the Study Area under Alternative 1. The number of 20 mm rounds would increase from 0 to 24,000 per year and the number of marine markers would increase from 34 to 124 per year. These changes would result in increased exposure of benthic communities to military expended materials. However, the analysis presented in Section 3.2 indicates that no significant accumulations of military expended materials would occur in any particular area and water quality would not be negatively affected by military expendable materials. Some of the materials would be colonized by benthic organisms that prefer hard substrate, resulting in localized increases in species richness and abundance. No significant changes in community structure or function would be anticipated based on the limited amount and dispersed nature of the materials. Military expended material use in territorial waters would have no

significant impact on marine communities under Alternative 1, in accordance with NEPA. Furthermore, in accordance with EO 12114, military expended material use in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 1. Therefore, the effects described for the No Action Alternative would no longer occur.

Marine Protected Areas

As discussed in Section 3.6.2.4, no National System MPAs are located within the GOMEX Study Area. Alternative 1 would not affect the natural or cultural resources that are protected by National System MPAs, including the Flower Garden Banks National Marine Sanctuary. With the exception of fisheries management zones, all MPAs on the MPA Inventory are located outside of the Study Area. Potential effects to fisheries management zones are discussed in Section 3.9.3.

3.6.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

The total number of vessel steaming days for the GOMEX Study Area would not change under Alternative 2. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 2. Vessel movements in territorial waters would have no significant impact on marine communities under Alternative 2. Similarly, in accordance with EO 12114, vessel movements in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Aircraft Overflights

Alternative 2 includes approximately 5,318 fixed-wing aircraft sorties per year over the Gulf of Mexico; a negligible increase of 2 sorties per year (0.04%) compared to Alternative 1. Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. Helocopter sorties would decrease from 38 to 18 per year under Alternative 2. Aircraft overflights over territorial waters would have no significant impact on marine communities under Alternative 2. In addition, aircraft overflights over non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Non-explosive Practice Munitions

Compared to the No Action Alternative, the number of 20 mm cannon rounds fired in W-151A/B and W-155A would increase from 0 to 24,000 per year (Table 2.2-8) and the number of non-explosive practice bombs dropped in W-151A/C and W-155B would increase from 180 to 335 per year (Table 3.6-3) under Alternative 2. Some of these non-explosive practice bombs would also be dropped in W-155A for this alternative. The number of non-explosive naval gun shells would be the same as the No Action Alternative. The potential effects would be similar to those described for the No Action Alternative and Alternative 1, but the total area affected by non-explosive practice bombs and naval gun shells would increase. The relative non-explosive practice bomb concentration would increase from 0.026/nm^2/year in W-151A/C and W-155B under the No Action Alternative to 0.036/nm^2/year in W-151A/C and W-155A/B under Alternative 2. Using the assumptions discussed for the No Action Alternative, the maximum area of benthic habitat affected by non-explosive practice bomb and naval gun shell strikes would increase from 2,780 ft^2 (0.00008 nm^2) per year to 4,977 ft^2 (0.0001 nm^2) per year (Table 3.6-3). The probability of a non-explosive practice bomb or naval gun shell striking live hard bottom or artificial habitats would be low given the number of used and the spatial distribution of the exercises and resources. If a non-explosive practice bomb or naval gun shell were to strike live hard bottom or an artificial habitat, long-term damage could result, but the area affected would be small (*i.e.*,

less than 4,977 ft^2 per year). As such, non-explosive practice bomb and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities and artificial habitats, but the effects would be localized and no long-term changes to community structure or function would be expected. NEPM strikes in territorial waters would have no significant impact on marine communities under Alternative 2. Similarly, NEPM strikes in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Underwater Detonations and High Explosive Ordnance

Mine Warfare underwater detonations would no longer occur in the GOMEX Study Area under Alternative 2, as was the case for Alternative 1. Anti-swimmer grenade training would be unchanged from the No Action Alternative. Demolition Pond training for Alternative 2 would also be the same as Alternative 1. However, Alternative 2 includes a substantial decrease in the number of HE bombs dropped (four per year) relative to both the No Action Alternative (52 per year) and Alternative 1 (155 per year). As a result, the potential for plankton to be exposed to HE ordnance would decrease substantially under Alternative 2 compared to the No Action Alternative and Alternative 1.

Underwater detonations and HE ordnance use in territorial waters would have no significant impact on marine communities under Alternative 1. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Military Expended Materials

Compared to the No Action Alternative, the amount of military expended materials entering the marine environment would increase in the Study Area under Alternative 2. The number of 20 mm rounds would increase from 0 to 24,000 per year, the number of marine markers would increase from 34 to 124 per year, and the number of non-explosive practice bombs would increase from 180 to 335 per year. These changes would result in increased exposure of benthic communities to military expended materials. However, the analysis presented in Section 3.2 indicates that no significant accumulations of military expended materials would occur in any particular area and water quality would not be negatively affected by military expendable materials. Some of the materials would be colonized by benthic organisms that prefer hard substrate, resulting in localized increases in species richness and abundance. No significant changes in community structure or function would be anticipated based on the limited amount and dispersed nature of the materials. Military expended material use in territorial waters would have no significant impact on marine communities under Alternative 2, in accordance with NEPA. Furthermore, in accordance with EO 12114, military expended material use in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 2 and would have no effect on marine communities.

Marine Protected Areas

As discussed in Section 3.6.2.4, no National System MPAs are located within the GOMEX Study Area. Alternative 2 would not affect the natural or cultural resources that are protected by National System MPAs, including the Flower Garden Banks National Marine Sanctuary. With the exception of fisheries management zones, all MPAs on the MPA Inventory are located outside of the Study Area. Potential effects to fisheries management zones are discussed in Section 3.9.3.

3.6.4 Unavoidable Significant Environmental Impacts

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to marine communities.

3.6.5 Summary of Environmental Impacts

As summarized in Table 3.6-4, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on marine communities in territorial waters, in accordance with NEPA. Furthermore, in accordance with EO 12114, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to marine communities in non-territorial waters.

TABLE 3.6-4
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE COMMUNITIES IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Vessel Movements	Localized disturbance, injury, and mortality to plankton. No long-term population or community-level effects.	Same as U.S. Territory.
Aircraft Overflights	Potential exposure to aircraft noise. No long-term population or community-level effects.	Same as U.S. Territory.
Non-Explosive Practice Munitions	Localized disturbance to benthic communities. No long-term population or community-level effects.	Same as U.S. Territory.
Underwater Detonations and High Explosive Ordnance	Short-term, localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton. No long-term population or community-level effects.	Same as U.S. Territory.
Military Expended Materials	Long-term, minor, and localized accumulation of expended materials in benthic communities. No long-term changes in community structure or function.	Same as U.S. Territory.
Towed Mine Warfare Devices	Short-term localized disturbance to water column. No long-term population or community-level effects.	Same as U.S. Territory.
Impact Conclusion	No significant impact to marine communities.	No significant harm to marine communities.
Alternative 1		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action.	Same as U.S. Territory.
Non-Explosive Practice Munitions	Slight increase compared to No Action.	Same as U.S. Territory.
Underwater Detonations and High Explosive Ordnance	Short-term, localized disturbance to benthic communities and water column in Demolition Pond. Underwater detonations associated with Mine Warfare no longer occur. No long-term population or community-level effects.	Underwater detonations associated with Mine Warfare no longer occur. Localized disturbance, injury, and mortality to plankton. Increase compared to No Action due to increase in HE bomb use. No long-term population or community-level effects.
Military Expended Materials	Slight increase compared to No Action. No long-term changes in community structure or function.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable.	Not applicable.
Impact Conclusion	No significant impact to marine communities.	No significant harm to marine communities.

TABLE 3.6-4 (CONTINUED)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE COMMUNITIES IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Alternative 2		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action.	Same as U.S. Territory.
Non-Explosive Practice Munitions	Slight increase compared to No Action.	Same as U.S. Territory.
Underwater Detonations and High Explosive Ordnance	Short-term, localized disturbance to benthic communities and water column in Demolition Pond. Underwater detonations associated with Mine Warfare no longer occur. No long-term population or community-level effects.	Underwater detonations associated with Mine Warfare no longer occur. Localized disturbance, injury, and mortality to plankton. Substantial decrease compared to No Action and Alternative 1 due to decrease in HE bomb use. No long-term population or community-level effects.
Military Expended Materials	Slight increase compared to No Action.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable.	Not applicable.
Impact Conclusion	No significant impact to marine communities.	No significant harm to marine communities.

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3.7 MARINE MAMMALS

3.7.1 Introduction and Methods

3.7.1.1 Regulatory Framework

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. 1361 *et seq.*) established, with limited exceptions, a moratorium on the "taking" of marine mammals (16 U.S.C. 1371). Except as provided, it is unlawful for any person or vessel subject to the jurisdiction of the United States to "take" any marine mammal on the high seas (16 U.S.C. 1372). The term "take," as defined in Section 3 (16 U.S.C. 1362) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." "Harassment" was further defined in the 1994 amendments to the MMPA, which provided two levels of "harassment," Level A (potential injury) and Level B (potential disturbance).

The National Defense Authorization Act for Fiscal Year 2004 (Public Law [PL] 108-136) amended the definition of harassment as applied to military readiness activities or scientific research activities conducted by or on behalf of the Federal government, consistent with Section 104(c)(3) of the MMPA [16 U.S.C. 1374 (c)(3)]. The National Defense Authorization Act for Fiscal Year 2004 adopted the definition of "military readiness activity" as set forth in the National Defense Authorization Act for Fiscal Year 2003 (PL 107-314). Military training activities within the GOMEX Range Complex constitute military readiness activities as defined in PL 107-314 because training activities constitute "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use". For military readiness activities, the relevant definition of harassment is any act that:

- Injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild ("Level A harassment").
- Disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered ("Level B harassment") [16 U.S.C. 1362 (18)(B)(i)(ii)].

Section 101(a)(5) of the MMPA directs the Secretaries of the Departments of Commerce and Interior (depending upon the species for which takes are requested) to allow, upon request, the incidental (but not intentional) taking of marine mammals by U.S. citizens who engage in a specified activity (exclusive of commercial fishing) if certain findings are made and regulations are issued. Authorization will be granted by the Secretary for the incidental take of marine mammals if the taking will have a negligible impact on the species or stock; will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses; and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such taking are set forth.

Several species of marine mammals may occur in the GOMEX Range Complex. Accordingly, the Navy has completed an analysis to determine if the action would result in incidental harassment of individual marine mammals (Level A or B harassment, as defined by MMPA) or if the action would have more than a negligible impact on marine mammal populations. The Navy has initiated the MMPA compliance process with the National Marine Fisheries Service (NMFS).

Endangered Species Act

The ESA of 1973 established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. An "endangered" species is a species that is in danger of extinction throughout all or a significant portion of its range, while a "threatened" species is one that is likely to become endangered within the foreseeable future throughout all or in a significant portion of its range. The USFWS and NMFS jointly administer the ESA and are also responsible for the listing of species (*i.e.*, the labeling of a species as either threatened or endangered). The USFWS has primary responsibility for the management of terrestrial species, freshwater species, sirenians, sea otters, polar bears, and sea turtles (while they are on land); the NMFS has primary responsibility for all other marine mammals (cetaceans and pinnipeds), sea turtles (in the water), and anadromous fish species (species that migrate from saltwater to freshwater to spawn). The ESA mandates the designation of geographic areas as critical habitat for threatened or endangered species.

The ESA requires Federal agencies to conserve listed species and consult with the USFWS and/or NMFS to ensure that proposed actions that may affect listed species or critical habitat are consistent with the requirements of the ESA. The ESA specifically requires agencies not to "take" or "jeopardize" the continued existence of any endangered or threatened species, or to destroy or adversely modify habitat critical to any endangered or threatened species. The USFWS or NMFS may authorize incidental take of listed species by issuing an Incidental Take Statement under Section 7 of the ESA. Under Section 9 of the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Under Section 7 of the ESA, "jeopardize" means to engage in any action that would be expected to reduce appreciably the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution.

Seven marine mammal species that are listed as endangered under the ESA could potentially occur in the GOMEX Range Complex. NMFS concluded ESA Section 7 formal consultation with Navy for listed and proposed whales. The Navy has completed the ESA Section 7 consultation process with USFWS for the West Indian manatee. Marine mammal critical habitat for listed species has not been designated under the ESA in the GOMEX Range Complex. Copies of correspondence with NMFS and USFWS are in Appendix C.

National Environmental Policy Act and Executive Order 12114

In addition to addressing MMPA and ESA requirements, potential effects were analyzed in accordance with the National Environmental Policy Act (NEPA) to determine if the action would result in significant impacts to marine mammals in territorial waters and in accordance with Executive Order (EO) 12114 to determine if the action would result in significant harm to marine mammals in non-territorial waters.

For purposes of NEPA and EO 12114, the Navy considered context and intensity to determine the significance of effects. Context refers to the affected environment in which the action would occur and intensity refers to the severity of impacts. The Navy considered several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. The duration of effects (*e.g.*, short-term, long-term, temporary, permanent); degree of controversy; degree of highly uncertain effects or unique or unknown risks; precedent-setting effects; cumulative effects; adverse effect on ESA-listed species or designated critical habitat; and whether the action threatens a violation of law or requirements imposed for the protection of the environment were also considered. The potential for adverse effects to be observed at the population, stock, or species level was a primary factor considered by the Navy in determining the significance of effects to marine mammals. While the factors outlined above for MMPA and ESA were considered in making NEPA and EO 12114

significance conclusions, it should be recognized that the terminology used to characterize effects varies under these Acts. For example, Level A or B harassment of an individual marine mammal under MMPA or take of an individual marine mammal under ESA do not necessarily equate to a significant impact under NEPA. Rather, the Navy considered context, intensity, and population-level effects in making its significance conclusions for marine mammals.

3.7.1.2 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this Final EIS/OEIS includes several warfare areas and most warfare areas include multiple types of training operations. Likewise, several activities (*e.g.*, vessel movements, aircraft overflights, munitions use/non-explosive practice munitions [NEPM], *etc*.) are contained in each operation and those activities typically are not unique to that operation. For example, many of the operations involve Navy vessel movements and aircraft overflights. Accordingly, the analysis for marine mammals is organized by specific activity and/or stressors associated with that activity, rather than warfare area or operations.

The following general steps were used to analyze the potential environmental consequences of the proposed action to marine mammals:

- Identify those aspects of the proposed action that are likely to act as stressors to biological resources by having a direct or indirect effect on the physical, chemical, and biotic environment. As part of this step, the spatial extent of these stressors, including changes in that spatial extent over time, were identified. The results of this step identified those aspects of the proposed action that required detailed analysis in this Final EIS/OEIS.
- Identify resources that may occur in the GOMEX Study Area.
- Identify the biological resources that are likely to co-occur with the stressors in space and time and the nature of that co-occurrence (exposure analysis).
- Determine whether and how biological resources are likely to respond given their exposure and available scientific knowledge of their responses (response analysis).
- Determine the risks those responses pose to biological resources and the significance of those risks.

Study Area

The GOMEX Study Area is described in Section 1.5 and is shown in Figure 1.1-1. The GOMEX Study Area is analogous to the "action area," for purposes of analysis under Section 7 of the ESA.

Data Sources

A comprehensive and systematic review of relevant literature and data has been conducted to complete this analysis for marine mammals. Of the available scientific literature (both published and unpublished), the following types of documents were used in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, theses, dissertations, endangered species recovery plans, species management plans, stock assessment reports, EISs, Range Complex Management Plans (RCMP), and other technical reports published by government agencies, private businesses, or consulting firms. The scientific literature was also consulted during the search for geographic location data on the occurrence and response behavior of marine resources within the GOMEX Study Area.

Information was collected from the following sources to summarize the occurrence patterns of marine mammals and to evaluate the impacts to marine mammals in the GOMEX Study Area and vicinity:

- Academic and educational/research institutions (College of William and Mary, Duke University, Florida Marine Research Institute, Johns Hopkins University, Massachusetts Institute of Technology, New England Aquarium, Old Dominion University, Shark Research Center, Texas A&M University, Texas A&M University at Galveston, University of Rhode Island, University of Texas at Dallas, and Virginia Institute of Marine Science);
- University databases: DIALOG (Oceanic Abstracts, Enviroline, Pollution Abstracts, Aquatic Sciences and Fisheries Abstracts, Life Science Collection, Zoological Record Online, Water Resources Abstracts, National Technical Information Service, Federal Register, Dissertation Abstracts, and BIOSIS Previews), First Search (*e.g.*, BIODigest, BiolAgrindex, GenSciIndex, and the Government Printing Office), and Cambridge Abstracts;
- Online resources, including various databases and related websites (National Oceanic and Atmospheric Agency [NOAA], NMFS, Ocean Biogeographic Information System [OBIS], Ocean Planning Information System [OPIS], U.S. Geological Survey [USGS], Mid-Atlantic Fishery Management Council [MAFMC], South Atlantic Fishery Management Council [SAFMC], Gulf of Mexico Fishery Management Council [GMFMC], National Pipeline Mapping System, Elsevier, Allen Press, Blackwell-Science, FishBase, ReefBase, GulfBase, Reef Environment Education Foundation, Food and Agriculture Organization, Federal Register, Marine Turtle Newsletter, Proceedings of the Annual Sea Turtle Symposium, and the National Sea Grant Library); and
- Federal agencies (Department of the Navy [DoN]; Department of State [DoS]; Department of Transportation [DOT]; Minerals Management Service [MMS]; National Aeronautic and Space Administration [NASA]; SAFMC, GMFMC, Gulf States Marine Fisheries Commission; NMFS: Highly Migratory Species Division, Southeast Fisheries Science Center [NMFS-SEFSC], Southeast Regional Office, Office of Habitat Protection, Office of Protected Resources; NOAA: Marine Managed Areas Inventory, National Ocean Service, USFWS Ecological Services Field Offices; USGS) and other state/regional agencies (Texas Parks and Wildlife Department, Florida Fish and Wildlife Conservation Commission, Alabama Department of Conservation and Natural Resources, Mississippi Department of Marine Resources, and Louisiana Department of Wildlife and Fisheries).

Marine Resource Assessments

The information contained in this section relies heavily on the data gathered in the Marine Resource Assessments (MRAs). The Navy MRA Program was implemented by the Commander, Fleet Forces Command, to initiate collection of data and information concerning the protected and commercial marine resources found in the Navy's Operating Areas (OPAREAs). Specifically, the goal of the MRA program is to describe and document the marine resources present in each of the Navy's OPAREAs. The MRA for the GOMEX OPAREA was published in 2007 (DoN, 2007a). The MRA data were used to provide a regional context for each species. The MRA represents a compilation and synthesis of available scientific literature (*e.g.*, journals, periodicals, theses, dissertations, project reports, and other technical reports published by government agencies, private businesses, or consulting firms), and NMFS reports including stock assessment reports, recovery plans, and survey reports.

Navy OPAREA Density Estimates (NODE) Report

The density estimates that were used in previous Navy environmental documents have been recently updated to provide a compilation of the most recent data and information on the occurrence, distribution, and density of marine mammals. The updated density estimates presented in this Final EIS/OEIS are derived from the *Navy OPAREA Density Estimates (NODEs) for the GOMEX OPAREA* report (DoN, 2007b).

Density estimates for cetaceans were either modeled using available line-transect survey data or derived using available data in order of preference: 1) through spatial models using line-transect survey data provided by NMFS; 2) or based on the cetacean abundance estimates found in the 2006 NOAA stock assessment reports (SARs) (Waring *et al.*, 2007). The abundance estimates in the stock assessment reports are from Mullin and Fulling (2004).

For the model-based approach, density estimates were calculated for each species within areas containing survey effort. A relationship between these density estimates and the associated environmental parameters such as depth, slope, distance from the shelf break, sea surface temperature (SST), and chlorophyll *a* (chl *a*) concentration was formulated using generalized additive models (GAMs). This relationship was then used to generate a two-dimensional density surface for the region by predicting densities in areas where no survey data exist.

The analyses for cetaceans were based on sighting data collected through shipboard surveys conducted by NMFS-SEFSC between 1998 and 2005. Species-specific density estimates derived through spatial modeling were compared with abundance estimates found in the 2006 NOAA SARs to ensure consistency. All spatial models and density estimates were reviewed by and coordinated with NMFS Science Center technical staff and scientists with the University of St. Andrews, Scotland, Centre for Environmental and Ecological Modeling (CREEM). For a more detailed description of the methods involved in calculating the density estimates provided in this Final EIS/OEIS, please refer to the *NODE report for the GOMEX OPAREA* (DoN, 2007b). The report is available at:

http://www.gomexrangecomplexeis.com/.

The following shows how density estimates were modeled or derived for species analyzed in this Final EIS/OEIS:

Model-Derived Density Estimates

- Sperm whale (*Physeter macrocephalus*)
- Dwarf and pygmy sperm whales (*Kogia* spp.)
- Beaked whales (Family *Ziphiidae*)
- Rough-toothed dolphin (*Steno bredanensis*)
- Bottlenose dolphin (*Tursiops truncatus*)
- Pantropical spotted dolphin (*Stenella attenuata*)
- Atlantic spotted dolphin (*Stenella frontalis*)
- Striped dolphin (*Stenella coeruleoalba*)
- Spinner dolphin (*Stenella longirostris*)
- Risso's dolphin (*Grampus griseus*)

Stock Assessment Report or Literature-Derived Density Estimates

- Bryde's whale (*Balaenoptera brydei*)
- Clymene dolphin (*Stenella clymene*)
- Fraser's dolphin (*Lagenodelphis hosei*)
- Killer whale (*Orcinus orca*)
- False killer whale (*Pseudorca crassidens*)
- Pygmy killer whale (*Feresa attenuata*)
- Melon-headed whale (*Peponocephala electra*)
- Short-finned pilot whale (*Globicephala macrorhynchus*)

Table 3.7-1 shows the density estimates by species for training areas where explosive ordnance use may occur in the GOMEX Range Complex.

TABLE 3.7-1
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX TRAINING AREAS WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Threatened or Endangered Marine Mammal Species				
Blue Whale	Insufficient data to estimate density.			
Fin Whale	Insufficient data to estimate density.			
Humpback Whale	Insufficient data to estimate density.			
North Atlantic Right Whale	Insufficient data to estimate density.			
Sei Whale	Insufficient data to estimate density.			
Sperm Whale				
Hotbox	0.00152	0.00086	0.00152	0.00152
Corpus Christi MINEX	<0.00001	0.00000	<0.00001	<0.00001
Corpus Christi E3 Small Arms	<0.00001	0.00000	<0.00001	<0.00001
Panama City On Shelf MINEX	<0.00001	0.00000	<0.00001	<0.00001
Panama City Off Shelf MINEX	<0.00001	0.00000	<0.00001	<0.00001
West Indian Manatee	Insufficient data to estimate density.			
Non-Threatened or Endangered Marine Mammal Species				
Atlantic Spotted Dolphin				
Hotbox	0.02188	0.02188	0.02188	0.02188
Corpus Christi MINEX	0.04396	0.04396	0.04396	0.04396
Corpus Christi E3 Small Arms	0.02178	0.02178	0.02178	0.02178
Panama City On Shelf MINEX	0.07877	0.07877	0.07877	0.07877
Panama City Off Shelf MINEX	0.12440	0.12440	0.12440	0.12440
Beaked Whales				
Hotbox	<0.00001	<0.00001	<0.00001	<0.00001
Corpus Christi MINEX	<0.00001	<0.00001	<0.00001	<0.00001
Corpus Christi E3 Small Arms	<0.00001	<0.00001	<0.00001	<0.00001
Panama City On Shelf MINEX	0.00000	<0.00001	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	<0.00001	0.00000	0.00000
Bottlenose Dolphin				
Hotbox	0.12408	0.12408	0.02658	0.12408
Corpus Christi MINEX	0.10443	0.10443	0.12067	0.10443
Corpus Christi E3 Small Arms	0.67494	0.67494	0.62439	0.67494
Panama City On Shelf MINEX	0.17487	0.17487	0.11147	0.17487
Panama City Off Shelf MINEX	0.14737	0.14737	0.13011	0.14737

TABLE 3.7-1 (Continued)
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX TRAINING AREAS WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Bryde's Whale				
Hotbox	0.00009	0.00009	0.00009	0.00009
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Clymene Dolphin				
Hotbox	0.04020	0.04020	0.04020	0.04020
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
False Killer Whale				
Hotbox	0.00240	0.00240	0.00240	0.00240
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Fraser's Dolphin				
Hotbox	0.00168	0.00168	0.00168	0.00168
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Killer Whale				
Hotbox	0.00031	0.00031	0.00031	0.00031
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Melon-headed Whale				
Hotbox	0.00799	0.00799	0.00799	0.00799
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Minke Whale	Insufficient data to estimate density.			
Pantropical Spotted Dolphin				
Hotbox	0.23178	0.06431	0.23178	0.23178
Corpus Christi MINEX	0.00043	0.00143	0.00043	0.00043
Corpus Christi E3 Small Arms	0.00016	0.00025	0.00016	0.00016

TABLE 3.7-1 (Continued)
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX TRAINING AREAS WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Panama City On Shelf MINEX	0.00064	0.00001	0.00064	0.00064
Panama City Off Shelf MINEX	0.00084	0.00002	0.00084	0.00084
Pygmy and Dwarf Sperm Whales				
Hotbox	0.00268	0.00333	0.00268	0.00268
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00001	0.00003	0.00001	0.00001
Panama City Off Shelf MINEX	0.00002	0.00005	0.00002	0.00002
Pygmy Killer Whale				
Hotbox	0.00095	0.00095	0.00095	0.00095
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Risso's Dolphin				
Hotbox	0.01207	0.01207	0.01207	0.01207
Corpus Christi MINEX	<0.00001	<0.00001	<0.00001	<0.00001
Corpus Christi E3 Small Arms	<0.00001	<0.00001	<0.00001	<0.00001
Panama City On Shelf MINEX	<0.00001	<0.00001	<0.00001	<0.00001
Panama City Off Shelf MINEX	<0.00001	<0.00001	<0.00001	<0.00001
Rough-toothed Dolphin				
Hotbox	0.00009	0.00009	0.00009	0.00009
Corpus Christi MINEX	0.03153	0.03153	0.03153	0.03153
Corpus Christi E3 Small Arms	0.01613	0.01613	0.01613	0.01613
Panama City On Shelf MINEX	0.00002	0.00002	0.00002	0.00002
Panama City Off Shelf MINEX	0.00009	0.00009	0.00009	0.00009
Short-finned Pilot Whale				
Hotbox	0.00553	0.00553	0.00553	0.00553
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Panama City Off Shelf MINEX	0.00000	0.00000	0.00000	0.00000
Spinner Dolphin				
Hotbox	0.20251	0.20251	0.20251	0.20251
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00001	0.00001	0.00001	0.00001
Panama City Off Shelf MINEX	<0.00001	<0.00001	<0.00001	<0.00001
Striped Dolphin				
Hotbox	0.06161	0.06161	0.06161	0.06161

TABLE 3.7-1 (Continued)
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX TRAINING AREAS WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Corpus Christi MINEX	0.00000	0.00000	0.00000	0.00000
Corpus Christi E3 Small Arms	<0.00001	<0.00001	<0.00001	<0.00001
Panama City On Shelf MINEX	0.00013	0.00013	0.00013	0.00013
Panama City Off Shelf MINEX	0.00015	0.00015	0.00015	0.00015

Source: (DoN, 2007b)

Density estimates could not be calculated for all species due to the limited available data. Occurrence of these species (with the exception of the West Indian manatee) in the GOMEX Range Complex is considered uncommon.

Species for Which Density Estimates Are Not Available

- Minke whale (*Balaenoptera acutorostrata*)
- Fin whale (*Balaenoptera physalus*)
- North Atlantic Right Whale (*Eubalaena glacialis*)
- Humpback whale (*Megaptera novaeangliae*)
- Blue whale (*Balaenoptera musculus*)
- Sei whale (*Balaenoptera borealis*)
- West Indian manatee (*Trichechus manatus*)

3.7.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to marine mammals. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Final EIS/OEIS. As shown in Table 3.7-2, potential stressors to marine mammals include vessel movements (disturbance or collisions), aircraft overflights (disturbance), munitions use/NEPM (disturbance and strikes), underwater detonations and high explosive (HE) ordnance (explosions), expended materials including ordnance-related materials, targets, chaff, self-protection flares, and marine markers (ingestion, entanglement, and habitat alteration), and towed Mine Warfare devices. The potential effects of these stressors on marine mammals are analyzed in detail in Section 3.7.3.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as a result of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on marine mammals. Accordingly, the effects of water and air quality changes on marine mammals are not addressed further in this Final EIS/OEIS.

3.7.2 Affected Environment

3.7.2.1 Regional Overview

Table 3.7-3 provides a list of marine mammal species that have confirmed or potential occurrence in the GOMEX Study Area.

Marine mammal distribution is affected by demographic, evolutionary, ecological, habitat-related, and anthropogenic factors (Bjørge, 2002; Bowen *et al.*, 2002; Forcada, 2002; Stevick *et al.*, 2002). Movement of individuals is generally associated with feeding or breeding activity (Stevick *et al.*, 2002). Some baleen whale species, such as the humpback whale, make extensive annual migrations to low-latitude mating and calving grounds in the winter and to high-latitude feeding grounds in the summer (Corkeron and Connor, 1999). Migrations probably occur during these seasons due to the presence of highly productive waters and associated cetacean prey species at high latitudes and of warm water temperatures for calving at low latitudes (Corkeron and Connor, 1999; Stern, 2002); however, not all baleen whales migrate. Some individuals, age classes, or subsets of a population may stay in one area year-round (Tershy *et al.*, 1993; Notarbartolo-di-Sciara *et al.*, 2003).

Cetacean movements can also reflect the distribution and abundance of prey (Gaskin, 1982; Payne *et al.*, 1986; Kenney *et al.*, 1996). Cetacean movements have been linked to indirect indicators of prey, such as temperature variations, sea-surface chl *a* concentrations, and features such as bottom depth (Croll *et al.*, 2005). Oceanographic features such as eddies, thermal fronts, and nearshore tidal mixing are important factors determining cetacean distribution since marine mammal prey are attracted to the increased primary productivity associated with some of these features (Wormuth *et al.*, 2000; Davis *et al.*, 2002; Johnston *et al.*, 2005; Etnoyer *et al.*, 2006). Several cetacean species have been shown to associate closely in space and time with areas of strong tidal mixing and oceanographic fronts, probably due to increased foraging efficiency resulting from the accumulation of prey in these regions (Mendes *et al.*, 2002; Johnston *et al.*, 2005; Etnoyer *et al.*, 2006).

Specific bathymetric and oceanographic features in the Gulf of Mexico serve to attract and concentrate marine mammals. In the northern Gulf of Mexico, there are numerous cetacean sightings in waters over the continental shelf (particularly in nearshore waters), in the vicinity of the continental shelf break, over the continental slope, and out over the abyssal plain. The continental shelf and slope areas have been identified repeatedly as important cetacean habitat (Mullin *et al.*, 1994a; Davis and Fargion, 1996; Davis *et al.*, 1998; Davis *et al.*, 2000; Fulling *et al.*, 2003; Mullin and Fulling, 2004). The continental shelf is very narrow near the Mississippi River Delta, so the high-productivity area associated with the nutrient-rich river plume extends into deep waters (Baumgartner *et al.*, 2001; Davis *et al.*, 2002; Mullin and

TABLE 3.7-2
SUMMARY OF POTENTIAL STRESSORS TO MARINE MAMMALS IN THE GOMEX STUDY AREA

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Mine Warfare (MIW)							
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓		✓	✓	✓
MCM - Surface	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Surface Warfare (SUW)							
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	✓	✓	
BOMBEX (A-S)	W-151 A/C; W-155B		✓	✓		✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓	✓		✓	
GUNEX (Surface-to-Surface) (S-S) (Ship)	W-151 A/B; W-155A	✓		✓		✓	
GUNEX (S-S) (Boat)	Panama City OPAREA	✓		✓		✓	

TABLE 3.7-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE MAMMALS IN THE GOMEX STUDY AREA

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
GUNEX (S-S) (Boat)	Corpus Christi UNDET Box E3	✓		✓	✓	✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓					
MSO to include VBSS/MIO-Helo	W-151/W-155	✓	✓				
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓			✓	✓	
Air Warfare (AW)							
Air Intercept Control (AIC)	W-151; W-155		✓				
Amphibious Warfare (AMW)							
Firing Exercise (Surface-to-Surface) with Integrated Maritime Portable Acoustic Scoring and Simulator System (FIREX with IMPASS) (no HE ordnance)	W-151A/B; W-155A	✓		✓		✓	
Electronic Combat (EC)							
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓			✓	
Chaff Exercises (CHAFFEX)	Brownwood MOAs						
Flare Exercises (FLAREX)	W-155A/B		✓			✓	
Flare Exercises (FLAREX)	Brownwood MOAs						
Mission Area Training[(1)]							
Mission Area Flight Training	W-92; W-54		✓				
Basic Flight Instruction	W-228; R-2908		✓				

TABLE 3.7-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE MAMMALS IN THE GOMEX STUDY AREA

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Salvage Diver Training	NSA Panama City Demolition Pond				✓	✓	
Underwater Demolitions	NSA Panama City Demolition Pond				✓	✓	
Security Force Training	NSA Panama City Demolition Pond				✓	✓	
Diver Training	NSA Panama City Demolition Pond				✓	✓	

(1)Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

TABLE 3.7-3
MARINE MAMMAL SPECIES FOUND IN THE GOMEX STUDY AREA

Family and Scientific Name	Common Name	Federal Status
Order Cetacea		
Suborder Mysticeti (baleen whales)		
Family Balaenidae (right whales)		
Eubalaena glacialis	North Atlantic right whale	ENDANGERED
Family Balaenopteridae (rorquals)		
Megaptera novaeangliae	Humpback whale	ENDANGERED
Balaenoptera acutorostrata	Minke whale	
Balaenoptera brydei	Bryde's whale	
Balaenoptera borealis	Sei whale	ENDANGERED
Balaenoptera physalus	Fin whale	ENDANGERED
Balaenoptera musculus	Blue whale	ENDANGERED
Suborder Odontoceti (toothed whales)		
Family Physeteridae (sperm whale)		
Physeter macrocephalus	Sperm whale	ENDANGERED
Family Kogiidae (pygmy and dwarf sperm whales)		
Kogia breviceps	Pygmy sperm whale	
Kogia sima	Dwarf sperm whale	
Family Ziphiidae (beaked whales)		
Ziphius cavirostris	Cuvier's beaked whale	
Mesoplodon europaeus	Gervais' beaked whale	
Mesoplodon bidens	Sowerby's beaked whale	
Mesoplodon densirostris	Blainville's beaked whale	
Family Delphinidae (dolphins)		
Steno bredanensis	Rough-toothed dolphin	
Tursiops truncatus	Bottlenose dolphin	
Stenella attenuata	Pantropical spotted dolphin	
Stenella frontalis	Atlantic spotted dolphin	
Stenella longirostris	Spinner dolphin	
Stenella clymene	Clymene dolphin	
Stenella coeruleoalba	Striped dolphin	
Lagenodelphis hosei	Fraser's dolphin	
Grampus griseus	Risso's dolphin	
Peponocephala electra	Melon-headed whale	
Feresa attenuata	Pygmy killer whale	
Pseudorca crassidens	False killer whale	
Orcinus orca	Killer whale	
Globicephala macrorhynchus	Short-finned pilot whale	
Order Sirenia		
Family Trichechidae (manatees)		
Trichechus manatus	West Indian manatee	ENDANGERED

Fulling, 2004). This region appears to attract a large number of oceanic cetaceans, especially sperm whales (Davis *et al.*, 2002). Regions of steep bathymetric relief such as offshore canyons and the continental slope are also areas of increased productivity where cetaceans are commonly sighted (Davis *et al.*, 1998; Davis *et al.*, 2002; Fulling *et al.*, 2003; Mullin and Fulling, 2004). Risso's dolphin and short-finned pilot whales occur in mid-slope areas where the steep shelf break and deep water may result in concentrated areas of prey (Davis *et al.*, 1998). Shallower waters over the continental shelf and inshore waters provide habitat for Atlantic spotted and bottlenose dolphins (Fulling *et al.*, 2003; Mullin and Fulling, 2004).

Warm-core eddies are persistent in the northern Gulf, moving westward and generating cold-core eddies as they reach the continental margin (Davis *et al.*, 1998). These dynamic oceanographic features result in temperature and salinity gradients across the northern Gulf that attract cetaceans (Davis *et al.*, 1998; 2002). Cetaceans probably track these features as they forage (Davis *et al.*, 2000; 2002). In the southeastern Gulf and west of the Dry Tortugas an area of upwelling driven by current movement and the periodic formation of the cyclonic Tortugas Gyre also is associated with above average marine mammal occurrence, particularly sperm whales (Mullin and Fulling, 2004).

3.7.2.2 Endangered Species Act-Listed Marine Mammals

Seven marine mammal species that may occur in the GOMEX Study Area are listed under the ESA. These include five baleen whale species (blue, fin, humpback, sei, and North Atlantic right whales), one toothed whale species (sperm whale), and one sirenian species (West Indian manatee). Information on the status, management, habitat, and distribution of each species is provided below.

Blue Whale

Blue whales are the largest living animals. Adults in the Northern Hemisphere reach 22.9 to 28 m in length (Jefferson *et al.*, 1993). Like other rorquals, blue whales feed by "gulping" (Pivorunas, 1979) almost exclusively on krill (Nemoto and Kawamura, 1977; Kenney *et al.*, 1985).

Status and Management—Blue whales are listed as endangered under the ESA and as depleted under the MMPA. At least two discrete populations are found in the North Atlantic. One population ranges from West Greenland to New England and is centered in eastern Canadian waters; the other includes individuals found in Icelandic waters and south to northwest Africa (Sears *et al.*, 2005; Ramp *et al.*, 2006). There are no current estimates of abundance for the blue whale populations in the North Atlantic (Waring *et al.*, 2008); however, the 308 photo-identified individuals from the Gulf of St. Lawrence area (Sears *et al.*, 2005) are considered to be a minimum population estimate for the western North Atlantic stock (Waring *et al.*, 2008). The blue whale is under the jurisdiction of NMFS. The recovery plan for the blue whale was issued in 1998 (NMFS, 1998b).

Habitat—Blue whales inhabit both coastal and oceanic waters in temperate and tropical areas (Yochem and Leatherwood, 1985). Stranding and sighting data suggest blue whale occurrence in the Atlantic extends south to Florida and the Gulf of Mexico; however, the southern limit of this species' range in the North Atlantic Ocean is unknown (Yochem and Leatherwood, 1985). Blue whales in the Atlantic are primarily found in deeper, offshore waters and are rare in shallower, shelf waters (Wenzel *et al.*, 1988). Important foraging areas for this species include the edges of continental shelves and upwelling regions (Reilly and Thayer, 1990; Schoenherr, 1991). Acoustic and tagging data in the North Pacific indicate that relatively cold, productive waters and fronts attract feeding blue whales (Moore *et al.*, 2002). In the Gulf of St. Lawrence, blue whales show preference for the nearshore regions where strong tidal and current mixing leads to high productivity and rich prey resources (Sears *et al.*, 1990). Clark and Gagnon (2004) determined that vocalizing blue whales show strong preferences for shelf breaks, seamounts, or other areas where food resources are known to occur, even during summer months.

Acoustics and Hearing—Blue whale vocalizations are typically long, patterned low-frequency sounds with durations up to 36 sec (Thomson and Richardson, 1995) repeated every 1 to 2 min (Mellinger and Clark, 2003). Their frequency range is 12 to 400 Hz, with dominant energy in the infrasonic range at 12 to 25 Hz (Ketten, 1998; Mellinger and Clark, 2003). The short-duration sounds are transient, frequency-modulated calls having a higher frequency range and shorter duration than song notes and often sweeping down in frequency (Di Iorio *et al.*, 2005; Rankin *et al.*, 2005). These short-duration sounds are less than 5 sec in duration (Di Iorio *et al.*, 2005; Rankin *et al.*, 2005) and are high-intensity, broadband (858±148 Hz) pulses (Di Iorio *et al.*, 2005). Source levels of blue whale vocalizations are up to 188 dB (Ketten, 1998; Moore, 1999; McDonald *et al.*, 2001).

Distribution—Blue whales are distributed from the ice edge to the tropics and subtropics in both hemispheres (Jefferson *et al.*, 2008). Blue whales now rarely occur in the U.S. Atlantic Exclusive Economic Zone (EEZ) and the Gulf of Maine from August to October, which may represent the limits of their feeding range (CETAP, 1982; Wenzel *et al.*, 1988). Sightings in the Gulf of Maine and U.S. EEZ have been made in late summer and early fall (August and October) (CETAP, 1982; Wenzel *et al.*, 1988). Very little is known about the winter distribution of blue whales in the North Atlantic Ocean (Rice, 1998). Researchers using the Navy integrated undersea surveillance system resources (Sound Surveillance System [SOSUS] hydrophones) detected blue whales throughout the open Atlantic south to at least the Bahamas (Clark, 1995), suggesting that all North Atlantic blue whales may comprise a single stock (NMFS, 1998b).

The locations of breeding and calving grounds for blue whales are unknown.

GOMEX Range Complex Blue Whale Occurrence—This is one of the rarest cetacean species in the Gulf of Mexico (Würsig *et al.*, 2000). There are two reliable records of blue whales in the Gulf of Mexico from stranding reports (Jefferson and Schiro, 1997). One of these was a blue whale that stranded along the east coast of Mexico just west of the Yucatan peninsula and the other was a stranding on the coast of Louisiana. Although occurrence is not likely, blue whales may be present in the Gulf of Mexico at any time of year. The presence of blue whales at higher latitudes during the summer suggests that occurrence in the Gulf of Mexico may be even less likely during these months (CETAP, 1982; Wenzel *et al.*, 1988; Sears *et al.*, 1990).

GOMEX Range Complex Blue Whale Density—There is not an abundance estimate in the NOAA stock assessment report for blue whales in the Gulf of Mexico nor were there sufficient data available to estimate a density for the Study Area (DoN, 2007b; Waring *et al.*, 2008).

Fin Whale

The fin whale is the second-largest whale species, with adults reaching 24 m in length (Jefferson *et al.*, 2008). Fin whales feed by "gulping" upon a wide variety of small, schooling prey (especially herring, capelin, and sand lance) including squid and crustaceans (krill and copepods) (Kenney *et al.*, 1985; NMFS, 2006g).

Status and Management—The NOAA stock assessment report estimates that there are 2,269 individual fin whales in the western North Atlantic stock (Waring *et al.*, 2008); this is probably extremely conservative due to incomplete survey coverage of known fin whale habitat and a lack of certainty regarding fin whale movement in the North Atlantic (Waring *et al.*, 2008). Other estimates that adjust for uncertainty put the population at 5,000 to 6,000 fin whales in the waters of the U.S. Atlantic (CETAP, 1982; Kenney *et al.*, 1997). There may be genetically distinct subpopulations of fin whales within the North Atlantic and Mediterranean Sea (Bérubé *et al.*, 1998); however, these divisions are not recognized by governing bodies such as NMFS or the International Whaling Commission (Donovan, 1991; Waring *et al.*, 2008). The fin whale is listed as endangered and is under the jurisdiction of NMFS.

The draft recovery plan for the fin whale was released in June 2006 (NMFS, 2006g). NMFS recently initiated a 5-yr status review for the fin whale as required by the ESA (NMFS, 2007a).

Habitat—The fin whale is found in continental shelf, slope, and oceanic waters. Off the U.S. east coast, the fin whale appears to be scarce in slope and Gulf Stream waters (CETAP, 1982; Waring *et al.*, 1992). Globally, this species tends to be aggregated in locations where populations of prey are most plentiful, irrespective of water depth, although those locations may shift seasonally or annually (Payne *et al.*, 1986; Payne *et al.*, 1990a; Kenney *et al.*, 1996; Notarbartolo-di-Sciara *et al.*, 2003). Clark and Gagnon (2004) determined that vocalizing fin whales show strong preferences for shelf breaks, seamounts, or other areas where food resources are known to occur.

Acoustics and Hearing—Fin and blue whales produce calls with the lowest frequency and some of the highest source levels of all cetaceans. Infrasonic, pattern sounds have been documented for fin whales (Watkins *et al.*, 1987; Clark and Fristrup, 1997; McDonald and Fox, 1999). Fin whales produce a variety of sounds with a frequency range up to 750 Hz. The long, patterned 15 to 30 Hz vocal sequence is most typically recorded; only males are known to produce these (Croll *et al.*, 2002). The most typical fin whale sound is a 20 Hz infrasonic pulse (actually an FM sweep from about 23 to 18 Hz) with durations of about 1 sec and can reach source levels of 184 to 186 dB (Watkins *et al.*, 1987; Thomson and Richardson, 1995; Charif *et al.*, 2002). While no data on hearing availability are available for this species, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Distribution—Fin whales are broadly distributed throughout the world's oceans, usually in temperate to polar latitudes and less commonly in the tropics (Reeves *et al.*, 2002). The overall range of fin whales in the North Atlantic extends from the Gulf of Mexico/Caribbean and Mediterranean north to Greenland, Iceland, and Norway (Gambell, 1985; NMFS, 2006g). In the western North Atlantic, the fin whale is the most commonly sighted large whale in continental shelf waters from the mid-Atlantic coast of the U.S. to eastern Canada (CETAP, 1982; Hain *et al.*, 1992).

Based on passive acoustic detection using Navy SOSUS hydrophones in the western North Atlantic (Clark, 1995), fin whales are believed to move southward in the fall and northward in spring. The location and extent of the wintering grounds are poorly known (Aguilar, 2002). Fin whales have been seen feeding as far south as the coast of Virginia (Hain *et al.*, 1992). Fin whales are not completely absent from northeastern U.S. continental shelf waters in winter, indicating that not all members of the population migrate seasonally. Perhaps a fifth to a quarter of the spring/summer peak population remains in this area year-round (CETAP, 1982; Hain *et al.*, 1992).

Peak calving is in October through January (Hain *et al.*, 1992); however, the locations of breeding and calving grounds are unknown.

GOMEX Range Complex Fin Whale Occurrence—Fin whales rarely occur in the Gulf of Mexico; during the summer, individuals should be found on their feeding grounds further north off the northeastern U.S. There are only four recorded strandings and two confirmed sightings in the Study Area (Jefferson and Schiro, 1997). The remaining five records of fin whales in the Study Area are not verified (Jefferson and Schiro, 1997). Jefferson and Schiro (1997) suggested that the Gulf might represent a part of the range of a low-latitude fin whale population in the northwestern Atlantic or that possibly a small relict population is resident in the Gulf. It is more likely that these fin whale individuals move into and out of the Gulf of Mexico from the North Atlantic population(s) (Jefferson and Schiro, 1997; Würsig *et al.*, 2000). Although occurrence is not likely, fin whales may be present in the Gulf of Mexico at any time of year.

GOMEX Range Complex Fin Whale Density— There is not an abundance estimate in the NOAA stock assessment report for fin whales in the Gulf of Mexico nor were there sufficient data available to estimate a density for the Study Area (DoN, 2007b; Waring *et al.*, 2008).

Humpback Whale

Adult humpback whales are 11 to 16 m in length and are more robust than other rorquals. The body is black or dark gray, with very long (about one-third of the body length) flippers that are usually at least partially white (Jefferson *et al.*, 2008; Clapham and Mead, 1999). Humpback whales feed on a wide variety of invertebrates and small schooling fishes including krill, herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham and Mead, 1999).

Status and Management—The humpback whale is listed as endangered under the ESA. An estimated 11,570 humpback whales occur in the entire North Atlantic (Stevick *et al.*, 2003a). Humpback whales in the North Atlantic are thought to belong to five different feeding stocks: Gulf of Maine, Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, and Iceland. There appears to be very little exchange between these separate feeding stocks (Katona and Beard, 1990). The best estimate of abundance for the Gulf of Maine Stock is 847 individuals based on line-transect surveys conducted in 2006 (Waring *et al.*, 2008). The humpback whale is under the jurisdiction of NMFS. The recovery plan for the humpback whale was issued in 1991 (NMFS, 1991).

Habitat—Although humpback whales typically travel over deep, oceanic waters during migration, their feeding and breeding habitats are mostly in shallow, coastal waters over continental shelves (Clapham and Mead, 1999). Shallow banks or ledges with high sea-floor relief characterize feeding grounds (Payne *et al.*, 1990b; Hamazaki, 2002). The habitat requirements of wintering humpbacks appear to be determined by the conditions necessary for calving. Optimal calving conditions are warm waters (24 to 28 degrees [°] Celsius [C]) and relatively shallow, low-relief ocean bottom in protected areas (*e.g.*, behind reefs) (Sanders *et al.*, 2005). Females with calves occur in significantly shallower waters than other groups of humpback whales, and breeding adults use deeper, more offshore waters (Smultea, 1994; Ersts and Rosenbaum, 2003).

Acoustics and Hearing—Humpback whales produce sounds from 20 Hz to over 10 kHz, with dominant frequencies below 3 kHz (Silber, 1986). Houser *et al* (2001a) produced the first humpback whale audiogram (using a mathematical model). The predicted audiogram indicates sensitivity to frequencies from 700 Hz to 10 kHz, with maximum relative sensitivity between 2 and 6 kHz. Au *et al*. (2006) noted that if the popular notion that animals generally hear the totality of the sounds they produce is applied to humpback whales, this suggests that its upper frequency limit of hearing is as high as 24 kHz.

Distribution—Humpback whales are globally distributed in all major oceans and most seas. They are generally found during the summer on high-latitude feeding grounds and during the winter in the tropics and subtropics around islands, over shallow banks, and along continental coasts, where calving occurs. Most humpback whale sightings are in nearshore and continental shelf waters; however, humpback whales frequently travel through deep water during migration (Clapham and Mattila, 1990; Calambokidis *et al.*, 2001).

In the North Atlantic Ocean, humpbacks are found from spring through fall on feeding grounds that are located from south of New England to northern Norway (NMFS, 1991). During the winter, much of the North Atlantic population of humpback whales is believed to migrate south to calving grounds in the West Indies region (Whitehead and Moore, 1982; Smith *et al.*, 1999; Stevick *et al.*, 2003b); however, significant numbers of humpbacks have been found at mid and high latitudes during this time, suggesting that not all individuals undergo the seasonal migration (Clapham *et al.*, 1993; Swingle *et al.*, 1993). An increasing occurrence of humpbacks, including juveniles, along the U.S. Atlantic coast from

Florida north to Virginia suggests that this area may be a supplemental winter feeding ground (Clapham *et al.*, 1993; Swingle *et al.*, 1993; Wiley *et al.*, 1995; Laerm *et al.*, 1997; Barco *et al.*, 2002). It is not known whether the occurrence of humpbacks off the mid-Atlantic represents a change in distribution or is an artifact of increased survey effort or coverage (Waring *et al.*, 2008).

Humpback whale breeding areas in the West Indies, especially around the Dominican Republic, are well known and humpbacks are spread throughout the Caribbean during the winter and spring. Würsig *et al.* (2000) noted that humpbacks were hunted near the southern tip of Florida but were uncommon within the Gulf of Mexico. While there is little likelihood that there is a resident population within the Gulf, as humpback populations increase individuals may begin to overwinter or stray into the Gulf as they move between feeding and wintering grounds (Würsig *et al.*, 2000).

GOMEX Range Complex Humpback Whale Occurrence—Humpbacks occur sporadically in the Gulf of Mexico and generally are considered strays from the breeding grounds in the Caribbean (Weller *et al.*, 1996; Jefferson and Schiro, 1997; Würsig *et al.*, 2000); however, it should be noted that recent reports of humpback whales are occurring more often than expected (DoN, 2007a). The western-most sighting of a humpback whale in the Gulf of Mexico was made in February 1992 off Galveston, Texas (Weller *et al.*, 1996). There are at least 19 additional reports of humpback whales in the Gulf, mostly from the Florida panhandle region. Reports include a stranding east of Destin, Florida, in mid-April 1998, a confirmed sighting of six humpback whales in May 1998 near DeSoto Canyon, and a handful of sightings during spring 2006 (MMS, 2001; Pitchford, 2006). In February 2004, an individual was sighted off the west coast of Florida. This individual was identified as "Fingerpaint," a humpback whale known to inhabit the Gulf of Maine. Fingerpaint was resighted in September later that year in the Gulf of Maine (Guinta, 2006). Although the individuals sighted in the Gulf of Mexico are probably stray juveniles from the breeding grounds and thus are more likely to be present during the winter and spring (Weller *et al.*, 1996), the available information suggests that such occurrences could occur during any time of the year.

GOMEX Range Complex Humpback Whale Density— There is not an abundance estimate in the NOAA stock assessment report for humpback whales in the Gulf of Mexico nor were there sufficient data available to estimate a density for the Study Area (DoN, 2007b; Waring *et al.*, 2008).

North Atlantic Right Whale

Adult North Atlantic right whales are robust and may reach 18 m in length (Jefferson *et al.*, 2008). North Atlantic right whales feed on zooplankton, particularly large calanoid copepods (Kenney *et al.*, 1985; Beardsley *et al.*, 1996; Baumgartner *et al.*, 2007).

Status and Management—Right whales in the North Atlantic are some of the most endangered cetaceans in the world (Clapham *et al.*, 1999; Perry *et al.*, 1999; IWC, 2001). According to the North Atlantic right whale report card released annually by the North Atlantic Right Whale Consortium, approximately 393 individuals are thought to occur in the western North Atlantic (NARWC, 2007). The most recent NOAA stock assessment report states that in a review of the photo identification (ID) recapture database for June 2006, 313 individually recognized whales were known to be alive during 2001 (Waring *et al.*, 2008). There is evidence of modest population growth (NARWC, 2007; Neuhauser, 2007); however, Kraus *et al.* (2005) noted that the recent increases in birth rate may be insufficient to counter the recent spike in human-caused mortality (entanglement and ship strikes) of right whales. The North Atlantic right whale is under the jurisdiction of NMFS. The recovery plan for the North Atlantic right whale was published in 2005 (NMFS, 2005a).

One calving and two feeding areas in U.S. waters are designated as critical habitat for the North Atlantic right whale (NMFS, 1994; NMFS, 2005a). None of these areas is in the Gulf of Mexico.

In an effort to reduce ship collisions with critically endangered North Atlantic right whales, the Early Warning System (EWS; Right Whale Sighting Advisory System) was instigated in 1994 for the calving region along the southeastern U.S. coast. A similar system, known as the Northeast U.S. Right Whale Sighting Advisory System in the northeast, was created in 1996 for the feeding areas off New England (NMFS-NEFSC, 2008).

In 1999, a mandatory ship reporting (MSR) system was implemented by the U.S. Coast Guard (USCG, 1999; USCG, 2001). This reporting system requires specified vessels (Navy ships are exempt) to report their location while in the nursery and feeding areas of the right whale (Ward-Geiger *et al.*, 2005). At the same time, ships receive information on locations of North Atlantic right whale sightings to try to avoid whale collisions.

Reporting takes place in the southeastern U.S. from 15 November through 15 April. In the northeastern U.S., the reporting system is year-round and the geographic boundaries include the waters of Cape Cod Bay, Massachusetts Bay, and the Great South Channel east and southeast of Massachusetts. NOAA and the U.S. Coast Guard (USCG) have recommended two-way routes into the harbors in both northern and southern right whale habitat areas to try to mitigate the chance of shipstrike to right whales (NMFS, 2006e; NARWC, 2007). In December 2008, NMFS published a final rule requiring that ships 65 feet or longer travel at 10 knots or less in certain areas where right whales are known to congregate (NMFS, 2008).

Habitat—North Atlantic right whales on the winter calving grounds are most often found in shallow, nearshore waters in cooler SSTs inshore of a mid-shelf front (Kraus *et al.*, 1993; Ward, 1999). High whale densities can extend more northerly than the current defined boundary of the calving critical habitat in response to interannual variability in regional SST distribution (Garrison, 2007). Warm Gulf Stream waters appear to represent a thermal limit (both southward and eastward) for right whales (Keller *et al.*, 2006).

Feeding areas are characterized by bottom topography, water column structure, currents, and tides that combine to physically concentrate zooplankton into extremely dense patches (Wishner *et al.*, 1988; Murison and Gaskin, 1989; Macaulay *et al.*, 1995; Beardsley *et al.*, 1996; Baumgartner *et al.*, 2003).

Acoustics and Hearing—Most of the sounds produced by right whales range in frequency from 0.02 to 15 kHz (dominant frequency range from 0.02 to less than 2 kHz; durations typically range from 0.01 to multiple seconds) with some sounds having multiple harmonics (Parks and Tyack, 2005). Recent morphometric analyses of northern right whale inner ears estimate a hearing range of approximately 0.01 to 22 kHz based on established marine mammal models (Parks *et al.*, 2004; Parks and Tyack, 2005; Parks *et al.*, 2007). In addition, Parks *et al.* (2007) estimated the functional hearing range for right whales to be 15 Hz to 18 kHz. Nowacek *et al* (2004) observed that exposure to short tones and down sweeps, ranging in frequency from 0.5 to 4.5 kHz, induced an alteration in behavior (received levels of 133 to 148 dB), but exposure to sounds produced by vessels (dominant frequency range of 0.05 to 0.5 kHz) did not produce any behavioral response (received levels of 132 to 142 dB).

Distribution—Right whales occur in sub-polar to temperate waters. The North Atlantic right whale was historically widely distributed, ranging from latitudes of 60° North (N) to 20°N prior to serious declines in abundance due to intensive whaling (*e.g.*, NMFS, 2006d; Reeves *et al.*, 2007). North Atlantic right whales are found primarily in continental shelf waters between Florida and Nova Scotia (Winn *et al.*, 1986). Most sightings are concentrated within five high-use areas: coastal waters of the southeastern U.S. (Georgia and Florida), Cape Cod and Massachusetts Bays, the Great South Channel, the Bay of Fundy, and the Nova Scotian Shelf (Winn *et al.*, 1986; Silber and Clapham, 2001). Of these, one calving and two feeding areas in U.S. waters are designated as critical habitat for North Atlantic right whales

under the ESA (NMFS, 1994; NMFS, 2005a). The critical habitat designated waters off Georgia and northern Florida are the only known calving ground for western North Atlantic right whales, with use concentrated in the winter (as early as November and through March) (Winn *et al.*, 1986). The feeding grounds of Cape Cod Bay, which have the greatest number of individuals in February through April (Winn *et al.*, 1986; Hamilton and Mayo, 1990), and the Great South Channel east of Cape Cod, with most frequent use in April through June (Winn *et al.*, 1986; Kenney *et al.*, 1995), have also been designated as critical habitat for the North Atlantic right whale.

Most North Atlantic right whale sightings follow a well-defined seasonal migratory pattern through several consistently utilized habitats (Winn *et al.*, 1986). It should be noted, however, that some individuals may be sighted in these habitats outside the typical time of year and that migration routes are poorly known (Winn *et al.*, 1986). Knowlton *et al.* (2002) analyzed sightings data collected in the mid-Atlantic from northern Georgia to southern New England and found that the majority of right whale sightings occurred within approximately 56 km (30 nm) from shore. In fact, trans-Atlantic migrations of North Atlantic right whales between the eastern U.S. coast and Norway have been documented (Jacobsen *et al.*, 2004) which suggests a possible offshore migration path. During the spring through early summer, North Atlantic right whales are found on feeding grounds off the northeastern U.S. and Canada. During the winter (as early as November and through March), North Atlantic right whales may be found in coastal waters off North Carolina, Georgia, and northern Florida (Winn *et al.*, 1986).

GOMEX Range Complex North Atlantic Right Whale Occurrence—The North Atlantic right whale rarely occurs in the Study Area. There are five confirmed records for the Gulf of Mexico; all of them occurred in winter and spring, including one stranding on the Texas coast in 1972 (Schmidly *et al.*, 1972; Zoodsma, 2006). Three of the sightings were of cow-calf pairs. One pair seen in late January 2004 off Miami, Florida and in mid-March to early April off the Florida Panhandle was later resighted in June in waters off Cape Cod (Neuhauser, 2007). More recently, a cow-calf pair was photographed in Corpus Christi Bay off southern Texas and sighted a few weeks later off Long Boat Key, Florida (NOAA and FWC, 2006; Zoodsma, 2006). These records likely represent strays from the wintering grounds though they may reflect a more extensive historic range beyond the known calving and wintering ground in the waters of the southeastern U.S. (Jefferson and Schiro, 1997; Waring *et al.*, 2008). Although individuals sighted in the Gulf of Mexico are considered strays from the wintering grounds, it should be noted that recent reports of North Atlantic right whales in the Gulf of Mexico are occurring more often than expected (DoN, 2007a). Sightings records indicate that this species is most likely to occur in the Gulf of Mexico during the winter and spring. During the summer months, individuals should be found farther north on their feeding grounds off the northeastern U.S. and Canada.

GOMEX Range Complex North Atlantic Right Whale Density— There is not an abundance estimate in the NOAA stock assessment report for North Atlantic right whales in the Gulf of Mexico nor were there sufficient data available to estimate a density for the Study Area (DoN, 2007b; Waring *et al.*, 2008).

Sei Whale

Adult sei whales are up to 18 m in length and are mostly dark gray in color with a lighter belly, often with mottling on the back (Jefferson *et al.*, 2008). In the North Atlantic Ocean, the major prey species are copepods and krill (Kenney *et al.*, 1985). The sei whale is atypical in that it primarily "skims" its food, although it is known to exhibit "gulping" feeding behavior like the other rorquals (Pivorunas, 1979).

Status and Management—Sei whales are listed as endangered under the ESA. The International Whaling Commission (IWC) recognizes three sei whale stocks in the North Atlantic: Nova Scotia, Iceland-Denmark Strait, and Northeast Atlantic (Perry *et al.*, 1999). The range of the Nova Scotia stock

includes U.S. Atlantic waters (Waring *et al.*, 2008). The most recent estimate of abundance for the Nova Scotia stock is 207 individuals; this is an extremely conservative estimate due to incomplete coverage of the entire range of the species and the uncertainty regarding movement in the North Atlantic Ocean (Waring *et al.*, 2008). The sei whale is under the jurisdiction of NMFS. A draft recovery plan for fin and sei whales was released in 1998 (NMFS, 1998a). It has since been determined that the two species should have separate recovery plans. The independent recovery plan for the sei whale has not yet been issued.

Habitat—Sei whales are most often found in deep, oceanic waters of the cool temperate zone. Sei whales appear to prefer regions of steep bathymetric relief, such as the continental shelf break, canyons, or basins situated between banks and ledges (Kenney and Winn, 1987; Schilling *et al.*, 1992; Gregr and Trites, 2001; Best and Lockyer, 2002). These areas are often the location of persistent hydrographic features, which may be important factors in concentrating prey, especially copepods. On the feeding grounds, the distribution is largely associated with oceanic frontal systems (Horwood, 1987). Characteristics of preferred breeding grounds are unknown. Horwood (1987) noted that sei whales prefer oceanic waters and are rarely found in marginal seas; historical whaling catches were usually from deepwater, and land station catches were usually taken from along or just off the edges of the continental shelf.

Acoustics and Hearing—Sei whale vocalizations have been recorded only on a few occasions. During winter months off Hawaii, Rankin and Barlow (2007a) recorded downsweep calls exhibiting two distinct frequency ranges that were attributed to sei whales: the frequency ranges were from 100 to 44 Hz and from 39 to 21 Hz with the former range usually shorter in duration. Baumgartner *et al.* (2008) documented a down sweep call attributed to sei whales in the Great South Channel of the northwest Atlantic which are similar to the frequency-modulated (100 Hz to 44 Hz) calls recorded by Ranken and Barlow (2007a) from sei whales in the Pacific Ocean. Recordings from the North Atlantic consisted of paired sequences (0.5 to 0.8 sec, separated by 0.4 to 1.0 sec) of 10 to 20 short (4 milliseconds [msec]) frequency-modulated (FM) sweeps between 1.5 and 3.5 kHz; source level was not known (Thomson and Richardson, 1995). While no data on hearing ability are available for this species, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Distribution—Sei whales have a worldwide distribution but are found primarily in cold temperate to subpolar latitudes rather than in the tropics or near the poles (Horwood, 1987). Sei whales spend the summer months feeding in the subpolar higher latitudes and return to the lower latitudes to calve in the winter. For the most part, the location of winter breeding areas remains a mystery (Rice, 1998; Perry *et al.*, 1999).

In the western North Atlantic Ocean, the Nova Scotia Stock of the sei whale occurs primarily from Georges Bank north to Davis Strait (northeast Canada, between Greenland and Baffin Island; Perry *et al.*, 1999; Waring *et al.*, 2008) but may be distributed as far south as North Carolina (NMFS, 1998a). Sei whales are not common in U.S. Atlantic waters (NMFS, 1998a); peak abundance in U.S. waters occurs from winter through spring (mid-March through mid-June), primarily around the edges of Georges Bank (CETAP, 1982; Stimpert *et al.*, 2003). Sei whales are known for occasional irruptive occurrences in areas followed by disappearances that may last for decades (Horwood, 1987; Schilling *et al.*, 1992; Clapham *et al.*, 1997; Gregr *et al.*, 2005). The hypothesis is that the Nova Scotia stock moves from spring feeding grounds on or near Georges Bank, to the Scotian Shelf in June and July, eastward to perhaps Newfoundland and the Grand Banks in late summer, then back to the Scotian Shelf in fall, and offshore and south in winter (Mitchell and Chapman, 1977).

GOMEX Range Complex Sei Whale Occurrence—The sei whale is represented by only three reliable records in the northern Gulf of Mexico. There are two stranding records near Louisiana and one

stranding on the Florida Panhandle (Mead, 1977; Jefferson and Schiro, 1997). The preferential mid-latitude distribution of the sei whale suggests that occurrence in the Gulf of Mexico is unlikely; however, the records of the sei whale in the Gulf indicate that this species may occur at any time of year.

GOMEX Range Complex Sei Whale Density— There is not an abundance estimate in the NOAA stock assessment report for sei whales in the Gulf of Mexico nor were there sufficient data available to estimate a density for the Study Area (DoN, 2007b; Waring *et al.*, 2008).

Sperm Whale

The sperm whale is the largest toothed whale species. Sperm whales are significantly sexually dimorphic with adult females reaching 12 m in length and adult males as much as 18 m (Jefferson *et al.*, 2008). Sperm whales prey on mesopelagic squids and other cephalopods, as well as demersal fishes and benthic invertebrates (Rice, 1989; Clarke, 1996).

Status and Management—Sperm whales are listed as endangered under the ESA. Sperm whales in the northern Gulf of Mexico are managed by NMFS as a separate stock with a current best population estimate of 1,665 individuals (Waring *et al.*, 2008). Based on mark-recapture analyses of photo-identified individuals, an estimated 398 individuals use the region south of the Mississippi River Delta between the Mississippi Canyon and DeSoto Canyon along and about the 1,000-m isobath (Jochens *et al.*, 2006). There is no designated critical habitat for this species. The draft recovery plan for the sperm whale was released in June 2006 for public comment (NMFS, 2006d). A 5-yr status review under the ESA was completed in January 2009 for the sperm whale (NMFS, 2009).

Habitat—Sperm whale habitat use varies, but is generally associated with waters over the continental shelf edge, continental slope, and offshore (CETAP, 1982; Hain *et al.*, 1985; Smith *et al.*, 1996; Waring *et al.*, 2001; Davis *et al.*, 2002). Sperm whale densities have been correlated with high secondary productivity and steep underwater topography (Jaquet and Whitehead, 1996). Data suggest that sperm whales adjust their movements to stay in or near cold-core rings, perhaps in response to prey density (Davis *et al.*, 2000; 2002). Griffin (1999) showed that sperm whales are five times more likely to occur near oceanographic features such as eddies and thermal fronts than in the remainder of his study area, suggesting that oceanographic features have a significant impact on the habitat use of sperm whales.

Acoustics and Hearing—Sperm whales typically produce short-duration (less than 30 ms), repetitive broadband clicks used for communication and echolocation. These clicks range in frequency from 0.1 to 30 kHz, with dominant frequencies between the 2 to 4 kHz and 10 to 16 kHz ranges (Thomson and Richardson, 1995). It has been shown that sperm whales may produce clicks during 81 percent of their dive period, specifically 64 percent of the time during their descent phases (Watwood *et al.*, 2006). The anatomy of the sperm whale's inner and middle ear indicates an ability to best hear high-frequency to ultrasonic frequency sounds. They may also possess better low-frequency hearing than other odontocetes, although not as low as many baleen whales (Ketten, 1992). The auditory brainstem response (ABR) technique used on a stranded neonatal sperm whale indicated it could hear sounds from 2.5 to 60 kHz with best sensitivity to frequencies between 5 and 20 kHz (Ridgway and Carder, 2001).

Distribution—Sperm whales are found from tropical to polar waters in all oceans of the world between approximately 70°N and 70° South (S) (Rice, 1998). Females are normally restricted to areas with SST greater than approximately 15°C, whereas males can be found in waters as far poleward as the pack ice with temperatures close to 0°C (Rice, 1989). The thermal limits of female distribution correspond approximately to the 40° parallels (Whitehead, 2003). Some sperm whales may have preferred "territories" demonstrated by home-range fidelity; this has been noted in the Galapagos (Lettevall *et al.*, 2002), the Gulf of California (Jaquet *et al.*, 2002), and the Gulf of Mexico (Würsig *et al.*, 2000).

Mating may occur December through August, with the peak breeding season falling in the spring (NMFS, 2006d); however, the location of specific breeding grounds is unknown. In the Gulf of Mexico, the Mississippi River Delta region has been identified as a possible calving area (*e.g.*, Davis *et al.*, 2002).

GOMEX Range Complex Sperm Whale Occurrence—Worldwide, sperm whales exhibit a strong affinity for deep waters beyond the continental shelf break (NMFS, 2006d). The recorded observations of sperm whales in the Gulf of Mexico support this trend, with sightings consistently recorded in waters beyond the 200-m isobath (DoN, 2007a). Sperm whales may occur year-round in the deepest waters of the northern Gulf of Mexico and the outer continental shelf waters in the region off the Mississippi River Delta (DoN, 2007a). They are associated with dynamic features such as eddies that concentrate zooplankton and may be indicative of an increased density of prey (Davis *et al.*, 2002). Satellite-tag studies of sperm whales in the northern Gulf of Mexico confirm their strong preference for deep water over the continental slope and submarine canyons as well as offshore habitats (Mate, 2003; Ortega-Ortiz *et al.*, 2005). Sperm whales tend to be observed most often near the 1,000-m isobath (Jochens *et al.*, 2006). In addition to the aggregations of sperm whales seen here, the Mississippi River Delta region appears to represent an important calving and nursery area for these animals (Townsend, 1935; Collum and Fritts, 1985; Mullin *et al.*, 1994a; Würsig *et al.*, 2000; Baumgartner *et al.*, 2001; Davis *et al.*, 2002; Mullin *et al.*, 2004; Jochens *et al.*, 2006). On the basis of photo-identification of sperm whale flukes and acoustic analyses, it is likely that some sperm whales are resident to the Gulf of Mexico (Weller *et al.*, 2000; Jochens *et al.*, 2006). Tagging data demonstrated that some individuals spend several months at a time in the Mississippi River Delta and the Mississippi Canyon, while other individuals move to other locations the rest of the year (Jochens *et al.*, 2006). Segregation between the sexes was noted during one year of survey by Jochens *et al.* (2006); females and juveniles showed high site fidelity to the region south of the Mississippi River Delta and Mississippi Canyon and in the western Gulf of Mexico, while males were mainly found in the DeSoto Canyon and along the Florida slope.

GOMEX Range Complex Sperm Whale Density—Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods and results are detailed in the GOMEX NODE report (DoN, 2007b). Density is not expected to be uniform across the BOMBEX Hotbox and associated warning areas. Sperm whales will likely be concentrated in waters near and seaward of the shelf break as well as around DeSoto Canyon based on habitat preferences. Density may shift in relation to dynamic oceanographic features. Sperm whales do not occur in the Demolition Pond.

West Indian Manatee

The West Indian manatee is a rotund, slow-moving animal that reaches a maximum length of 3.9 m (Jefferson *et al.*, 2008). They have an unusually low metabolic rate and a high thermal conductance that leads to energetic stress in winter (Bossart *et al.*, 2002). West Indian manatees are herbivores that feed opportunistically on a wide variety of submerged, floating, and emergent vegetation, but they also ingest invertebrates (USFWS, 2001; Courbis and Worthy, 2003; Reich and Worthy, 2006).

Status and Management—West Indian manatees are listed as endangered under the ESA and fall under the jurisdiction of the USFWS. West Indian manatee numbers are assessed by aerial surveys during the winter months when they are concentrated in warm-water refuges. Aerial surveys conducted in 2007 produced a preliminary abundance estimate of 2,812 West Indian manatees in Florida (FMRI, 2007). Along Florida's Gulf Coast, observers counted 1,400 West Indian manatees, while observers on the Atlantic coast counted 1,412 (FMRI, 2007).

In the most recent revision of the West Indian manatee recovery plan, manatees around Florida were divided into four relatively discrete management units or subpopulations, each representing a significant portion of the species' range (USFWS, 2001). West Indian manatees found along the Atlantic U.S. coast make up two subpopulations: the Atlantic Region and the Upper St. Johns River Region (USFWS, 2001). West Indian manatees from the western coast of Florida make up the other two subpopulations: the Northwest Region and the Southwest Region (USFWS, 2001). There are areas of critical habitat for the West Indian manatee along the Atlantic and Gulf coasts of Florida in coastal and inshore waters (Figure 3.7-1).

Habitat—West Indian manatees occur in very shallow waters of 2 to 4 m in depth, generally close to shore (Beck *et al.*, 2004). Shallow seagrass beds close to deep channels are preferred feeding areas in coastal and riverine habitats (*e.g.*, Lefebvre *et al.*, 2000; USFWS, 2001). West Indian manatees are frequently located in secluded canals, creeks, embayments, and lagoons near the mouths of coastal rivers and sloughs. These areas serve as locations of feeding, resting, mating, and calving (USFWS, 2001).

Estuarine and brackish waters, including natural and artificial freshwater sources, are typical West Indian manatee habitat (USFWS, 2001). West Indian manatees rarely occur in offshore waters, where abundant seagrass and vegetation are not available (Reynolds and Wilcox, 1994). When ambient water temperatures drop below about 20°C in fall and winter, migration to natural or anthropogenic warm-water sources takes place (Irvine, 1983).

Acoustics and Hearing—West Indian manatees produce a variety of squeak-like sounds that have a typical frequency range of 0.6 to 12 kHz (dominant frequency range from 2 to 5 kHz), and last 0.25 to 0.5 s (Steel and Morris, 1982; Thomson and Richardson, 1995; Niezrecki *et al.*, 2003). Recently, vocalizations below 0.1 kHz have also been recorded (Frisch and Frisch, 2003; Frisch, 2006). Overall, West Indian manatee vocalizations are considered relatively stereotypic, with little variation between isolated populations examined (*i.e.*, Florida and Belize; Nowacek *et al.*, 2003). However, vocalizations have been newly shown to possess nonlinear dynamic characteristics (e.g., subharmonics or abrupt, unpredictable transitions between frequencies), which could aid in individual recognition and mother-calf communication (Mann *et al.*, 2006). Average source levels for vocalizations have been calculated to range from 90 to 138 dB re: 1 µPa (average: 100 to 112 dB re 1 µPa) (Nowacek *et al.*, 2003; Phillips *et al.*, 2004). Behavioral data on two animals indicate an underwater hearing range of approximately 0.4 to 46 kHz, with best sensitivity between 16 and 18 kHz (Gerstein *et al.*, 1999), while earlier electrophysiological studies indicated best sensitivity from 1 to 1.5 kHz (Bullock *et al.*, 1982).

Distribution—The West Indian manatee occurs in warm, subtropical, and tropical waters of the western North Atlantic Ocean, from the southeastern U.S. to Central America, northern South America, and the West Indies (Lefebvre *et al.*, 2001). West Indian manatees occur along both the Atlantic and Gulf coasts of Florida. West Indian manatees are sometimes reported in the Florida Keys; these sightings are typically in the upper Florida Keys, with some reports as far south as Key West (Moore, 1951a, b; Beck, 2006). During winter months, the West Indian manatee population confines itself to inshore and inner shelf waters of the southern half of peninsular Florida and to springs and warm water outfalls (*e.g.*, power plant cooling water outfalls) further north along both coasts. As water temperatures rise in spring, West Indian manatees disperse from winter aggregation areas. West Indian manatees are frequently reported in coastal rivers of Georgia and South Carolina during warmer months (Lefebvre *et al.*, 2001). Along the Gulf of

Mexico coast, West Indian manatees occur year-round in coastal waters from Pensacola, Florida, south to the tip of Florida, although some sporadic occurrences have been documented as far west as Texas (Fertl *et al.*, 2005). Sightings are becoming more common along the coasts of Texas, Louisiana, and Mississippi. Although West Indian manatees are expected to inhabit nearshore areas, some have been sighted offshore as well, indicating that some individuals are capable of wide-ranging movements (*e.g.*, Reid, 2000; Lefebvre *et al.*, 2001; Fertl *et al.*, 2005; Alvarez-Alemán *et al.*, 2007).

GOMEX Range Complex West Indian Manatee Occurrence—On the Gulf coast of Florida, the West Indian manatee normally occurs in nearshore waters from Pensacola south to the Florida Keys (DoN, 2007a). Though West Indian manatees are most commonly found east and south of the panhandle region of Florida, they are known to occur in Bay County, Florida (USFWS, 2007). The West Indian manatee occurs normally in the nearshore waters of the Pensacola and Panama City OPAREAs and in the vicinity of the Demolition Pond. Since occasional occurrences are documented in nearshore waters as far west as Texas (Fertl *et al.*, 2005), West Indian manatees may also occur periodically in nearshore waters throughout the rest of the Study Area. West Indian manatee distribution is limited by ready access to food and fresh water, confining them to rivers, estuaries, and nearshore waters in the northern Gulf of Mexico (Reid, 2000). Additionally, offshore currents and lack of suitable resources make it unlikely that West Indian manatees deliberately travel offshore (Lefebvre *et al.*, 2001). Occurrences of the West Indian manatee seaward of 12 nm from shore are considered extralimital (Reid, 2000; Lefebvre *et al.*, 2001; DoN, 2007a).

West Indian manatees in the southeastern U.S. are divided into discrete populations based upon geographic boundaries; it is likely that any West Indian manatees affected by proposed actions in the GOMEX Range Complex would be from the Northwest Region subpopulation. However, West Indian manatees are known to make extensive movements; potential impacts to individuals from other areas of Florida (*i.e.*, the other four subpopulations) cannot be discounted. Therefore, any discussion of effects to West Indian manatees in this Final EIS/OEIS includes any and all individuals from the Florida population and is not limited to those occurring in the Northwest Region management unit.

GOMEX Range Complex West Indian Manatee Density—There is not an abundance estimate in the NOAA stock assessment report for West Indian manatees in the Gulf of Mexico nor were there sufficient data available to estimate a density for the Study Area (DoN, 2007b; Waring *et al.*, 2008).

3.7.2.1 Non-Threatened or Endangered Marine Mammal Species

Twenty-two non-threatened/non-endangered marine mammal species identified in Table 3.7-3 may occur in the GOMEX Study Area. These species include 2 baleen whale species and 20 toothed whale species.

Atlantic Spotted Dolphin

Atlantic spotted dolphins are born spotless and develop spots as they age (Perrin *et al.*, 1994a; Dudzinski, 1996; Herzing, 1997). Adults are up to 2.3 m long (Jefferson, *et al.* 2008); there is marked regional variation in the adult body size of the Atlantic spotted dolphin (Perrin *et al.*, 1987). There are two forms: a robust, heavily spotted form that inhabits the continental shelf and is usually found within 350 km of the coast and a smaller, less-spotted form that inhabits offshore waters (Perrin *et al.*, 1987; Perrin *et al.*, 1994a). The larger form is known specifically from the continental shelf of North America, including the U.S. east coast, the Gulf of Mexico, and the Atlantic coast of Central America. The smaller form occurs in more oceanic areas and around offshore islands such as the Azores (Jefferson *et al.*, 2008). Atlantic spotted dolphins feed on small cephalopods, fish, and benthic invertebrates (Perrin *et al.*, 1994a).

Figure 3.7-1

Designated Critical Habitat for the West Indian Manatee near the GOMEX Study Area

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Status and management—The best estimate of abundance for the Atlantic spotted dolphin in the northern Gulf of Mexico is 27,393 individuals (Waring *et al.*, 2008). The northern Gulf of Mexico management stock is genetically distinct from the western North Atlantic populations (Adams and Rosel, 2006; Waring *et al.*, 2008). The Atlantic spotted dolphin is under the jurisdiction of NMFS.

Habitat—Atlantic spotted dolphins occupy both continental shelf and offshore habitats. The large, heavily spotted coastal form of the Atlantic spotted dolphin typically occurs over the continental shelf inside or near the 185-m isobath, usually at least 8 to 20 km offshore (Perrin *et al.*, 1994a; Davis *et al.*, 1998; Würsig *et al.*, 2000; Perrin, 2002). There are also often sightings of this species beyond the shelf break in the Caribbean, Gulf of Mexico, and off the Atlantic coast of the U.S. (Mills and Rademacher, 1996; Roden and Mullin, 2000; Fulling *et al.*, 2003; Mullin and Fulling, 2004).

Acoustics and Hearing—A variety of sounds including whistles, echolocation clicks, squawks, barks, growls, and chirps have been recorded for the Atlantic spotted dolphin (Thomson and Richardson, 1995). Whistles have dominant frequencies below 20 kHz (range: 7.1 to 14.5 kHz) but multiple harmonics extend above 100 kHz, while burst pulses consist of frequencies above 20 kHz (dominant frequency of approximately 40 kHz) (Lammers *et al.*, 2003). Other sounds, such as squawks, barks, growls, and chirps, typically range in frequency from 0.1 to 8 kHz (Thomson and Richardson, 1995). Recently recorded echolocation clicks have two dominant frequency ranges at 40 to 50 kHz and 110 to 130 kHz, depending on source level (*i.e.*, lower source levels typically correspond to lower frequencies and higher frequencies to higher source levels (Au and Herzing, 2003). Echolocation click source levels as high as 210 dB re 1 μPa-m peak-to-peak have been recorded (Au and Herzing, 2003). Spotted dolphins in The Bahamas were frequently recorded during agonistic/aggressive interactions with bottlenose dolphins (and their own species) to produce squawks (0.2 to 12 kHz broad band burst pulses; males and females), screams (5.8 to 9.4 kHz whistles; males only), barks (0.2 to 20 kHz burst pulses; males only), and synchronized squawks (0.1-15 kHz burst pulses; males only in a coordinated group) (Herzing, 1996). There has been no data collected on Atlantic spotted dolphin hearing ability. However, odontocetes are generally adapted to hear high-frequencies (Ketten, 1997).

Distribution—Atlantic spotted dolphins are distributed in tropical and warm-temperate waters of the Atlantic Ocean from approximately 45°N to 35°S. In the western North Atlantic, it ranges from northern New England to the Gulf of Mexico and the Caribbean, and southward to the coast of Venezuela (Perrin *et al.*, 1987; Rice, 1998).

Peak calving periods in the Bahamas are early spring and late fall (Herzing, 1997); however, in the western Atlantic seasonality and location of breeding are unknown.

GOMEX Study Area Atlantic spotted dolphin occurrence—Atlantic spotted dolphins in the northern Gulf of Mexico are abundant in continental shelf waters (Fulling *et al.*, 2003; Waring *et al.*, 2007). Known densities of Atlantic spotted dolphins are highest in the eastern Gulf of Mexico, east of Mobile Bay (Fulling *et al.*, 2003). In oceanic waters, this species usually occurs near the shelf break and upper continental slope waters (Davis *et al.*, 1998; Mullin and Hansen, 1999). On the West Florida shelf, Atlantic spotted dolphins are more common in deeper waters than bottlenose dolphins (Griffin and Griffin, 2003); Griffin and Griffin (2004) reported higher densities of Atlantic spotted dolphins in this area during cool months (November to May) than during warm months (June to October). Würsig *et al.* (2000) note that this species is normally found at least 8 to 20 km offshore, but may move inshore in the late spring and summer, perhaps in response to prey distribution. The Atlantic spotted dolphin is expected to occur year-round in the northern Gulf of Mexico.

GOMEX Study Area Atlantic spotted dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1.

Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Atlantic spotted dolphins do not occur in the Demolition Pond.

Beaked Whales

Based on available data, the following four beaked whale species may be affected by the proposed action in the GOMEX Study Area: Cuvier's beaked whale (*Ziphius cavirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), and two other members of the genus *Mesoplodon* [Blainville's beaked whale (*Mesoplodon densirostris*) and Gervais' beaked whale (*Mesoplodon europaeus*)]. Sowerby's beaked whale (*Mesoplodon bidens*) is endemic to the North Atlantic and is considered to be a temperate species (MacLeod *et al.*, 2006). There is one reported stranding of Sowerby's beaked whale on the Gulf coast of Florida that is considered extralimital (Jefferson and Schiro, 1997; MacLeod *et al.*, 2006); therefore, this species is not discussed further.

Cuvier's beaked whales are relatively robust compared to other beaked whale species. Male and female Cuvier's beaked whales may reach 7.5 and 7.0 m in length, respectively (Jefferson *et al.*, 1993). *Mesoplodon* spp. have maximum reported adult lengths of 6.2 m (Mead, 1989). Blainville's and Gervais' beaked whales are nearly indistinguishable at sea (Coles, 2001). Stomach content analyses of captured and stranded individuals suggest beaked whales are deep divers that feed by suction on mesopelagic fish, squid, and deepwater benthic invertebrates (Heyning, 1989; Heyning and Mead, 1996; Santos *et al.*, 2001; MacLeod *et al.*, 2003). Stomach contents of Cuvier's beaked whales rarely contain fish, while stomach contents of *Mesoplodon* species frequently do (MacLeod *et al.*, 2003).

Status and management— The best estimate of abundance for Cuvier's beaked whale in the northern Gulf of Mexico is 65 individuals (Waring *et al.*, 2008). The best estimate of abundance for the two *Mesoplodon* species (Blainville's and Gervais' beaked whales) in the northern Gulf of Mexico is 57 individuals (Waring *et al.*, 2008). Species-specific estimates for *Mesoplodon* beaked whales in the Gulf of Mexico are not available due to the difficulty of identification at sea. Beaked whales are under NMFS jurisdiction.

Habitat—Beaked whales normally inhabit continental slope and deep oceanic waters (>200 m) (Waring *et al.*, 2001; Cañadas *et al.*, 2002; Pitman, 2002; MacLeod and Herman, 2004; Ferguson *et al.*, 2006; MacLeod and Mitchell, 2006). Beaked whales are only occasionally reported in waters over the continental shelf (Pitman, 2002). In the Gulf of Mexico, beaked whales are seen in waters with a bottom depth ranging from 420 to 3,487 m (Ward *et al.*, 2005).

Acoustics and Hearing—Sounds recorded from beaked whales are divided into two categories: whistles and pulsed sounds (clicks); whistles likely serve a communicative function and pulsed sounds are important in foraging and/or navigation (Johnson *et al.*, 2004; Madsen *et al.*, 2005; MacLeod and D'Amico, 2006; Tyack *et al.*, 2006). Whistle frequencies are about 2 to 12 kHz, while pulsed sounds range in frequency from 300 Hz to 135 kHz; however, as noted by MacLeod and D'Amico (2006), higher frequencies may not be recorded due to equipment limitations. Whistles recorded from free-ranging Cuvier's beaked whales off Greece ranged in frequency from 8 to 12 kHz, with an upsweep of about 1 sec (Manghi *et al.*, 1999), while pulsed sounds had a narrow peak frequency of 13 to 17 kHz, lasting 15 to 44 sec in duration (Frantzis *et al.*, 2002). Short whistles and chirps from a stranded subadult Blainville's beaked whale ranged in frequency from slightly less than 1 to almost 6 kHz (Caldwell and Caldwell, 1971a).

Recent studies incorporating DTAGs (miniature sound and orientation recording tag) attached to Blainville's beaked whales in the Canary Islands and Cuvier's beaked whales in the Ligurian Sea recorded high-frequency echolocation clicks (duration: 175 microseconds (µs) for Blainville's and 200 to 250 µs for Cuvier's) with dominant frequency ranges from about 20 to over 40 kHz (limit of

recording system was 48 kHz) and only at depths greater than 200 m (656 ft) (Johnson *et al.*, 2004; Madsen *et al.*, 2005; Zimmer *et al.*, 2005; Tyack *et al.*, 2006). The source level of the Blainville's beaked whales' clicks were estimated to range from 200 to 220 dB re 1 μPa-m peak-to-peak (Johnson *et al.*, 2004), while they were 214 dB re 1 μPa-m peak-to-peak for the Cuvier's beaked whale (Zimmer *et al.*, 2005). Mid-frequency sounds including a frequency-modulated pure tone, and three FM and AM pulsed sounds (between 6 and 16 kHz) were attributed to three cow/calf pairs of Blainville's beaked whales during shipboard visual/acoustic surveys near the Hawaiian islands (Rankin and Barlow, 2007b).

From anatomical examination of their ears, it is presumed that beaked whales are predominantly adapted to best hear ultrasonic frequencies (MacLeod, 1999; Ketten, 2000). Beaked whales have well-developed semi-circular canals (typically for vestibular function but may function differently in beaked whales) compared to other cetacean species, and they may be more sensitive than other cetaceans to low-frequency sounds (MacLeod, 1999; Ketten, 2000). Ketten (2000) remarked on how beaked whale ears (computerized tomography (CT) scans of Cuvier's, Blainville's, Sowerby's, and Gervais' beaked whale heads) have anomalously well-developed vestibular elements and heavily reinforced (large bore, strutted) Eustachian tubes and noted that they may impart special resonances and acoustic sensitivities. The only direct measure of beaked whale hearing is from a stranded juvenile Gervais' beaked whale using auditory evoked potential techniques (Cook *et al.*, 2006). The hearing range was 5 to 80 kHz, with greatest sensitivity at 40 and 80 kHz (Cook *et al.*, 2006).

Distribution—Cuvier's beaked whales are the most widely distributed of the beaked whales and are present in most regions of all major oceans, with a preference for deepwater areas (Heyning, 1989; MacLeod and Mitchell, 2006). This species occupies almost all temperate, subtropical, and tropical waters, as well as subpolar and even polar waters in some areas (MacLeod and Mitchell, 2006). Blainville's beaked whales are thought to have a continuous distribution throughout tropical, subtropical, and warm-temperate waters of the world's oceans; they occasionally occur in cold-temperate areas (MacLeod *et al.*, 2006). The Gervais' beaked whale is restricted to warm-temperate and tropical Atlantic waters with records throughout the Caribbean Sea (MacLeod *et al.*, 2006).

Beaked whale life histories are poorly known, reproductive biology is generally undescribed, and the location of specific breeding grounds is unknown.

GOMEX Study Area beaked whale occurrence—Beaked whales may occur seaward of the shelf break throughout the Study Area year-round based on their preference for deep waters. A few beaked whale sightings have been recorded on the continental shelf (Esher *et al.*, 1992); however, these sightings are suspect, and one of the sightings in shallow water may have been of an individual which later stranded (DoN, 2007a). The northern Gulf of Mexico continental shelf margin is considered a "key area" for beaked whales (MacLeod *et al.*, 2006). Gervais' beaked whale comprises most of the records of *Mesoplodon* spp. from the Gulf of Mexico (Jefferson and Schiro, 1997).

GOMEX Study Area beaked whale density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Beaked whales do not occur in the Demolition Pond.

Bottlenose Dolphin

Bottlenose dolphins are medium-sized, relatively robust dolphins that vary in color from light gray to charcoal. There is striking regional variation in body size with adult body length ranging from 1.9 to 3.8 m (Jefferson *et al.*, 2008). Bottlenose dolphins are opportunistic feeders that use numerous feeding strategies to prey on a variety of fish, cephalopods, and shrimps (Shane, 1990; Wells and Scott, 1999).

Bottlenose dolphins in the Gulf of Mexico exhibit at least two morphotypes: a nearshore form and an offshore form (Würsig *et al.*, 2000).

Status and management—Bottlenose dolphins are under the jurisdiction of NMFS. Two forms of bottlenose dolphins are recognized in the northern Gulf of Mexico: nearshore (coastal) and offshore morphotypes. The following stocks are recognized in the northern Gulf of Mexico: coastal stocks; a continental shelf stock; an oceanic stock; and bay, sound, and estuarine stocks (Waring *et al.*, 2008).

The bay, sound, and estuarine stocks are provisionally identified in the 33 areas of contiguous, enclosed, or semi-enclosed bodies of water adjacent to the Gulf of Mexico. There are no recent estimates of abundance for these stocks, but previous minimum population estimates for each stock are summarized in the NOAA SARs for the Gulf of Mexico (Waring *et al.*, 2008).

Three coastal stocks in the northern Gulf of Mexico occupy waters from the shore to the 20-m isobath but not necessarily within the bays, sounds and estuaries: eastern (84°W to Key West, Florida), northern (Mississippi River mouth to approximately 84°W), and western (Texas/Mexico border to the Mississippi River mouth) stocks. Coastal stocks may consist of both nearshore and offshore morphotypes and may co-mingle with the bay, sound, and estuarine stocks and the continental shelf stock. Current abundance estimates are not known; however, best estimates of abundance from 1992 to 1994 surveys are as follows: eastern stock (9,912 individuals), northern stock (4,191), and western stock (3,449) (Waring *et al.*, 2008).

The continental shelf stock is defined as dolphins inhabiting the waters from the Texas/Mexico border to Key West, Florida, between the 20 and 200 m isobaths and may consist of a mixture of both morphotypes. The best population estimate for this stock is 21,531 individuals (Waring *et al.*, 2008).

Oceanic stock is provisionally defined as bottlenose dolphins inhabiting waters from the 200 m isobath to the seaward extent of the EEZ. The best population estimate for the oceanic stock is 3,708 individuals (Waring *et al.*, 2008).

Habitat—Bottlenose dolphins are seen in both coastal and oceanic waters over the continental slope (Mullin and Fulling, 2004) and appear to have an almost bimodal distribution in the Gulf of Mexico: over the shallow continental shelf (0 to 150 m, with a peak at 75 m) and just seaward of the shelf break (200 to 750 m) (Baumgartner *et al.*, 2001). These regions may represent the individual depth preferences for the nearshore and offshore forms (Baumgartner *et al.*, 2001). Bottlenose dolphins are one of only two species of cetaceans encountered regularly over the continental shelf in the northern Gulf of Mexico (Baumgartner *et al.*, 2001). This species probably has the widest range of habitat preferences of any dolphin species that occurs in the Gulf of Mexico. They occur in brackish, estuarine, coastal, and open ocean habitats. Finer scale habitat use is probably influenced by risk of predation and food availability (Shane *et al.*, 1986; Wells *et al.*, 1987; Allen *et al.*, 2001; Heithaus and Dill, 2002).

Acoustics and Hearing—Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous sounds (whistles), which usually are frequency modulated. Clicks and whistles have a dominant frequency range of 110 to 130 kHz and a source level of 218 to 228 dB re 1 μPa-m peak-to-peak (Au, 1993) and 3.4 to 14.5 kHz and 125 to 173 dB re 1 μPa-m peak-to-peak, respectively (Ketten, 1998). Whistles are primarily associated with communication and can serve to identify specific individuals (*i.e.*, signature whistles) (Caldwell and Caldwell, 1965; Janik *et al.*, 2006). Up to 52 percent of whistles produced by bottlenose dolphin groups with mother-calf pairs can be classified as signature whistles (Cook *et al.*, 2004). Sound production is also influenced by group type (single or multiple individuals), habitat, and behavior (Nowacek, 2005). Bray calls (low-frequency vocalizations; majority of energy below 4 kHz), for example, are used when capturing fishes, specifically sea trout (*Salmo trutta*) and Atlantic salmon

(*Salmo salar*), in some regions (*i.e.*, Moray Firth, Scotland) (Janik, 2000). Additionally, whistle production has been observed to increase while feeding (Acevedo-Gutiérrez and Stienessen, 2004; Cook *et al.*, 2004). Furthermore, both whistles and clicks have been demonstrated to vary geographically in terms of overall vocal activity, group size, and specific context (*e.g.*, feeding, milling, traveling, and socializing) (Jones and Sayigh, 2002; Zaretsky *et al.*, 2005; Baron, 2006). For example, preliminary research indicates that characteristics of whistles from populations in the northern Gulf of Mexico significantly differ (*i.e.*, in frequency and duration) from those in the western north Atlantic (Zaretsky *et al.*, 2005; Baron, 2006).

Bottlenose dolphins can typically hear within a broad frequency range of 0.04 to 160 kHz (Au, 1993; Turl, 1993). Electrophysiological experiments suggest that the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and another for lower-frequency sounds, such as whistles (Ridgway, 2000). Scientists have reported a range of highest sensitivity between 25 and 70 kHz, with peaks in sensitivity at 25 and 50 kHz (Nachtigall *et al.*, 2000). Recent research on the same individuals indicates that auditory thresholds obtained by electrophysiological methods correlate well with those obtained in behavior studies, except at the some lower (10 kHz) and higher (80 and 100 kHz) frequencies (Finneran and Houser, 2006).

Temporary threshold shifts in hearing have been experimentally induced in captive bottlenose dolphins using a variety of noises (*i.e.*, broad-band, pulses) (Ridgway *et al.*, 1997; Schlundt *et al.*, 2000; Nachtigall *et al.*, 2003; Finneran *et al.*, 2005; Mooney *et al.*, 2005; Mooney, 2006). For example, TTS has been induced with exposure to a 3 kHz, one-second pulse with sound exposure level (SEL) of 195 dB re 1 μPa2-s (Finneran *et al.*, 2005), one-second pulses from 3 to 20 kHz at 192 to 201 dB re 1μPa-m (Schlundt *et al.*, 2000), and octave band noise (4 to 11 kHz) for 50 minutes at 179 dB re 1 μPa-m (Nachtigall *et al.*, 2003). Preliminary research indicates that TTS and recovery after noise exposure are frequency dependent and that an inverse relationship exists between exposure time and sound pressure level associated with exposure (Mooney *et al.*, 2005; Mooney, 2006). Observed changes in behavior were induced with an exposure to a 75 kHz one-second pulse at 178 dB re 1 μPa-m (Ridgway *et al.*, 1997; Schlundt *et al.*, 2000). Finneran *et al.* (2005) concluded that a SEL of 195 dB re 1 μPa^2 s is a reasonable threshold for the onset of TTS in bottlenose dolphins exposed to mid-frequency tones.

Distribution—In the western North Atlantic Ocean, bottlenose dolphins occur as far north as Nova Scotia but are most common in coastal waters from New England to Florida, the Gulf of Mexico, the Caribbean, and southward to Venezuela and Brazil (Würsig *et al.*, 2000). Seasonal shifts in distribution have been noted in some areas, such as the U.S. mid-Atlantic coast (Torres *et al.*, 2005).

Bottlenose dolphins are flexible in their timing of reproduction. Seasons of birth for bottlenose dolphin populations are likely responses to seasonal patterns of availability of local resources (Urian *et al.*, 1996). There are no specific breeding locations for this species.

GOMEX Study Area bottlenose dolphin occurrence—The bottlenose dolphin is by far the most widespread and common cetacean in coastal waters of the Gulf of Mexico (Würsig *et al.*, 2000). They are frequently sighted near the Mississippi River Delta (Baumgartner *et al.*, 2001) and have even been known to travel several kilometers up the Mississippi River (Jefferson, 2002a). Bottlenose dolphins are abundant in continental shelf waters throughout the northern Gulf of Mexico (*e.g.*, Fulling *et al.*, 2003; Waring *et al.*, 2008). Mullin and Fulling (2004) noted that in oceanic waters, bottlenose dolphins are encountered primarily in upper continental slope waters (<1,000 m in bottom depth) and that highest densities are in the northeastern Gulf of Mexico. The bottlenose dolphin occurs throughout the Gulf of Mexico year-round over the continental shelf and continental slope (Baumgartner *et al.*, 2001) as well as in the bays and sounds along the coast (Waring *et al.*, 2008). Baumgartner *et al.* (2001) noted that bottlenose dolphins are more likely to be found in areas of high sea surface temperature variability.

GOMEX Study Area bottlenose dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Bottlenose dolphins do not occur in the Demolition Pond.

Bryde's Whale

Bryde's whales usually have three prominent ridges on the rostrum (other rorquals generally have only one) (Jefferson *et al.*, 1993). Adults can be up to 15.5 m in length (Jefferson *et al.*, 1993). Bryde's whales are often confused with sei whales. Bryde's whales are lunge-feeders, feeding on schooling fish and krill (Nemoto and Kawamura, 1977; Siciliano *et al.*, 2004; Anderson, 2005).

Status and management—The best estimate of abundance for the Bryde's whale in the northern Gulf of Mexico is 15 individuals (Waring *et al.*, 2008). It has been suggested that Bryde's whales found in the northern Gulf of Mexico may represent a resident stock (Schmidly, 1981), but there is no information on stock differentiation (Waring *et al.*, 2008). The Bryde's whale is under the jurisdiction of NMFS.

Habitat—Bryde's whales are found both offshore and near the coasts in many regions. Bryde's whales appear to have a preference for water temperatures between approximately 15° and 20°C (Yoshida and Kato, 1999). Bryde's whales are more restricted to tropical and subtropical waters than other rorquals.

Acoustics and Hearing—Bryde's whales produce low frequency tonal and swept calls similar to those of other rorquals (Oleson *et al.*, 2003). Calls vary regionally, yet all but one of the call types have a fundamental frequency below 60 Hz. They last from one-quarter of a second to several seconds and are produced in extended sequences. Heimlich *et al.* (2005) recently described five tone types. These include two types of alternating tonal "phrases," a wideband "burst" followed by a tone that occurred in either lower (19 to 30 Hz) or higher (42 Hz) frequencies depending on the area, and an "harmonic tone phrase" with a fundamental frequency of 26 Hz. No vocalization exceeded 80 Hz. While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Distribution—Bryde's whales are found in tropical and subtropical waters, generally not moving poleward of 40° in either hemisphere (Jefferson *et al.*, 2008). Long migrations are not typical of Bryde's whales although limited shifts in distribution toward and away from the equator in winter and summer, respectively, have been observed (Cummings, 1985). The Bryde's whale does not have a well-defined breeding season in most areas and locations of specific breeding areas are unknown.

GOMEX Study Area Bryde's whale occurrence—In the Gulf of Mexico, all Bryde's whale sightings have been near the shelf break in and near DeSoto Canyon (Mullin *et al.*, 1994a; Davis and Fargion, 1996; Jefferson and Schiro, 1997; Davis *et al.*, 1998; Davis *et al.*, 2000). Mead (1977) and Schmidly (1981) both postulated that the Gulf of Mexico hosts a resident population of Bryde's whale, but more data are needed to confirm this. There are 12 confirmed sightings of Bryde's whales in the Gulf of Mexico, making it the most commonly sighted baleen whale species in this area (Jefferson and Schiro, 1997; Würsig *et al.*, 2000). Most sightings of Bryde's whales are from the spring, but strandings are reported year-round indicating the presence of Bryde's whales in the Gulf of Mexico throughout the year (Mead, 1977; Jefferson and Schiro, 1997; Würsig *et al.*, 2000).

GOMEX Study Area Bryde's whale density—Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Bryde's whales do not occur in the Demolition Pond.

Clymene Dolphin

Due to similarity in appearance, Clymene dolphins are easily confused with spinner and short-beaked common dolphins (Fertl *et al.*, 2003). The Clymene dolphin, however, is smaller and more robust, with a much shorter and stockier beak. The Clymene dolphin reaches at least 2 m in length and weights of at least 80 kilograms (kg) (Jefferson *et al.*, 2008). Clymene dolphins feed on small pelagic fish and squid (Perrin *et al.*, 1981; Perrin and Mead, 1994; Fertl *et al.*, 1997).

Status and management—The best estimate of abundance for Clymene dolphins in the northern Gulf of Mexico is 6,575 individuals (Waring *et al.*, 2008). This species is under the jurisdiction of NMFS.

Habitat—Clymene dolphins are a tropical to subtropical species, primarily sighted in deep waters well beyond the edge of the continental shelf (Fertl *et al.*, 2003). The Clymene dolphin is found in the warmer waters of the North Atlantic and is often associated with the North Equatorial Current, the Gulf Stream, and the Canary Current (Fertl *et al.*, 2003). In the western North Atlantic, Clymene dolphins are likely to be strongly influenced by oceanographic features (Mullin and Fulling, 2003).

Acoustics and Hearing—The only data available for this species is a description of their whistles. Clymene dolphin whistle structure is similar to that of other stenellids, but it is generally higher in frequency (range of 6.3 to 19.2 kHz) (Mullin *et al.*, 1994b). There is no empirical data on the hearing ability of Clymene dolphins; however, the most sensitive hearing range for odontocetes generally includes high frequencies (Ketten, 1997).

Distribution— The Clymene dolphin has a tropical and subtropical distribution in the Atlantic Ocean (Perrin and Mead, 1994). In the western Atlantic Ocean, Clymene dolphins are distributed from New Jersey to Brazil, including the Gulf of Mexico and Caribbean Sea (Fertl *et al.*, 2003; Moreno *et al.*, 2005).

Seasonality and location of Clymene dolphin breeding are unknown.

GOMEX Study Area Clymene dolphin occurrence—The Clymene dolphin is a deepwater species (Perrin and Mead, 1994; Würsig *et al.*, 2000; Reeves *et al.*, 2002; Fertl *et al.*, 2003). Mullin and Hansen (1999) noted that the majority of sightings for this species in the Gulf of Mexico are west of the Mississippi River. Although Jefferson *et al.* (1995) did not identify seasonal shifts in distribution, Wursig *et al.* (2000) note a wider, though still oceanic, distribution in the western Gulf during spring and in the northeastern Gulf during summer and winter. In a study of habitat preferences in the Gulf of Mexico, Clymene dolphins were found more often on the lower slope and deepwater areas in regions of cyclonic or confluence circulation (Davis *et al.*, 2002). Two mass strandings of Clymene dolphins were reported in the Florida Keys: one in July 1983 and the other in December 1992 (Jefferson *et al.*, 1995). The vast majority of known records of the Clymene dolphin come from the northern Gulf of Mexico, though this is probably indicative of research effort rather than any actual density or distribution pattern (Jefferson *et al.*, 1995; Würsig *et al.*, 2000; Fertl *et al.*, 2003).

GOMEX Study Area Clymene dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Clymene dolphins do not occur in the Demolition Pond.

False Killer Whale

The false killer whale is a large, dark gray to black dolphin with adult body length reaching 6 m (Jefferson *et al.*, 2008). It has a long slender body, a rounded overhanging forehead, and little or no beak. External coloration includes a faint gray patch on the chest and light gray areas on the head (Jefferson *et al.*, 1993). The flippers have a "hump" on the leading edge that is useful for species

identification (Reeves *et al.*, 2002). The distinctive flipper shape is perhaps the best characteristic for distinguishing this species from other dark, round-headed delphinid species (*i.e.*, pygmy killer, melon-headed, and pilot whales) (Jefferson *et al.*, 1993). Deepwater cephalopods and fish are their primary prey (Odell and McClune, 1999), but large pelagic species such as dorado have been taken.

Status and management—The best estimate of abundance for false killer whales in the northern Gulf of Mexico is 777 individuals (Waring *et al.*, 2008). This species is under the jurisdiction of NMFS.

Habitat—False killer whales are primarily offshore animals, although they do come close to shore, particularly around oceanic islands (Baird, 2002). Inshore movements are occasionally associated with movements of prey and shoreward flooding of warm ocean currents (Stacey *et al.*, 1994).

Acoustics and Hearing—Dominant frequencies of false killer whale whistles are from 4 to 9.5 kHz, and those of their echolocation clicks are from either 20 to 60 kHz or 100 to 130 kHz depending on ambient noise and target distance (Thomson and Richardson, 1995). Click source levels typically range from 200 to 228 dB re 1 μPa-m (Ketten, 1998). Recently, false killer whales recorded in the Indian Ocean produced echolocation clicks with dominant frequencies of about 40 kHz and estimated source levels of 201-225 dB re 1 μPa-m peak-to-peak (Madsen *et al.*, 2004). False killer whales can hear frequencies ranging from approximately 2 to 115 kHz with best hearing sensitivity ranging from 16 to 64 kHz (Thomas *et al.*, 1988). Additional behavioral audiograms of false killer whales support a range of best hearing sensitivity between 16 and 24 kHz, with peak sensitivity at 20 kHz (Yuen *et al.*, 2005). The same study also measured audiograms using the ABR technique, which came to similar results, with a range of best hearing sensitivity between 16 and 22.5 kHz, peaking at 22.5 kHz (Yuen *et al.*, 2005). Behavioral audiograms in this study consistently resulted in lower thresholds than those obtained by ABR.

Distribution—False killer whales are found in tropical and temperate waters, generally between 50°N and 50°S latitude with a few records north of 50°N in the Pacific and the Atlantic (Baird *et al.*, 1989; Odell and McClune, 1999). Seasonality and location of false killer whale breeding are unknown.

GOMEX Study Area false killer whale occurrence—The false killer whale is an oceanic species. Most sightings in the Gulf of Mexico have been made seaward of the shelf break, although there are also sightings from over the continental shelf (Davis and Fargion, 1996; Jefferson and Schiro, 1997; Mullin and Fulling, 2004). Mullin and Fulling (2004) reported most sightings east of the Mississippi River. There is the possibility of encountering false killer whales between the 50-m isobath and the shelf break based on the fact that false killer whales sometimes make their way into shallower waters, as well as the many sightings reported by sport fishermen in the mid-1960s of "blackfish" (most likely false killer whales based on the descriptions) in waters offshore of Pensacola and Panama City, Florida (Brown *et al.*, 1966). Stranding and sighting records are from the spring and summer (Jefferson and Schiro, 1997; Würsig *et al.*, 2000; Mullin and Fulling, 2004; Waring *et al.*, 2008), but there are not enough data to determine whether there is a significant seasonal component to the distribution of this species in the northern Gulf of Mexico (Jefferson and Schiro, 1997; Würsig *et al.*, 2000). False killer whales are expected to occur year-round in the Gulf of Mexico seaward of the shelf break, though they may be encountered over the continental shelf as well.

GOMEX Study Area false killer whale density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). False killer whales do not occur in the Demolition Pond.

Fraser's Dolphin

The Fraser's dolphin reaches a maximum length of 2.7 m and is generally more robust than other small delphinids (Jefferson *et al.*, 2008). They feed on mesopelagic fish, squid, and shrimp (Jefferson and Leatherwood, 1994; Perrin *et al.*, 1994c).

Status and management—There is no current estimate of abundance for Fraser's dolphins in the northern Gulf of Mexico (Waring *et al.*, 2008). This species is under the jurisdiction of NMFS.

Habitat—Fraser's dolphin is a deep-water species found beyond the continental shelf break; it does not occur in shallow nearshore waters (Perrin *et al.*, 1994c; Jefferson and Schiro, 1997; Würsig *et al.*, 2000). However, they may be seen nearshore in areas where deep waters are close to the coast (Dolar, 2002).

Acoustics and Hearing—Fraser's dolphin whistles have been recorded having a frequency range of 7.6 to 13.4 kHz in the Gulf of Mexico (duration less than 0.5 sec) (Leatherwood *et al.*, 1993). There are no empirical hearing data available for this species.

Distribution—The Fraser's dolphin has a pantropical distribution, typically between 30°N and 30°S (Jefferson *et al.*, 2008). Few records are available from the Atlantic Ocean (Leatherwood *et al.*, 1993; Watkins *et al.*, 1994; Bolaños and Villarroel-Marin, 2003). Location of Fraser's dolphin breeding is unknown, and available data do not support calving seasonality.

GOMEX Study Area Fraser's dolphin occurrence—In the Gulf of Mexico, this species occurs mostly in very deep waters well beyond the continental shelf break (Jefferson, 2002a). There are verified stranding and sighting records for Fraser's dolphin in the Gulf of Mexico from all seasons (Jefferson and Schiro, 1997; Würsig *et al.*, 2000). Leatherwood *et al.* (1993) reported sightings over the abyssal plain in the southern Gulf of Mexico. Mullin and Fulling (2004) noted that this is a rare species, but it is thought to occur in the northern Gulf of Mexico even during years with survey effort when they are not sighted. Fraser's dolphins are expected to occur year round in the Study Area.

GOMEX Study Area Fraser's dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Fraser's dolphins do not occur in the Demolition Pond.

Killer Whale

Killer whales are the largest delphinids and are one of the most recognizable species of cetaceans. The black-and-white color pattern of the killer whale is striking, as is the tall, erect dorsal fin of the adult male (1.0 to 1.8 m in height) (Jefferson *et al.*, 1993). Killer whales are sexually dimorphic with males reaching a maximum length of 9.8 m and females 8.5 m (Jefferson *et al.*, 2008). Killer whales feed on fish, cephalopods, seabirds, sea turtles, and other marine mammals (Katona *et al.*, 1988; Jefferson *et al.*, 1991; Estes *et al.*, 1998; Visser and Bonoccorso, 2003; Pitman and Dutton, 2004; Visser, 2005).

Status and management—The best estimate of abundance for killer whales in the northern Gulf of Mexico is 49 individuals (Waring *et al.*, 2008). Most cetacean taxonomists agree that multiple killer whale species or subspecies occur worldwide (Krahn *et al.*, 2004; Waples and Clapham, 2004). There is some evidence that there may be distinct stocks in the North Atlantic Ocean but none differentiating killer whales in the Gulf of Mexico (Waring *et al.*, 2008). The killer whale is under the jurisdiction of NMFS.

Habitat—Killer whales have the most ubiquitous distribution of any species of marine mammal. They have been observed in virtually every marine habitat from the tropics to the poles and from shallow, inshore waters (and even rivers) to deep, oceanic regions (Dahlheim and Heyning, 1999). In coastal areas, killer whales often enter shallow bays, estuaries, and river mouths (Leatherwood *et al.*, 1976).

Based on a review of historical sighting and whaling records, killer whales in the northwestern Atlantic are found most often along the shelf break and farther offshore (Katona *et al.*, 1988; Mitchell and Reeves, 1988). Their movements may also reflect the movements of their prey species, particularly migratory fish (Katona *et al.*, 1988; Gormley, 1990).

Acoustics and Hearing—Killer whales produce a wide variety of clicks and whistles, but most of this species' social sounds are pulsed, with frequencies ranging from 0.5 to 25 kHz (dominant frequency range: 1 to 6 kHz) (Thomson and Richardson, 1995). Echolocation clicks recorded for Canadian killer whales foraging on salmon have source levels ranging from 195 to 224 dB re: 1 µPa-m peak-to-peak, a center frequency ranging from 45 to 80 kHz, and durations of 80 to 120 µs (Au *et al.*, 2004). Echolocation clicks from Norwegian killer whales were considerably lower than the previously mentioned study and ranged from 173 to 202 re: 1 µPa-m peak-to-peak. The clicks had a center frequency ranging from 22 to 49 kHz and durations of 31 to 203 µs (Simon *et al.*, 2007). Source levels associated with social sounds have been calculated to range from 131 to 168 dB re 1 µPa-m and have been demonstrated to vary with vocalization type (*e.g.*, whistles: average source level of 140.2 dB re 1 µPa-m, variable calls: average source level of 146.6 dB re 1 µPa-m, and stereotyped calls: average source level 152.6 dB re 1 µPa-m) (Veirs, 2004). Additionally, killer whales modify their vocalizations depending on social context or ecological function (*i.e.*, short-range vocalizations [less than 10 km [5 nm] range] are typically associated with social and resting behaviors and long-range vocalizations [10 to 16 km [5 to 9 nm) range] are associated with travel and foraging) (Miller, 2006). Likewise, echolocation clicks are adapted to the type of fish prey (Simon *et al.*, 2007).

Acoustic studies of resident killer whales in British Columbia have found that they possess dialects, which are highly stereotyped, repetitive discrete calls that are group-specific and are shared by all group members (Ford, 2002). These dialects likely are used to maintain group identity and cohesion and may serve as indicators of relatedness that help in the avoidance of inbreeding between closely related whales (Ford, 1991 and 2002). Dialects have been documented in northern Norway (Ford, 2002) and southern Alaskan killer whale populations (Yurk *et al.*, 2002) and likely occur in other regions as well.

Both behavioral and ABR techniques indicate killer whales can hear a frequency range of 1 to 100 kHz and are most sensitive at 20 kHz, which is one of the lowest maximum-sensitivity frequency known among toothed whales (Szymanski *et al.*, 1999).

Distribution—Killer whales are found throughout all oceans and contiguous seas, from equatorial regions to the polar pack ice zones of both hemispheres. Although found in tropical waters and the open ocean, the killer whale as a species is most numerous in coastal waters and at higher latitudes (Dahlheim and Heyning, 1999). In the western North Atlantic, killer whales are known from the polar pack ice southward to Florida, the Lesser Antilles, and the Gulf of Mexico (Würsig *et al.*, 2000). A year-round killer whale population may exist in the western North Atlantic south of around 35°N.

In the Atlantic, calving takes place from late fall to mid-winter (Jefferson *et al.*, 2008); however the location of killer whale breeding in the North Atlantic Ocean is unknown.

GOMEX Study Area killer whale occurrence—Killer whales in the Gulf of Mexico are sighted most often in waters with a bottom depth greater than 200 m (averaging 1,242 m; range of 256 to 2,652 m), although there have also been occasional sightings over the continental shelf (Jefferson and Schiro, 1997; O'Sullivan and Mullin, 1997). Killer whale sightings in the northern Gulf of Mexico are generally clumped in a broad region south of the Mississippi River Delta (O'Sullivan and Mullin, 1997); however, it should be noted that southern Texas (specifically, the Port Aransas area) seems to be an area where there are a number of anecdotal reports of killer whale sightings. There are sightings of killer whales from all seasons in the northern Gulf of Mexico (Jefferson and Schiro, 1997; O'Sullivan and

Mullin, 1997; Würsig *et al.*, 2000). It is not known whether killer whales in the Gulf of Mexico stay within its confines or range more widely into the Caribbean and adjacent portions of the North Atlantic Ocean (Würsig *et al.*, 2000). Killer whales may occur in the Gulf of Mexico at any time of year, particularly beyond the shelf break.

GOMEX Study Area killer whale density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Killer whales do not occur in the Demolition Pond.

Melon-headed Whale

Melon-headed whales are medium-sized delphinids that may reach 2.8 m in total body length (Jefferson *et al.*, 2008). They closely resemble pygmy killer whales and may be extremely difficult to differentiate at sea based on morphology (Perryman *et al.*, 1994). Melon-headed whales have pointed (versus rounded) flippers and a more triangular head shape than pygmy killer whales (Jefferson *et al.*, 1993). Melon-headed whales prey on squid, pelagic fish, and occasionally crustaceans. Most fish and squid prey are mesopelagic in waters up to 1,500 m deep, suggesting that feeding takes place deep in the water column (Jefferson and Barros, 1997).

Status and management—The best estimate of abundance for melon-headed whales in the northern Gulf of Mexico is 2,283 individuals (Waring *et al.*, 2008). This species is under the jurisdiction of NMFS.

Habitat—Melon-headed whales are most often found in offshore waters. Sightings in the Gulf of Mexico have been well beyond the edge of the continental shelf break (Mullin *et al.*, 1994c; Davis and Fargion, 1996; Davis *et al.*, 2000) and out over the abyssal plain (Waring *et al.*, 2004). Nearshore sightings are generally from areas where deep, oceanic waters approach the coast (Perryman, 2002).

Acoustics and Hearing—The only published acoustic information for melon-headed whales is from the southeastern Caribbean (Watkins *et al.*, 1997). Sounds recorded included whistles and click sequences. Recorded whistles have dominant frequencies between 8 and 12 kHz; higher level whistles were estimated at no more than 155 dB re 1 μPa-m (Watkins *et al.*, 1997). Clicks had dominant frequencies of 20 to 40 kHz; higher-level click bursts were judged to be about 165 dB re 1 μPa-m (Watkins *et al.*, 1997). No empirical data on hearing ability for this species are available.

Distribution—Melon-headed whales occur worldwide in deep tropical and subtropical waters (Reeves *et al.*, 2002). There are very few records for melon-headed whales in the North Atlantic (Ross and Leatherwood, 1994; Jefferson and Barros, 1997). Maryland is thought to represent the extreme of the northern distribution in the western North Atlantic Ocean (Perryman *et al.*, 1994; Jefferson and Barros, 1997). Seasonality and location of melon-headed whale breeding are unknown.

GOMEX Study Area melon-headed whale occurrence—The first two occurrence records for this species in the Gulf of Mexico were strandings in Texas and Louisiana during 1990 and 1991, respectively (Barron and Jefferson, 1993). Most melon-headed whale sightings in the Gulf of Mexico are well beyond the edge of the continental shelf (Mullin *et al.*, 1994c; Davis and Fargion, 1996; Davis *et al.*, 2000) and include waters out over the abyssal plain (Jefferson, 2002a). Würsig *et al.* (2000) noted melon-headed whales occurring in water depths of 200 to 2,000 m in large groups (up to 400 animals) and often in association with Fraser's dolphins. Mullin and Hansen (1999) noted that melon-headed whales appear to be more frequently sighted west of the Mississippi River. The melon-headed whale is expected to occur seaward of the shelf break year-round in the Gulf of Mexico.

GOMEX Study Area melon-headed whale density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Melon-headed whales do not occur in the Demolition Pond.

Minke Whale

The minke whale is the smallest rorqual species in the North Atlantic Ocean, with adults reaching lengths of just over 9 m (Jefferson *et al.*, 1993). In the western North Atlantic, minke whales feed primarily on schooling fish, such as sand lance, capelin, herring, and mackerel (Kenney *et al.*, 1985), as well as copepods and krill (Horwood, 1990).

Status and management—There are four recognized populations of minke whales in the North Atlantic Ocean: Canadian East Coast, West Greenland, Central North Atlantic, and Northeastern North Atlantic (Waring *et al.*, 2008). Minke whales off the eastern U.S. are considered to be part of the Canadian East Coast stock which inhabits the area from the eastern half of the Davis Strait to 45°W and south to the Gulf of Mexico (Waring *et al.*, 2008). The best estimate of abundance for the Canadian East Coast minke whale stock is 3,312 individuals (Waring *et al.*, 2008). Minke whales are under the jurisdiction of NMFS.

Habitat—Minke whales occupy waters over the continental shelf, including inshore bays and some estuaries (Mitchell and Kozicki, 1975; Ivashin and Votrogov, 1981; Murphy, 1995; Mignucci-Giannoni, 1998; Calambokidis *et al.*, 2003). However, global whaling records and surveys indicate that minke whales also use deep-water habitats (Slijper *et al.*, 1964; Horwood, 1990; Mitchell, 1991).

Acoustics and Hearing—Recordings of minke whale sounds indicate the production of both high- and low-frequency sounds (range of 0.06 to 20 kHz) (Beamish and Mitchell, 1973; Winn and Perkins, 1976; Thomson and Richardson, 1995; Mellinger *et al.*, 2000). Minke whale sounds have a dominant frequency range of 0.06 to greater than 12 kHz, depending on sound type (Thomson and Richardson, 1995; Edds-Walton, 2000). "Boings" are produced by minke whales and are suggested to be a breeding display, consisting of a brief pulse at 1.3 kHz followed by an amplitude-modulated call with greatest energy at 1.4 kHz, with slight frequency modulation over a duration of 2.5 sec (Rankin and Barlow, 2005). While no empirical data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes are most adapted to hear low to infrasonic frequencies.

Distribution—Minke whales are distributed in polar, temperate, and tropical waters (Jefferson *et al.*, 1993), though they are less common in the tropics than in temperate and polar regions. Along the U.S. east coast, minke whales are more abundant in New England waters than in the mid-Atlantic (Hamazaki, 2002; Waring *et al.*, 2007). Minke whales off the U.S. Atlantic Coast apparently migrate offshore and southward in winter (Mitchell, 1991; Mellinger *et al.*, 2000) and are known to occur in the western North Atlantic from Bermuda to the West Indies during the winter months (November through March) (Mitchell, 1991; Mellinger *et al.*, 2000).

Mating is thought to occur from October to March but has never been observed (Stewart and Leatherwood, 1985); the locations of specific breeding grounds are unknown but they are thought to be in areas of low latitude (Jefferson *et al.*, 2008).

GOMEX Study Area minke whale occurrence—Minke whale occurrence in the Gulf of Mexico is supported by ten confirmed stranding records, all of which occurred during the winter and spring months. This supports the supposition that minke whales move to lower latitudes during the colder months of the year. Based on their known habitat preferences, minke whales might occur anywhere from nearshore waters seaward into deeper waters in the eastern Gulf of Mexico but are considered extralimital to the western Gulf of Mexico. Minke whales are not expected in the Gulf of Mexico

during the summer when these whales should occur on feeding grounds farther north. Due to the timing of the strandings, these individuals may represent individuals moving into the Gulf of Mexico during their migrations (Würsig *et al.*, 2000; Jefferson, 2006). While it is most likely that individuals will occur in the Study Area during the winter months, minke whales may occur in the Gulf of Mexico at any time of year.

GOMEX Study Area minke whale density—There were not sufficient data available to estimate a density for the Study Area, nor is there an abundance estimate for a Gulf of Mexico population in the NOAA SAR (DoN, 2007b).

Pantropical Spotted Dolphin

The pantropical spotted dolphin is a slender, spotted dolphin. Adults may reach 2.6 m in length (Jefferson *et al.*, 2008). Pantropical spotted dolphins are born spotless and develop spots as they age, although the degree of spotting varies geographically (Perrin and Hohn, 1994) and some populations may be virtually unspotted (Jefferson, 2006). Pantropical spotted dolphins prey on epipelagic fish, squid, and crustaceans (Perrin and Hohn, 1994; Robertson and Chivers, 1997; Wang *et al.*, 2003).

Status and management—The best estimate of abundance for the pantropical spotted dolphin in the northern Gulf of Mexico is 34,067 individuals (Waring *et al.*, 2008). Pantropical spotted dolphins are under NMFS jurisdiction.

Habitat—Pantropical spotted dolphins tend to associate with bathymetric relief and oceanographic interfaces. Pantropical spotted dolphins may rarely be sighted in shallower waters (Peddemors, 1999; Gannier, 2002; Mignucci-Giannoni *et al.*, 2003; NMFS-SWFSC, 2007). Most sightings of this species in the Gulf of Mexico, Caribbean, and off Brazil occur over the lower continental slope (Davis *et al.*, 1998; Mignucci-Giannoni *et al.*, 2003; Mullin and Fulling, 2004; Moreno *et al.*, 2005).

Acoustics and Hearing—Pantropical spotted dolphin whistles have a frequency range of 3.1 to 21.4 kHz (Thomson and Richardson, 1995). Clicks typically have two frequency peaks (bimodal) at 40 to 60 kHz and 120 to 140 kHz with estimated source levels up to 220 dB re 1 µPa peak-to-peak (Schotten *et al.*, 2004). No direct measures of hearing ability are available for pantropical spotted dolphins, but ear anatomy has been studied and indicates that this species should be adapted to hear the lower range of ultrasonic frequencies (less than 100 kHz) (Ketten, 1992 and 1997).

Distribution—The pantropical spotted dolphin is distributed between about 40°N and 40°S in all oceans but is more abundant in the lower latitudes of its range (Jefferson *et al.*, 2008). In the eastern tropical Pacific, where this species has been best studied, there are two (possibly three) calving peaks: one in spring, (one possibly in summer), and one in fall (Perrin and Hohn, 1994). However, in the western Atlantic breeding times and locations are largely unknown.

GOMEX Study Area pantropical spotted dolphin occurrence—The pantropical spotted dolphin is the most abundant and commonly sighted cetacean in deep waters of the northern Gulf of Mexico (Davis and Fargion, 1996; Jefferson, 1996; Mullin and Hansen, 1999; Davis *et al.*, 2000; Würsig *et al.*, 2000; Mullin and Fulling, 2004). Mullin and Fulling (2004) reported that in the northeastern Gulf of Mexico, the pantropical spotted dolphin was two times more abundant during the summer than the rest of the year. Mullin *et al.* (2004) reported sighting pantropical spotted dolphins in the Gulf of Mexico in waters with bottom depths ranging from 435 to 2,121 m. Studies of this species in the northern Gulf of Mexico show both a uniform distribution with respect to effort (Baumgartner *et al.*, 2001) and higher encounter frequency in warm- and cold-core eddies with respect to effort (Davis *et al.*, 2000). The pantropical dolphin is expected to occur over the continental slope and in deeper waters seaward of the slope year-round.

GOMEX Study Area pantropical spotted dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Pantropical spotted dolphins do not occur in the Demolition Pond.

Pygmy and Dwarf Sperm Whales

Dwarf (*Kogia sima*) and pygmy (*Kogia breviceps*) sperm whales are very difficult to distinguish from one another and sightings of either species are often categorized generally as *Kogia* spp. (Jefferson *et al.*, 2008). The difficulty in identifying dwarf and pygmy sperm whales is exacerbated by their avoidance reaction toward ships and change in behavior toward approaching survey aircraft (Würsig *et al.*, 1998). Pygmy and dwarf sperm whales reach body lengths of around 3 and 2.5 m, respectively (Plön and Bernard, 1999). Both species feed on cephalopods and, less often, on deep-sea fish and shrimp (Caldwell and Caldwell, 1989; McAlpine *et al.*, 1997; Willis and Baird, 1998; Santos *et al.*, 2006).

Status and management—The best estimate of abundance for *Kogia* spp. in the Gulf of Mexico is 453 individuals (Waring *et al.*, 2008). Separate estimates of abundance for the pygmy sperm whale or the dwarf sperm whale cannot be calculated due to uncertainty of species identification at sea (Waring *et al.*, 2008). Both the pygmy and the dwarf sperm whale are under the jurisdiction of NMFS.

Habitat—World-wide, *Kogia* spp. generally occur in waters along the continental shelf break and over the continental slope (McAlpine, 2002). Several studies have suggested that pygmy sperm whales live mostly beyond the continental shelf break, while dwarf sperm whales tend to occur closer to shore, often over the outer continental shelf (Rice, 1998; Wang *et al.*, 2002; MacLeod *et al.*, 2004). However, the difference in habitats may be more in terms of a difference between juveniles and adults instead of a difference between the two species of the genus (Ross, 1984). Distribution at sea in relation to the shelf break requires further study.

Acoustics and Hearing—There is little published information on sounds produced by *Kogia* spp, although they are categorized as non-whistling smaller toothed whales. Recently, free-ranging dwarf sperm whales off La Martinique (Lesser Antilles) were recorded producing clicks at 13 to 33 kHz with durations of 0.3 to 0.5 sec (Jérémie *et al.*, 2006). The only sound recordings for the pygmy sperm whale are from two stranded individuals. A stranded individual being prepared for release in the western North Atlantic emitted clicks of narrow band pulses with a mean duration of 119 µsec, interclick intervals between 40 and 70 msec, centroid frequency of 129 kHz (centroid is the frequency which divides the energy in the click into two equal portions), peak frequency of 130 kHz, and apparent peak-peak source level up to 175 dB re 1 µPa-m (Madsen *et al.*, 2005). Another individual found stranded in Monterey Bay produced echolocation clicks ranging from 60 to 200 kHz, with a dominant frequency of 120 to 130 kHz (Ridgway and Carder, 2001). No information on sound production or hearing is available for the dwarf sperm whale.

Distribution—*Kogia* spp. have a worldwide distribution in tropical and temperate waters (Jefferson *et al.*, 1993). In the western Atlantic Ocean, stranding records have documented the pygmy sperm whale as far north as the northern Gulf of St. Lawrence, New Brunswick and parts of eastern Canada (Measures *et al.*, 2004; McAlpine et. al., 1997) and as far south as Colombia and around to Brazil (in the southern Atlantic) (Muñoz-Hincapié *et al.*, 1998). Pygmy sperm whales are also found in the Gulf of Mexico (Baumgartner *et al.*, 2001) and in the Caribbean (MacLeod and Hauser, 2002).

The northern range of the dwarf sperm whale is largely unknown; however, multiple stranding records exist on the eastern coast of the U.S. as far north as North Carolina (Hohn *et al.*, 2006) and Virginia (Morgan *et al.*, 2002; Potter, 1979). Records of strandings and incidental captures indicate the dwarf

sperm whale may range as far south as the Northern Antilles in the northern Atlantic (Muñoz-Hincapié *et al.*, 1998); although records continue south along Brazil in the southern Atlantic (Muñoz-Hincapié *et al.*, 1998). Dwarf sperm whales occur in the Caribbean (Caldwell *et. al.*, 1973; Cardona-Maldonado and Mignucci-Giannoni, 1999) and the Gulf of Mexico (Davis *et. al.*, 2002; Jefferson and Schiro, 1997).

Births have been recorded between December and March for dwarf sperm whales in South Africa (Plön, 2004); however, the breeding season and locations of specific breeding grounds are unknown.

GOMEX Study Area Kogia spp. occurrence—*Kogia* spp. generally occur along the continental shelf break and over the continental slope in the Gulf of Mexico (Baumgartner *et al.*, 2001; Fulling and Fertl, 2003). Data suggest that *Kogia* spp. may associate with frontal regions along the shelf break and upper continental slope in the Gulf of Mexico where higher epipelagic zooplankton biomass may enhance the densities of squid, their primary prey (Baumgartner *et al.*, 2001). *Kogia* spp. are expected to occur seaward of the shelf break throughout the Gulf of Mexico year-round (DoN, 2007a).

GOMEX Study Area Kogia spp. density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). *Kogia* spp. do not occur in the Demolition Pond.

Pygmy Killer Whale

The pygmy killer whale is a mid-sized delphinid that reaches 2.6 m in body length (Jefferson *et al.*, 2008). The pygmy killer whale is often confused with the melon-headed whale and less often with the false killer whale. Flipper shape is the best distinguishing characteristic; pygmy killer whales have rounded flipper tips (Jefferson *et al.*, 1993). Pygmy killer whales eat predominantly fish and squid, and sometimes take large fish. They are known occasionally to attack other dolphins (Perryman and Foster, 1980; Ross and Leatherwood, 1994).

Status and management—The best estimate of abundance for pygmy killer whales in the northern Gulf of Mexico is 323 individuals (Waring *et al.*, 2008). This species is under the jurisdiction of NMFS.

Habitat—Pygmy killer whales generally occupy offshore habitats. Their habitat includes waters seaward of the shelf break deeper than 1,500 m (Hansen *et al.*, 1994).

Acoustics and Hearing—The pygmy killer whale emits short duration, broadband signals similar to a large number of other delphinid species (Madsen *et al.*, 2004). Clicks produced by pygmy killer whales have centroid frequencies (centroid is the frequency which divides the energy in the click into two equal portions) between 70 and 85 kHz; there are bimodal peak frequencies between 45 and 117 kHz. The estimated source levels are between 197 and 223 dB re 1 μPa-m peak-to-peak (Madsen *et al.*, 2004). These clicks possess characteristics of echolocation clicks (Madsen *et al.*, 2004). There are no empirical hearing data available for this species.

Distribution—Pygmy killer whales have a worldwide distribution in deep tropical, subtropical, and warm temperate oceans. Pygmy killer whales generally do not range north of 40°N or south of 35°S (Jefferson, *et al.* 2008). There are few records of this species in the western North Atlantic (Caldwell and Caldwell, 1971b; Ross and Leatherwood, 1994). Most of the records outside the tropics are associated with unseasonable intrusions of warm water (Ross and Leatherwood, 1994). Evidence suggests that calving occurs in the summer months (Ross and Leatherwood, 1994). Location of breeding is unknown.

GOMEX Study Area pygmy killer whale occurrence—In the northern Gulf of Mexico, the pygmy killer whale is found primarily in deeper waters beyond the continental shelf (Davis and Fargion, 1996; Davis *et al.*, 2000; Würsig *et al.*, 2000) extending out to waters over the abyssal plain (Jefferson,

2002a). The pygmy killer whale does not appear to be common in the Gulf of Mexico (Davis and Fargion, 1996a; Jefferson and Schiro, 1997; Davis *et al.*, 2000; Würsig *et al.*, 2000). There is a seasonal peak in strandings during the winter, but there is no evidence to suggest (or refute) seasonal distribution changes (Jefferson and Schiro, 1997). Also relevant is the difficulty in distinguishing pygmy killer whales and melon-headed whales; often sightings of these two species are lumped together when individual species cannot be determined. The pygmy killer whale is expected to occur in the Study Area seaward of the shelf break year-round.

GOMEX Study Area pygmy killer whale density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Pygmy killer whales do not occur in the Demolition Pond.

Risso's Dolphin

Risso's dolphins are mid-sized delphinids that can reach as much as 3.8 m length (Jefferson *et al.*, 2008). Cephalopods are their primary prey (Clarke, 1996).

Status and management—The best estimate of abundance for Risso's dolphins in the northern Gulf of Mexico is 1,589 individuals (Waring *et al.*, 2008). Risso's dolphins are under the jurisdiction of NMFS.

Habitat—Several studies have noted that Risso's dolphins are found offshore, along the continental slope, and over the continental shelf (CETAP, 1982; Green *et al.*, 1992; Baumgartner, 1997; Davis *et al.*, 1998; Mignucci-Giannoni, 1998; Kruse *et al.*, 1999). Habitat use of the Risso's dolphin may reflect prey distribution (Baumgartner, 1997; Waring *et al.*, 1992).

Acoustics and Hearing—Risso's dolphin vocalizations include broadband clicks, barks, buzzes, grunts, chirps, whistles, and combined whistle and burst-pulse sounds that range in frequency from 0.4 to 22 kHz and in duration from less than a second to several seconds (Corkeron and Van Parijs, 2001). The combined whistle and burst pulse sound (2 to 22 kHz, mean duration of 8 seconds) appears to be unique to Risso's dolphin (Corkeron and Van Parijs, 2001). Risso's dolphins also produce echolocation clicks (40 to 70 µs duration) with a dominant frequency range of 50 to 65 kHz and estimated source levels up to 222 dB re 1 µPa-m peak-to-peak (Thomson and Richardson, 1995; Philips *et al.*, 2003; Madsen *et al.*, 2004). Baseline research on the hearing ability of this species was conducted by Nachtigall *et al.* (1995) in a natural setting (included natural background noise) using behavioral methods on one older individual. This individual could hear frequencies ranging from 1.6 to 100 kHz and was most sensitive between 8 and 64 kHz. Recently, the auditory brainstem response technique has been used to measure hearing in a stranded infant (Nachtigall *et al.*, 2005). This individual could hear frequencies ranging from 4 to 150 kHz, with best sensitivity at 90 kHz. This study demonstrated that this species can hear higher frequencies than previously reported.

Distribution—Risso's dolphins are distributed worldwide in cool-temperate to tropical waters from roughly 60ºN to 60ºS, where SSTs are generally greater than 10ºC (Kruse *et al.*, 1999). In the western North Atlantic, this species is found from Newfoundland southward to the Gulf of Mexico, throughout the Caribbean, and around the equator (Würsig *et al.*, 2000). In general, U.S. Atlantic Risso's dolphins occupy the mid-Atlantic continental shelf year-round (Payne *et al.*, 1984).

In the North Atlantic, there appears to be a summer calving peak (Jefferson *et al.*, 1993; Würsig *et al.*, 2000); however locations of breeding areas are unknown.

GOMEX Study Area Risso's dolphin occurrence—There are numerous sighting and stranding records for Risso's dolphins in the Study Area (DoN, 2007a). Jefferson and Schiro (1997) noted a possible seasonal increase of this species over the upper continental slope during the spring. Baumgartner (1997)

hypothesized that the strong correlation between Risso's dolphin distribution and the steeper portions of the upper continental slope in the Gulf is most likely the result of cephalopod distribution in the same area. Würsig *et al.* (2000) identified a general preference among Risso's dolphins for deep continental slope waters, but recent sightings near the Mississippi River Delta near the 200-m isobath may represent a shift in distribution. Risso's dolphins are expected to occur along the shelf break and continental slope and in deep waters farther offshore in the Gulf of Mexico year-round.

GOMEX Study Area Risso's dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Risso's dolphins do not occur in the Demolition Pond.

Rough-toothed Dolphin

The rough-toothed dolphin is relatively robust with a cone-shaped head and no demarcation between the melon and beak (Jefferson *et al.*, 2008). The rough-toothed dolphin reaches 2.8 m in length (Jefferson *et al.*, 2008), and feeds on cephalopods and fish, including large fish such as dorado (Miyazaki and Perrin, 1994; Reeves *et al.*, 1999; Pitman and Stinchcomb, 2002).

Status and management—The best estimate of abundance for rough-toothed dolphins in the northern Gulf of Mexico is 2,942 individuals (Waring *et al.*, 2008). Rough-toothed dolphins are under the jurisdiction of NMFS.

Habitat—The rough-toothed dolphin is regarded as an offshore species that prefers deep waters; however, it can occur in shallow waters (Gannier and West, 2005; Banick and Borger, 2005). Tagging data for this species from the Gulf of Mexico and western North Atlantic indicate wide-ranging movements over variable bottom depths (<110 m to >4,000 m in depth) (Wells *et al.*, 1999; Manire and Wells, 2005; Wells, 2007).

Acoustics and Hearing—The rough-toothed dolphin produces a variety of sounds, including broadband echolocation clicks and whistles. Echolocation clicks (duration less than 250 microseconds [µsec]) typically have a frequency range of 0.1 to 200 kHz, with a dominant frequency of 25 kHz (Miyazaki and Perrin, 1994; Yu *et al.*, 2003). Whistles (duration less than 1 sec) have a wide frequency range of 0.3 to greater than 24 kHz but dominate in the 2 to 14 kHz range (Miyazaki and Perrin, 1994; Yu *et al.*, 2003).

Auditory evoked potential measurements were performed on six individuals involved in a mass stranding event on Hutchinson Island, Florida in August 2004 (Cook *et al.*, 2005). The rough-toothed dolphin can detect sounds between 5 and 80 kHz and is most likely capable of detecting frequencies much higher than 80 kHz (Cook *et al.*, 2005).

Distribution—Rough-toothed dolphins are found in tropical to warm-temperate waters globally, rarely ranging north of 40°N or south of 35°S (Miyazaki and Perrin, 1994). This species is not a commonly encountered species in the areas where it is known to occur (Jefferson, 2002b). Not many records for this species exist from the western North Atlantic, but they indicate that rough-toothed dolphins occur from Virginia south to Florida, the Gulf of Mexico, the West Indies, and along the northeastern coast of South America (Leatherwood *et al.*, 1976; Würsig *et al.*, 2000). Seasonality and location of rough-toothed dolphin breeding are unknown.

GOMEX Study Area rough-toothed dolphin occurrence—In the Gulf of Mexico, the rough-toothed dolphin primarily occurs seaward of the shelf break (Davis *et al.*, 1998; Mullin and Fulling, 2004), although sighting and tagging data indicate the use of continental shelf waters as well (Wells *et al.*, 1999; Fulling *et al.*, 2003). Rough-toothed dolphins are expected to occur in the northern Gulf of Mexico year-round.

GOMEX Study Area rough-toothed dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Rough-toothed dolphins do not occur in the Demolition Pond.

Short-finned Pilot Whale

Short-finned pilot whales may reach 5.5 m (females) and 7.2 m (males) in length (Jefferson *et al.*, 2008). The flippers of the short-finned pilot whale are long and sickle-shaped and range in length from 16 percent (%) to 22% of the total body length (Jefferson *et al.*, 1993). Pilot whale species feed primarily on squid but also take fish (Bernard and Reilly, 1999).

Status and management—The best estimate of abundance for the short-finned pilot whale in the northern Gulf of Mexico is 716 individuals (Waring *et al.*, 2008). The short-finned pilot whale is under the jurisdiction of NMFS.

Habitat—Pilot whales are found on the continental shelf break, in slope waters, and in areas of high topographic relief (Olson and Reilly, 2002). While pilot whales typically occur along the continental shelf break, movements over the continental shelf are commonly observed in the northeastern U.S. (CETAP, 1982; Payne and Heinemann, 1993). A number of studies in different regions suggest that the distribution and seasonal inshore/offshore movements of pilot whales coincide closely with the abundance of squid, their preferred prey (Hui, 1985; Payne and Heinemann, 1993; Waring and Finn, 1995; Bernard and Reilly, 1999).

Acoustics and Hearing—Pilot whale sound production includes whistles and echolocation clicks. Short-finned pilot whale whistles and clicks have a dominant frequency range of 2 to 14 kHz and 30 to 60 kHz, respectively, at an estimated source level of 180 dB re 1 μPa-m (Fish and Turl, 1976; Ketten, 1998). There are no hearing data available for the short-finned pilot whale. However, the most sensitive hearing range for odontocetes generally includes high frequencies (Ketten, 1997).

Distribution—The short-finned pilot whale is found worldwide in tropical to warm-temperate seas and usually does not range north of 50°N or south of 40°S (Jefferson *et al.*, 2008). Distribution in the North Atlantic Ocean may shift seasonally, moving southward during the colder months of the year (Würsig *et al.*, 2000).

Short-finned pilot whale calving peaks in the northern hemisphere are in the fall and winter for the majority of populations (Jefferson *et al.*, 2008). Locations of breeding areas are unknown.

GOMEX Study Area short-finned pilot whale occurrence—There are many pilot whales in the historical records for the northern Gulf of Mexico, but there have been fewer sightings in recent years (Jefferson and Schiro, 1997; Würsig *et al.*, 2000). The reason for this apparent decline is not known, but Jefferson and Schiro (1997) suggested that abundance or distribution patterns might have changed over the past few decades, perhaps due to changes in available prey species. There are no confirmed records of long-finned pilot whales (*Globicephala melas*) in the Gulf of Mexico (Würsig *et al.*, 2000); however, many pilot whale specimen records from the Gulf of Mexico and most or all sightings have not been shown unequivocally to be of the short-finned pilot whale (Jefferson and Schiro, 1997). Based on known distribution and habitat preferences of pilot whales, it is assumed that all pilot whale records in the northern Gulf of Mexico are of the short-finned pilot whale (Jefferson and Schiro, 1997; Würsig *et al.*, 2000). Short-finned pilot whales are expected to occur in the Gulf of Mexico year-round, particularly in areas of steep bathymetric relief (DoN, 2007a).

GOMEX Study Area short-finned pilot whale density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1.

Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Short-finned pilot whales do not occur in the Demolition Pond.

Spinner Dolphin

The spinner dolphin generally has a dark eye-to-flipper stripe and dark lips and beak tip (Jefferson *et al.*, 2008). This species typically has a three-part color pattern (dark gray cape, light gray sides, and white belly). Adults can reach 2.4 m in length (Jefferson *et al.*, 2008). Spinner dolphins feed primarily on small mesopelagic fish, squid, and sergestid shrimp (Perrin and Gilpatrick, 1994).

Status and management—The best estimate of abundance for spinner dolphins in the northern Gulf of Mexico is 1,989 individuals (Waring *et al.*, 2008). Spinner dolphins are under the jurisdiction of NMFS.

Habitat—Spinner dolphins occur in both oceanic and coastal environments. Most sightings of this species have been associated with inshore waters, islands, or banks (Perrin and Gilpatrick, 1994). Spinner dolphin distribution in the Gulf of Mexico and off the northeastern U.S. coast is primarily in offshore waters. Along the northeastern U.S. and Gulf of Mexico, they are distributed in waters with a bottom depth greater than 2,000 m (CETAP, 1982; Davis *et al.*, 1998).

Acoustics and Hearing—Pulses, whistles, and clicks have been recorded from this species. Pulses and whistles have dominant frequency ranges of 5 to 60 kHz and 8 to 12 kHz, respectively (Ketten, 1998). Spinner dolphins consistently produce whistles with frequencies as high as 24.9 kHz (Bazúa-Durán and Au, 2002; Lammers *et al.*, 2003). Clicks have a dominant frequency of 60 kHz (Ketten, 1998). The burst pulses are predominantly ultrasonic, often with little or no energy below 20 kHz (Lammers *et al.*, 2003). Source levels between 195 and 222 dB re 1 μPa-m peak-to-peak have been recorded for spinner dolphin clicks (Schotten *et al.*, 2004).

Distribution—Spinner dolphins are found in tropical and subtropical waters worldwide with different geographical forms in various ocean basins. Limits are near 40°N and 40°S (Jefferson *et al.*, 2008). Distribution in the Gulf of Mexico appears to be oceanic (Waring *et al.*, 2008).

Breeding occurs across all seasons with calving peaks that may range from late spring to fall for different populations (Jefferson *et al.*, 2008); however location of breeding areas is unknown.

GOMEX Study Area spinner dolphin occurrence—Spinner dolphins occur year-round in deep waters of the Gulf of Mexico. Mullin and Fulling (2004) noted that the vast majority of spinner dolphin sightings were over the continental slope in the northeastern Gulf of Mexico. Würsig *et al.* (2000) also noted that sightings of spinners in the Gulf of Mexico come primarily from east and southeast of the Mississippi River Delta. Spinners typically occur in water depths greater than 100 m (Würsig *et al.* 2000). Davis *et al.* (2002) noted the presence of spinner dolphins at intermediate depths along the continental slope; they venture farther offshore than oceanic bottlenose dolphins but not as far as other stenellids (Clymene, striped, and pantropical spotted dolphins). Previous studies noting spinner dolphins in shallower waters (<200 m) (Fritts *et al.*, 1983) likely misidentified this species (Jefferson and Schiro, 1997; Würsig *et al.*, 2000). It is probable that these dolphins were actually Atlantic spotted dolphins (Jefferson, 2006).

GOMEX Study Area spinner dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Spinner dolphins do not occur in the Demolition Pond.

Striped Dolphin

The striped dolphin is uniquely marked with black lateral stripes from eye to flipper and eye to anus. There is also a light gray spinal blaze originating above and behind the eye and narrowing below and behind the dorsal fin (Jefferson *et al.*, 2008). This species reaches 2.6 m in length. Small, mid-water fish, particularly myctophids (lanternfish) and squid are the dominant prey (Perrin *et al.*, 1994b; Ringelstein *et al.*, 2006).

Status and management—The best estimate of abundance for striped dolphins in the northern Gulf of Mexico is 3,325 individuals (Waring *et al.*, 2008). Striped dolphins are under the jurisdiction of NMFS.

Habitat—Striped dolphins are usually found beyond the continental shelf, typically over the continental slope out to oceanic waters; they prefer areas of oceanographic variability including convergence and upwelling zones (Au and Perryman, 1985). They are also associated with seasonal changes in SST and thermocline depth (Perrin *et al.*, 1994b) and appear to avoid waters with SST of less than 20°C (Van Waerebeek *et al.*, 1998).

Acoustics and Hearing—Striped dolphin whistles range from 6 to greater than 24 kHz, with dominant frequencies ranging from 8 to 12.5 kHz (Thomson and Richardson, 1995). A single striped dolphin's hearing range, determined by using standard psycho-acoustic techniques, was from 0.5 to 160 kHz with best sensitivity at 64 kHz (Kastelein *et al.*, 2003).

Distribution—The striped dolphin occurs in tropical, sub-tropical and temperate waters of all major ocean basins (Rice, 1998; Würsig *et al.*, 2000; Reeves *et al.*, 2002). In the western North Atlantic, this species ranges from Newfoundland southward to the Caribbean, the Gulf of Mexico, and Brazil (Würsig *et al.*, 2000).

Information from Pacific populations suggests that breeding occurs seasonally with peaks in calving rates during the summer and the winter (Perrin *et al.*, 1994b). In the western North Atlantic, breeding times and locations are largely unknown.

GOMEX Study Area striped dolphin occurrence—The striped dolphin is an oceanic species and is expected to occur seaward of the shelf break in the Gulf of Mexico year-round. Würsig *et al.* (2000) noted a higher concentration of this species in the vicinity of the DeSoto Canyon east of the Mississippi River Delta. There is probably no seasonal difference in distribution (Jefferson and Schiro, 1997) although in other areas of the world, striped dolphins are known to follow migrating convergence zones (Perrin *et al.*, 1994b). Fritts *et al.* (1983) recorded many sightings of striped dolphins over the continental shelf off southern Florida, but these were probably all misidentifications of Atlantic spotted dolphins (Jefferson and Schiro, 1997; Würsig *et al.*, 2000).

GOMEX Study Area striped dolphin density— Available density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.7-1. Methods of how the density estimates were derived are detailed in the GOMEX NODE report (DoN, 2007b). Stripped dolphins do not occur in the Demolition Pond.

3.7.3 Environmental Consequences

The following sections provide an in-depth discussion of the biological framework for assessing impacts of sound on marine species. Section 3.7.3.1 focuses on the acoustic characteristics of sound. The discussion in this section is presented primarily as it relates to sonar, but much of the information is also applicable to the acoustic components of explosives. Additional consideration was given to discussing the effects of sound from impulsive sources related to underwater detonations. A thorough analysis of these impacts is provided in section 3.7.3.2.

3.7.3.1 Conceptual Biological Framework for Assessing Marine Mammal Response to Anthropogenic Sound

The regulatory language of the MMPA and ESA requires that all anticipated responses to sound resulting from Navy exercises be considered relative to their potential impact on animal growth, survivability and reproduction. Although a variety of effects may result from an acoustic exposure, not all effects will impact survivability or reproduction (*e.g.*, short-term changes in respiration rate would have no effect on survivability or reproduction). Whether an effect significantly affects a marine mammal must be determined from the best available science regarding marine mammal responses to sound.

A conceptual framework (Figure 3.7-2) has been constructed to assist in ordering and evaluating the potential responses of marine mammals to sound. Although the framework is described in the context of effects of sonar on marine mammals, the same approach could be used for fish, sea turtles, sea birds, etc., that are exposed to other sound sources (*e.g.*, impulsive sounds from explosions); the framework need only be consulted for potential pathways leading to possible effects.

Organization

The framework is a "block diagram" or "flow chart," organized from left to right, and grossly compartmentalized according to the phenomena that occur within each. These include the physics of sound propagation (physics component), the potential physiological responses associated with sound exposure (physiology component), the behavioral processes that might be affected (behavior component), and the life functions that may be immediately affected by changes in behavior at the time of exposure (life function – proximate). These are extended to longer term life functions (life function – ultimate) and into population and species effects.

Throughout the flow chart, dotted and solid lines are used to connect related events. Solid lines are those items which "will" happen, and dotted lines are those which "might" happen, but which must be considered (including those hypothesized to occur but for which there is no direct evidence). Blue dotted lines indicate instances of "feedback," where the information flows back to a previous block. Some boxes are colored according to how they relate to the definitions of harassment in the MMPA, with red indicating Level A harassment (injury) and yellow indicating Level B harassment (behavioral disturbance).

The following sections describe the flowthrough of the framework, starting with the production of a sound, and flowing through marine mammal exposures, responses to the exposures, and the possible consequences of the exposure. Along with the description of each block, an overview of the state of knowledge is described with regard to marine mammal responses to sound and the consequences of those exposures. Application of the conceptual framework to impact analyses and regulations defined by the MMPA and ESA are discussed in subsequent sections.

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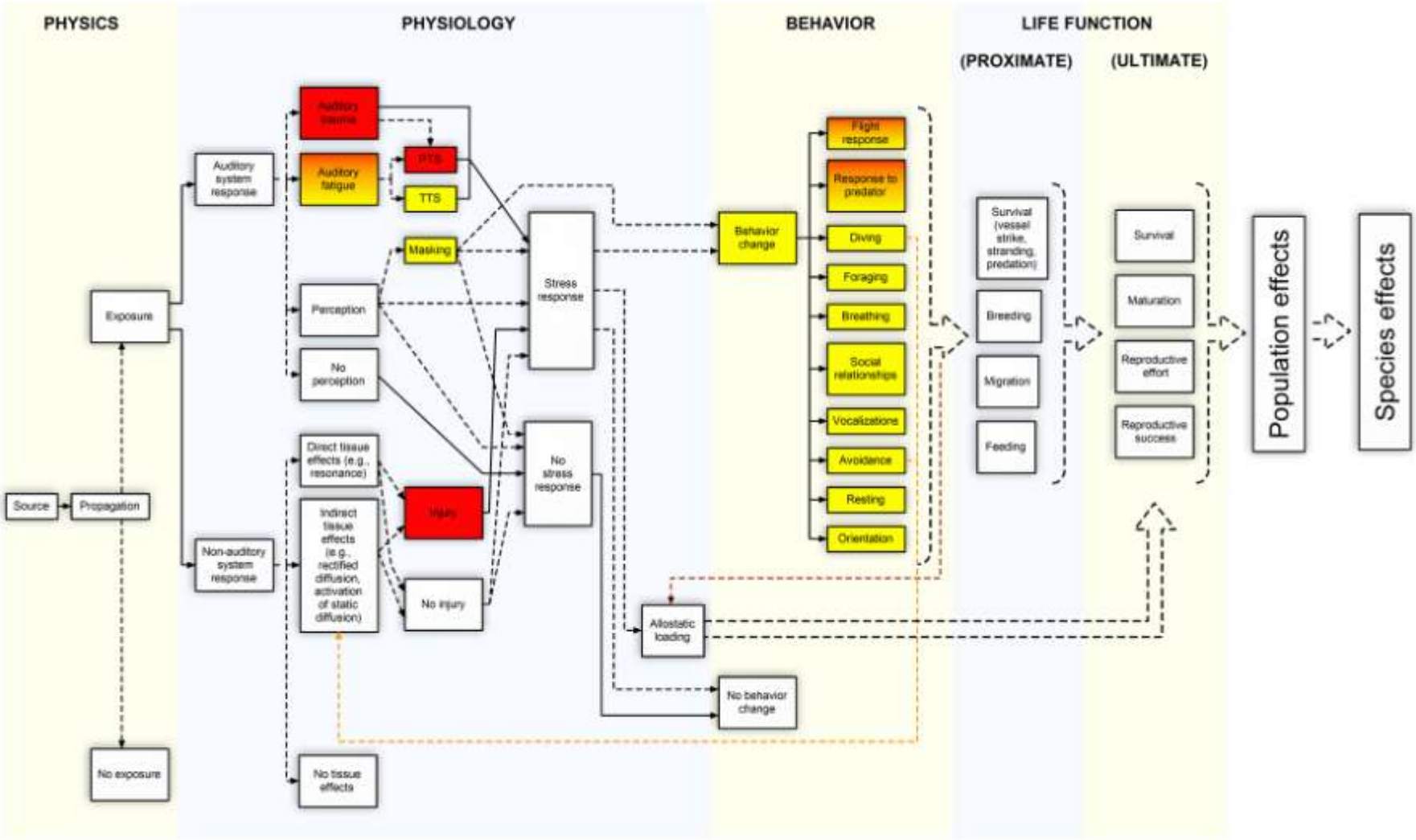

Figure 3.7-2 Conceptual Biological Framework Used to Order and Evaluate the Potential Responses of Marine Mammals to Sound

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Physics Block

Sounds emitted from a source propagate through the environment to create a spatially variable sound field. To determine if an animal is "exposed" to the sound, the received sound level at the animal's location is compared to the background ambient noise. An animal is considered exposed if the predicted received sound level, at the animal's location, is above the ambient level of background noise. If the animal is determined to be exposed, two possible scenarios must be considered with respect to the animal's physiology, responses of the auditory system and responses of non-auditory system tissues. These are not independent pathways and both must be considered since the same sound could affect both auditory and non-auditory tissues.

Physiology Block

Auditory System Response

The primary physiological effects of sound are on the auditory system (Ward, 1997). The mammalian auditory system consists of the outer ear, middle ear, inner ear, and central nervous system. Sound waves are transmitted through the outer and middle ears to fluids within the inner ear. The inner ear contains delicate electromechanical hair cells that convert the fluid motions into neural impulses that are sent to the brain. The hair cells within the inner ear are the most vulnerable to overstimulation by noise exposure (Yost, 1994).

Potential auditory system effects are assessed by considering the characteristics of the received sound (*e.g.*, amplitude, frequency, duration) and the sensitivity/susceptibility of the exposed animals. Some of these assessments can be numerically based, while others will be necessarily qualitative, due to lack of information, or will need to be extrapolated from other species for which information exists. Potential physiological responses to a sound exposure are discussed here in order of increasing severity, progressing from perception of sound to auditory trauma.

No Perception

The received level is not of sufficient amplitude, frequency or duration, or is outside its frequency band to be perceptible to the animal (*i.e.*, the sound is not audible). By extension, this cannot result in a stress response or a change in behavior.

Perception

Sounds with sufficient amplitude and duration to be detected within the background ambient noise are assumed to be perceived (*i.e.*, sensed) by an animal. This category includes sounds from the threshold of audibility through the normal dynamic range of hearing. To determine whether an animal perceives the sound, the received level, frequency, and duration of the sound are compared to what is known of the species' hearing sensitivity. Within this conceptual framework, a sound capable of auditory masking, auditory fatigue, or trauma is assumed to be perceived by the animal.

Information on hearing sensitivity exists for approximately 25 of the nearly 130 species of marine mammals. Within the cetaceans, these studies have focused primarily on odontocete species (*e.g.*, Szymanski *et al.*, 1999; Kastelein *et al.*, 2002a; Nachtigall *et al.*, 2005; Yuen *et al.*, 2005; Houser and Finneran, 2006). Because of size and availability, direct measurements of mysticete whale hearing are nearly non-existent (Ridgway and Carder, 2001). Measurements of hearing sensitivity have been conducted on species representing all of the families within the suborder Pinnipedia (Phocidae, Otariidae, Odobenidae) (Schusterman *et al.*, 1972; Moore and Schusterman, 1987; Terhune, 1988; Thomas *et al.*, 1990a; Turnbull and Terhune, 1990; Kastelein *et al.*, 2002b, 2005; Wolski *et al.*, 2003;). Hearing sensitivity measured in these studies can be compared to the amplitude, duration and frequency

of a received sound, as well as the ambient environmental noise, to predict whether or not an exposed marine mammal will perceive a sound to which it is exposed.

The features of a perceived sound (*e.g.*, amplitude, frequency, duration, and temporal pattern) are also used to judge whether the sound exposure is capable of producing a stress response. Factors to consider in this decision include the probability of the animal being naïve or experienced with the sound (*i.e.*, what are the known/unknown consequences to the animal from the exposure). Although preliminary because of the small numbers of samples collected, different types of sounds (impulsive vs. continuous broadband vs. continuous tonal) have been shown to produce variable stress responses in marine mammals. Belugas demonstrated no catecholamine (hormones released in situations of stress) response to the playback of oil drilling sounds (Thomas *et al.*, 1990b) but showed an increase in catecholamines following exposure to impulsive sounds produced from a seismic water gun (Romano *et al.*, 2004). A dolphin exposed to the same seismic water gun signals did not demonstrate a catecholamine response, but did demonstrate an elevation in aldosterone, a hormone that has been suggested as being a significant indicator of stress in odontocetes (St. Aubin and Geraci, 1989; St. Aubin *et al.*, 2001). Increases in heart rate were observed in dolphins to which conspecific calls were played, although no increase in heart rate was observed when tank noise was played back (Miksis *et al.*, 2001). Collectively, these results suggest a variable response that depends on the characteristics of the received signal and prior experience with the received signal.

Audible natural and artificial sounds can potentially result in auditory masking, a condition that occurs when a sound interferes with an animal's ability to hear other sounds. Masking occurs when the perception of a sound is interfered with by a second sound and the probability of masking increases as the two sounds increase in similarity. It is important to distinguish auditory fatigue, which persists after the sound exposure, from masking, which occurs during the sound exposure. Critical ratios have been determined for pinnipeds (Southall *et al.*, 2000; Southall *et al.*, 2003) and detections of signals under varying masking conditions have been determined for active echolocation and passive listening tasks in odontocetes (Johnson, 1971; Au and Pawloski, 1989; Erbe, 2000). These studies provide baseline information from which the probability of masking can be estimated. The potential impact to a marine mammal depends on the type of signal that is being masked. Important cues from conspecifics, signals produced by predators, or interference with echolocation are likely to have a greater impact on a marine mammal when they are masked than will a sound of little biological consequence.

Unlike auditory fatigue, which always results in a localized stress response because the sensory tissues are being stimulated beyond their normal physiological range, masking may or may not result in a stress response since it depends on the degree and duration of the masking effect and the signal that is being masked. Masking may also result in a unique circumstance where an animal's ability to detect other sounds is compromised without the animal's knowledge. This could conceivably result in sensory impairment and subsequent behavior change; in this case, the change in behavior is the *lack of a response* that would normally be made if sensory impairment did not occur. For this reason, masking also may lead directly to behavior change without first causing a stress response.

The most intense underwater sounds that may occur in the GOMEX Study Area are those produced by sonars and other acoustic sources that are in the mid-frequency or higher range. The sonar signals are likely within the audible range of most cetaceans, but are very limited in the temporal, frequency, and spatial domains. In particular, the pulse lengths are short, the duty cycle low, the events are geographically and temporally dispersed, event durations are limited, and the tactical sonars transmit within a narrow band of frequencies (typically less than one-third octave). Finally, high levels of sound are confined to a volume around the source and are constrained by attenuation at mid- and high-

frequencies, as well as by limited beam widths and pulse lengths. For these reasons, the likelihood of sonar operations causing masking effects is considered negligible in this Final EIS/OEIS.

Auditory Fatigue

The most familiar effect of exposure to high intensity sound is hearing loss, meaning an increase in the hearing threshold. This phenomenon is called a noise-induced threshold shift (NITS), or simply a threshold shift (TS) (Miller, 1974). TS may be either permanent, in which case it is called a permanent threshold shift (PTS), or temporary, in which case it is called a temporary threshold shift (TTS). The distinction between PTS and TTS is based on whether there is a complete recovery of TS following a sound exposure. If the TS eventually returns to zero (the threshold returns to the pre-exposure value), the TS is a TTS. If the TS does not return to zero but leaves some finite amount of TS, then that remaining TS is a PTS. Figure 3.7-3 (Two Hypothetical Threshold Shifts) shows one hypothetical TS that completely recovers, a TTS, and one that does not completely recover, leaving some PTS.

Although both auditory trauma and fatigue may result in hearing loss, the mechanisms responsible for auditory fatigue differ from auditory trauma and would primarily consist of metabolic fatigue and exhaustion of the hair cells and cochlear tissues. Note that the term "auditory fatigue" is often used to mean "TTS"; however, in this document we use a more general meaning to differentiate fatigue mechanisms (*e.g.*, metabolic exhaustion and distortion of tissues) from trauma mechanisms (*e.g.*, physical destruction of cochlear tissues occurring at the time of exposure). Auditory fatigue may result in PTS or TTS but is always assumed to result in a stress response. The actual amount of threshold shift depends on the amplitude, duration, frequency, and temporal pattern of the sound exposure.

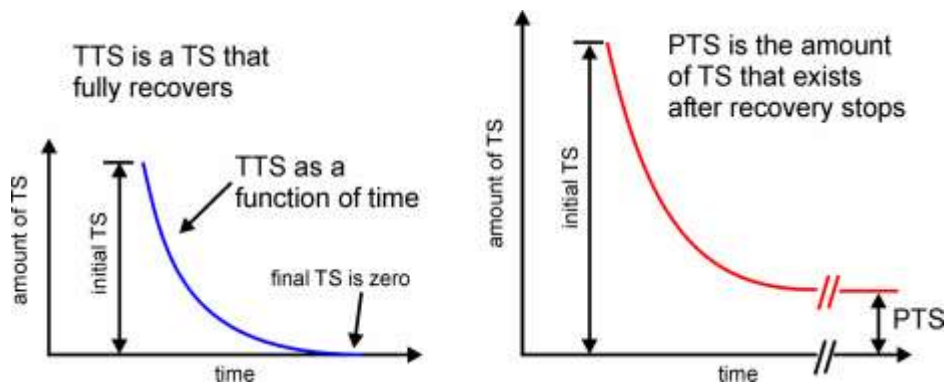

Figure 3.7-3 Two Hypothetical Threshold Shifts

There are no PTS data for cetaceans; however, a number of investigators have measured TTS in cetaceans (Schlundt *et al.*, 2000, 2006; Finneran *et al.*, 2000, 2002, 2005, 2007; Nachtigall *et al.*, 2003, 2004; Mooney *et al.*, 2009; Lucke *et al.*, 2009). In these studies hearing thresholds were measured in trained marine mammals before and after exposure to intense sounds. Some of the more important data obtained from these studies are onset-TTS levels – exposure levels sufficient to cause a just-measurable amount of TTS, often defined as 6 dB of TTS (for example, Schlundt *et al.*, 2000). The existing cetacean TTS data show the following:

- The growth and recovery of TTS are analogous to those in land mammals. This means that, as in land mammals, cetacean TSs depend on the amplitude, duration, frequency content, and temporal pattern of the sound exposure. Threshold shifts will generally increase with the amplitude and duration of sound exposure. For continuous sounds, exposures of equal energy will lead to approximately equal effects (Ward, 1997). For intermittent sounds, less TS will occur than from a continuous exposure with the same energy (some recovery will occur during the quiet period between exposures) (Kryter *et al.*, 1966; Ward, 1997).
- Sound pressure level (SPL) by itself is not a good predictor of onset-TTS, since the amount of TTS depends on both SPL and duration.
- Exposure energy flux density level (EL) is correlated with the amount of TTS and is a good predictor for onset-TTS from single, continuous exposures with variable durations. This agrees with human TTS data presented by Ward *et al.* (1958, 1959).

The most relevant TTS data for analyzing the effects of mid-frequency sonars are from Schlundt *et al.* (2000, 2006) and Finneran *et al.* (2005). These studies point to an energy flux density level of 195 dB re 1 μPa^2-s as the most appropriate predictor for onset-TTS in dolphins and belugas from a single, continuous exposure in the mid-frequency range. This finding is supported by the recommendations of a panel of scientific experts formed to study the effects of sound on marine mammals (Southall *et al.*, 2007).

Research by Kastak *et al.* (1999; 2005) provided estimates of the average SEL (EFD level) for onset-TTS for a harbor seal, sea lion, and northern elephant seal. Although the duration for exposure sessions is well beyond those typically used with tactical sonars, the frequency ranges are similar (2.5 kHz to 3.5 kHz). This data provides good estimates for the onset of TTS in pinnipeds since the researchers tested different combinations of SPL and exposure duration, and plotted the growth of TTS with an increasing energy exposure level. Of the three pinniped groups studied by Kastak *et al.* (1999, 2005), harbor seals are the most representative of other pinnipeds likely to be present in the Study Area. The onset-TTS number, provided by Kastak *et al.* (1999, 2005) for harbor seals, is 183 dB re 1 μPa^2-s.

In a more recent study, Mooney *et al.* (2009) measured TTS in a bottlenose dolphin exposed to mid-frequency naval sonar recorded from Puget Sound during US Navy training. Hearing thresholds for a 5.6 kHz tone were determined before and after exposure using auditory evoked potentials. These studies showed that TTS occurred at exposures of 210 to 214 dB re 1 μPa2 s (SEL) and typically required 20 minutes to recover (all had recovered within 40 minutes).

In contrast to TTS data, PTS data do not exist and are unlikely to be obtained for marine mammals. Differences in auditory structures and the way that sound propagates and interacts with tissues prevent terrestrial mammal PTS thresholds from being directly applied to marine mammals; however, the inner ears of marine mammals are analogous to those of terrestrial mammals. Experiments with marine mammals have revealed similarities between marine and terrestrial mammals with respect to features such as TTS, age-related hearing loss, ototoxic drug-induced hearing loss, masking, and frequency selectivity. Therefore, in the absence of marine mammal PTS data, onset-PTS exposure levels may be estimated from marine mammal TTS data and PTS/TTS relationships observed in terrestrial mammals. This involves:

- Estimating the largest amount of TTS that may be induced without PTS. Exposures causing TS greater than this value are assumed to cause PTS.
- Estimating the additional exposure, above the onset-TTS exposure, necessary to reach the maximum allowable amount of TTS (assumed here to indicate PTS). This requires estimating the growth rate of TTS – how much additional TTS is produced by an increase in exposure level.

A variety of terrestrial mammal data sources indicate that TSs up to 40 to 50 dB may be induced without PTS, and that 40 dB is a reasonable upper limit for TS to prevent PTS (Ward *et al.*, 1958, 1959, 1960; Miller *et al.*, 1963; Kryter *et al.*, 1966). A conservative assumption is that continuous-type exposures producing TSs of 40 dB or more always result in some amount of PTS.

The TTS growth rate as a function of exposure EL is nonlinear; the growth rate at small amounts of TTS is less than the growth rate at larger amounts of TTS. In other words, the curve relating TTS and EL is not a straight line but a curve that becomes steeper as EL and TTS increase. This means that the relatively small amounts of TTS produced in marine mammal studies limit the applicability of these data to estimate the TTS growth rate — since the amounts of TTS are generally small the TTS growth rate estimates would likely be too low. Fortunately, data exist for the growth of TTS in terrestrial mammals at higher amounts of TTS. Data from Ward *et al.* (1958, 1959) reveal a linear relationship between TTS and exposure EL with growth rates of 1.5 to 1.6 dB TTS per dB increase in EL. Since there is a 34 dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB), the additional exposure above onset-TTS that is required to reach PTS would be 34 dB divided by 1.6 dB, or approximately 20 dB. Therefore, exposures with ELs 20 dB above those producing TTS may be assumed to produce a PTS. For an onset-TTS exposure with EL = 195 dB re 1 μPa^2-s, the estimate for onset-PTS for cetaceans would be 215 dB re 1 μPa^2-s. The estimate for onset-PTS threshold for harbor seals would be 203 dB re 1 μPa^2-s. This extrapolation process and the resulting TTS prediction is identical to that recently proposed by a panel of scientific experts formed to study the effects of sound on marine mammals (Southall *et al.*, 2007). The method predicts larger (worse) effects than have actually been observed in tests on a bottlenose dolphin [Schlundt *et al.* (2006) reported a TTS of 23 dB (no PTS) in a bottlenose dolphin exposed to a 3 kHz tone with an EL = 217 dB re 1 μPa^2-s].

Auditory Trauma

Auditory trauma represents direct mechanical injury to hearing related structures, including tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as the organ of Corti and the associated hair cells. The potential for trauma is related to the frequency, duration, onset time and received sound pressure as well as the sensitivity of the animal to the sound frequencies. Because of these interactions, the potential for auditory trauma will vary among species. Auditory trauma is always injurious, but could be temporary and not result in permanent hearing loss. Auditory trauma is always assumed to result in a stress response.

Relatively little is known about auditory system trauma in marine mammals resulting from known sound exposure. A single study spatially and temporally correlated the occurrence of auditory system trauma in humpback whales with the detonation of a 5,000 kg (11,023 lb) explosive (Ketten *et al.*, 1993). The exact magnitude of the exposure in this study cannot be determined and it is possible that the trauma was caused by the shock wave produced by the explosion (which would not be generated by sonar). There are no known occurrences of direct auditory trauma in marine mammals exposed to tactical sonars.

Non-Auditory System Response

Potential impacts to tissues other than those related to the auditory system are assessed by considering the characteristics of the sound (*e.g.*, amplitude, frequency, duration) and the known or estimated response characteristics of non-auditory tissues. Some of these assessments can be numerically based (*e.g.*, exposure required for rectified diffusion). Others will be necessarily qualitative, due to lack of information on the mechanical properties of the tissues and their function. Each of the potential responses may or may not result in a stress response. Further information on non-auditory system responses (such as direct and in-direct tissue effects) as it relates to the impulsive characteristics of

sound will be discussed in section 3.7.3.2 under Potential Impacts from Exposure to Underwater Detonations.

Direct Tissue Effects

Direct tissue responses to sound stimulation may range from tissue trauma (injury) to mechanical vibration with no resulting injury. Any tissue injury would produce a stress response whereas non-injurious stimulation may or may not.

Resonance is a phenomenon that exists when an object is vibrated at a frequency near its natural frequency of vibration, or the particular frequency at which the object vibrates most readily. The size and geometry of an air cavity determine the frequency at which the cavity will resonate. Displacement of the cavity boundaries during resonance has been suggested as a cause of injury. Large displacements have the potential to tear tissues that surround the air space (*e.g.*, lung tissue).

Understanding resonant frequencies and the susceptibility of marine mammal air cavities to resonance is important in determining whether certain sonars have the potential to affect different cavities in different species. In 2002, NMFS convened a panel of government and private scientists to address this issue (NOAA, 2002). They modeled and evaluated the likelihood that Navy mid-frequency sonars caused resonance effects in beaked whales that eventually led to their stranding (DoC and DoN, 2001). The conclusions of that group were that resonance in air-filled structures was not likely to have caused the Bahamas stranding (NOAA, 2002). The frequencies at which resonance was predicted to occur were below the frequencies utilized by the sonar systems employed. Furthermore, air cavity vibrations, even at resonant frequencies, were not considered to be of sufficient amplitude to cause tissue damage, even under the worst-case scenario in which air volumes would be undamped by surrounding tissues and the amplitude of the resonant response would be maximal. These same conclusions would apply to other actions involving mid-frequency tactical sonar.

Indirect Tissue Effects

Based upon the amplitude, frequency, and duration of the sound, it must be assessed whether exposure is sufficient to indirectly affect tissues. For example, one suggested (indirect) cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. Under this hypothesis, one of three things could happen: (1) bubbles grow to the extent that tissue hemorrhage (injury) occurs; (2) bubbles develop to the extent that a complement immune response is triggered or the nervous tissue is subjected to enough localized pressure that pain or dysfunction occurs (a stress response without injury); or (3) the bubbles are cleared by the lung without negative consequence to the animal. The probability of rectified diffusion, or any other indirect tissue effect, will necessarily be based upon what is known about the specific process involved.

Rectified diffusion is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). The dive patterns of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater supersaturation (Houser *et al.*, 2001b). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness (DCS).

It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable microbubbles could be destabilized by high-level sound exposures such that

bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario, the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size.

Recent research with *ex vivo* supersaturated tissues suggested that sound exposures of approximately 215 dB re 1 µPa would be required before microbubbles became destabilized and grew (Crum *et al.* 2005). Assuming spherical spreading loss and a nominal sonar source level of 235 dB re 1 µPa, a whale would need to be within 10 m (33 ft) of the sonar dome to be exposed to such sound levels. Furthermore, tissues were supersaturated by exposing them to pressures of 400 to 700 kPa for periods of hours and then releasing them to ambient pressures. Assuming the equilibration of gases with the tissues occurred when the tissues were exposed to the high pressures, levels of supersaturation in the tissues could have been as high as 400 to 700 percent. These levels of tissue supersaturation are substantially higher than model predictions for marine mammals (Houser *et al.*, 2001b). It is improbable that this mechanism is responsible for stranding events or traumas associated with beaked whale strandings. Both the degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert.

Yet another hypothesis has speculated that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson *et al.*, 2003; Fernandez *et al.*, 2005). This is accounted for in the conceptual framework via a feedback path from the behavioral changes of "diving" and "avoidance" to the "indirect tissue response" block. In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Recent modeling suggests that unrealistically rapid rates of ascent from normal dive behaviors are unlikely to result in supersaturation to the extent that bubble formation would be expected in beaked whales (Zimmer *et al.*, 2007). Recently, Tyack *et al.* (2006) suggested that emboli observed in animals exposed to mid-frequency range sonar (Jepson *et al.*, 2003; Fernandez *et al.*, 2005) could stem instead from a behavioral response that involves repeated dives shallower than the depth of lung collapse. Given that nitrogen gas accumulation is a passive process (*i.e.* nitrogen is metabolically inert), a bottlenose dolphin was trained to repetitively dive a profile predicted to elevate nitrogen saturation to the point that nitrogen bubble formation was predicted to occur. However, inspection of the vascular system of the dolphin via ultrasound did not demonstrate the formation of even asymptomatic nitrogen gas bubbles (Houser *et al.*, 2007).

There is considerable disagreement among scientists as to the likelihood of this phenomenon (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). Although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.*, 2003; Fernandez *et al.*, 2005), nitrogen bubble formation as the cause of the traumas has not been verified. The presence of bubbles postmortem, particularly after decompression, is not necessarily indicative of bubble pathology. Prior experimental work has demonstrated the post-mortem presence of bubbles following decompression in laboratory animals can occur as a result of invasive investigative procedures (Stock *et al.*, 1980).

Additionally, the fat embolic syndrome identified by Fernández *et al.* (2005) is the first of its kind. The pathogenesis of fat emboli formation is as yet undetermined and remains largely unstudied, and it would therefore be inappropriate to causally link it to nitrogen bubble formation. Because evidence of nitrogen bubble formation following a rapid ascent by beaked whales is arguable and requires further investigation, this document makes no assumptions about it being the causative mechanism in beaked whale strandings associated with sonar operations. No similar findings to those found in beaked whales stranding coincident with sonar activity have been reported in other stranded animals following known

exposure to sonar operations. By extension, no marine mammals addressed in this Final EIS/OEIS are given differential treatment due to the possibility for acoustically mediated bubble growth.

No Tissue Effects

The received sound is insufficient to cause either direct (mechanical) or indirect effects to tissues. No stress response occurs.

The Stress Response

The acoustic source is considered a potential stressor if, by its action on the animal, via auditory or nonauditory means, it may produce a stress response in the animal. The term "stress" has taken on an ambiguous meaning in the scientific literature, but with respect to Figure 3.7-2 and the later discussions of allostasis and allostatic loading, the stress response will refer to an increase in energetic expenditure that results from exposure to the stressor and which is predominantly characterized by either the stimulation of the sympathetic nervous system (SNS) or the hypothalamic-pituitary-adrenal (HPA) axis (Reeder and Kramer, 2005), or through oxidative stress, as occurs in noise-induced hearing loss (Henderson *et al.*, 2006). The SNS response to a stressor is immediate and acute and is characterized by the release of the catecholamine neurohormones norepinephrine and epinephrine (*i.e.*, adrenaline). These hormones produce elevations in the heart and respiration rate, increase awareness, and increase the availability of glucose and lipids for energy. The HPA response is ultimately defined by increases in the secretion of the glucocorticoid steroid hormones, (*e.g.* cortisol, aldosterone). The amount of increase in circulating glucocorticoids above baseline may be an indicator of the overall severity of a stress response (Hennessy *et al.*, 1979). Each component of the stress response is variable in time; *e.g.*, adrenalines are released nearly immediately and are used or cleared by the system quickly, whereas cortisol levels may take long periods of time to return to baseline.

The presence and magnitude of a stress response in an animal depends on a number of factors. These include the animal's life history stage (*e.g.*, neonate, juvenile, and adult), the environmental conditions, reproductive or developmental state, and experience with the stressor. Not only will these factors be subject to individual variation, but they will also vary within an individual over time. Prior experience with a stressor may be of particular importance as repeated experience with a stressor may dull the stress response via acclimation (St. Aubin and Dierauf, 2001). In considering potential stress responses of marine mammals to acoustic stressors, each of these should be considered. For example, is the acoustic stressor in an area where animals engage in breeding activity? Are animals in the region resident and likely to have experience with the stressor (*i.e.*, repeated exposures)? Is the region a foraging ground or are the animals passing through as transients? What is the ratio of young (naïve) to old (experienced) animals in the population? It is unlikely that all such questions can be answered from empirical data; however, they should be addressed in any qualitative assessment of a potential stress response as based on available literature.

Marine mammals naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with conspecifics, and interactions with predators all contribute to the stress a marine mammal experiences. In some cases, naturally occurring stressors can have profound impacts on marine mammals; for example, chronic stress, as observed in stranded animals with long-term debilitating conditions (*e.g.*, disease), has been demonstrated to result in an increased size of the adrenal glands and an increase in the number of epinephrine-producing cells (Clark *et al.*, 2006). Anthropogenic activities have the potential to provide additional stressors above and beyond those that occur naturally. Potential stressors resulting from anthropogenic activities must be

considered not only as to their direct impact on the animal but also as to their cumulative impact with environmental stressors already experienced by the animal.

Studies on the stress response of odontocete cetaceans to acute acoustic stimuli were previously discussed Thomas *et al.*, 1990; Miksis *et al.*, 2001; Romano *et al.*, 2004). Other types of stressors include the presence of vessels, fishery interactions, acts of pursuit and capture, the act of stranding, and pollution. In contrast to the limited amount of work performed on stress responses resulting from sound exposure, a considerably larger body of work exists on stress responses associated with pursuit, capture, handling and stranding. Pursuit, capture and short-term holding of belugas have been observed to result in a decrease in thyroid hormones (St. Aubin and Geraci, 1988) and increases in epinephrine (St. Aubin and Dierauf, 2001). In dolphins, the trend is more complicated with the duration of the handling time potentially contributing to the magnitude of the stress response (St. Aubin *et al.*, 1996; Ortiz and Worthy, 2000; St. Aubin, 2002). Elephant seals demonstrate an acute cortisol response to handling, but do not demonstrate a chronic response; on the contrary, adult females demonstrate a reduction in the adrenocortical response following repetitive chemical immobilization (Engelhard *et al.*, 2002). With respect to anthropogenic sound as a stressor, the current limited body of knowledge will require extrapolation from species for which information exists to those for which no information exists.

The stress response may or may not result in a behavioral change, depending on the characteristics of the exposed animal. However, provided a stress response occurs, we assume that some contribution is made to the animal's allostatic load. Allostasis is the ability of an animal to maintain stability through change by adjusting its physiology in response to both predictable and unpredictable events (McEwen and Wingfield, 2003). The same hormones associated with the stress response vary naturally throughout an animal's life, providing support for particular life history events (*e.g.*, pregnancy) and predictable environmental conditions (*e.g.*, seasonal changes). The allostatic load is the cumulative cost of allostasis incurred by an animal and is generally characterized with respect to an animal's energetic expenditure. Perturbations to an animal that may occur with the presence of a stressor, either biological (*e.g.*, predator) or anthropogenic (*e.g.*, construction), can contribute to the allostatic load (Wingfield, 2003). Additional costs are cumulative and additions to the allostatic load over time may contribute to reductions in the probability of achieving ultimate life history functions (*e.g.*, survival, maturation, reproductive effort and success) by producing pathophysiological states. The contribution to the allostatic load from a stressor requires estimating the magnitude and duration of the stress response, as well as any secondary contributions that might result from a change in behavior.

If the acoustic source does not produce tissue effects, is not perceived by the animal, or does not produce a stress response by any other means, Figure 3.7-2 assumes that the exposure does not contribute to the allostatic load. Additionally, without a stress response or auditory masking, it is assumed that there can be no behavioral change. Conversely, any immediate effect of exposure that produces an injury (*i.e.*, red boxes on the flow chart in Figure 3.7-2) is assumed to also produce a stress response and contribute to the allostatic load.

Behavior Block

Acute stress responses may or may not cause a behavioral reaction. However, all changes in behavior are expected to result from an acute stress response. This expectation is conservatively based on the assumption that some sort of physiological trigger must exist for an anthropogenic stimulus to alter a biologically significant behavior that is already being performed. The exception to this rule is the case of masking. The presence of a masking sound may not produce a stress response, but may interfere with the animal's ability to detect and discriminate biologically relevant signals. The inability to detect and discriminate biologically relevant signals hinders the potential for normal behavioral responses to auditory cues and is thus considered a behavioral change.

Numerous behavioral changes can occur as a result of stress response, and Figure 3.7-2 lists only those that might be considered the most common types of response for a marine animal. For each potential behavioral change, the magnitude in the change and the severity of the response needs to be estimated. Certain conditions, such as a flight response might have a probability of resulting in injury. For example, a flight response, if significant enough, could produce a stranding event. Under the MMPA, such an event precipitated by anthropogenic noise would be considered a Level A harassment. Each altered behavior may also have the potential to disrupt biologically significant events (*e.g.*, breeding or nursing) and may need to be qualified as Level B harassment. All behavioral disruptions have the potential to contribute to the allostatic load. This secondary potential is signified by the feedback from the collective behaviors to allostatic loading (*i.e.*, physiology block).

The response of a marine mammal to an anthropogenic sound source will depend on the frequency content, duration, temporal pattern and amplitude of the sound as well as the animal's prior experience with the sound and the context in which the sound is encountered (*i.e.*, what the animal is doing at the time of the exposure). The direction of the responses can vary, with some changes resulting in either increases or decreases from baseline (*e.g.*, decreased dive times and increased respiration rate). Responses can also overlap; for example, an increased respiration rate is likely to be coupled to a flight response. Differential responses between and within species are expected since hearing ranges vary across species and the behavioral ecology of individual species is unlikely to completely overlap.

A review of marine mammal responses to anthropogenic sound was first conducted by Richardson and others in 1995. A more recent review (Nowacek *et al.*, 2007) addresses studies conducted since 1995 and focuses on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated. The following sections provide a very brief overview of the state of knowledge of behavioral responses. The overviews focus on studies conducted since 2000 but are not meant to be comprehensive; rather, they provide an idea of the variability in behavioral responses that would be expected given the differential sensitivities of marine mammal species to sound and the wide range of potential acoustic sources to which a marine mammal may be exposed. Estimates of the types of behavioral responses that could occur for a given sound exposure should be determined from the literature that is available for each species, or extrapolated from closely related species when no information exists.

Flight Response

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. Relatively little information, on flight responses of marine mammals to anthropogenic signals exists, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). Flight responses have been speculated as being a component of marine mammal strandings associated with sonar activities (Evans and England, 2001).

Response to Predator

Evidence suggests that at least some marine mammals have the ability to acoustically identify potential predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke *et al.*, 2002), a capability that should increase survivorship while reducing the energy required for attending to and responding to all killer whale calls. The occurrence of masking or hearing impairment provides a means by which marine mammals may be prevented from responding to the acoustic cues produced by their predators. Whether or not this is a

possibility depends on the duration of the masking/hearing impairment and the likelihood of encountering a predator during the time that predator cues are impeded.

Diving

Changes in dive behavior can vary widely. They may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive. Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.*, foraging) or they may be of little biological significance. Variations in dive behavior may also expose an animal to potentially harmful conditions (*e.g.*, increasing the chance of ship-strike) or may serve as an avoidance response that enhances survivorship. The impact of a variation in diving resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Nowacek *et al.* (2004) reported disruptions of dive behaviors in foraging North Atlantic right whales when exposed to an alerting stimulus, an action, they noted, that could lead to an increased likelihood of ship strike. However, the whales did not respond to playbacks of either right whale social sounds or vessel noise, highlighting the importance of the sound characteristics in producing a behavioral reaction. Conversely, Indo-Pacific humpback dolphins have been observed to dive for longer periods of time in areas where vessels were present and/or approaching (Ng and Leung, 2003). In both of these studies, the influence of the sound exposure cannot be decoupled from the physical presence of a surface vessel, thus complicating intepretation of the relative contribution of each stimulus to the response. Indeed, the presence of surface vessels, their approach and speed of approach, seemed to be significant factors in the response of the Indo-Pacific humpback dolphins (Ng and Leung, 2003). Low frequency signals of the Acoustic Thermometry of Ocean Climate (ATOC) sound source were not found to affect dive times of humpback whales in Hawaiian waters (Frankel and Clark, 2000) or to overtly affect elephant seal dives (Costa *et al.*, 2003). They did, however, produce subtle effects that varied in direction and degree among the individual seals, illustrating the equivocal nature of behavioral effects and consequent difficulty in defining and predicting them.

Due to past incidents of beaked whale strandings associated with sonar operations, feedback paths are provided between avoidance and diving and indirect tissue effects. This feedback accounts for the hypothesis that variations in diving behavior and/or avoidance responses can possibly result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation (Jepson *et al.*, 2003). Although hypothetical, the potential process is being debated within the scientific community.

Foraging

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.*, bubble nets or sediment plumes), or changes in dive behavior. Noise from seismic surveys was not found to impact the feeding behavior in western gray whales off the coast of Russia (Yazvenko *et al.*, 2007) and sperm whales engaged in foraging dives did not abandon dives when exposed to distant signatures of seismic airguns (Madsen *et al.*, 2006). Balaenopterid whales exposed to moderate low-frequency signals similar to the ATOC sound source demonstrated no variation in foraging activity (Croll *et al.*, 2001), whereas five out of six North Atlantic right whales exposed to an acoustic alarm interrupted their foraging dives (Nowacek *et al.*, 2004). Although the received sound pressure level at the animals was similar in the latter two studies, the frequency, duration, and temporal pattern of signal presentation were different. These factors, as well as differences in species sensitivity, are likely contributing factors to the differential response. A determination of whether foraging

disruptions incur fitness consequences will require information on or estimates of the energetic requirements of the individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Breathing

Variations in respiration naturally vary with different behaviors and variations in respiration rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Mean exhalation rates of gray whales at rest and while diving were found to be unaffected by seismic surveys conducted adjacent to the whale feeding grounds (Gailey *et al.*, 2007). Studies with captive harbor porpoises showed increased respiration rates upon introduction of acoustic alarms (Kastelein *et al.*, 2001; Kastelein *et al.*, 2006a) and emissions for underwater data transmission (Kastelein *et al.*, 2005). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein *et al.*, 2006a), again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure.

Social relationships

Social interactions between mammals can be affected by noise via the disruption of communication signals or by the displacement of individuals. Disruption of social relationships therefore depends on the disruption of other behaviors (*e.g.*, caused avoidance, masking, etc.) and no specific overview is provided here. However, social disruptions must be considered in context of the relationships that are affected. Long-term disruptions of mother/calf pairs or mating displays have the potential to affect the growth and survival or reproductive effort/success of individuals, respectively.

Vocalizations

Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes may result in response to a need to compete with an increase in background noise or may reflect an increased vigilance or startle response. For example, in the presence of low-frequency active sonar, humpback whales have been observed to increase the length of their ”songs” (Miller *et al.*, 2000; Fristrup *et al.*, 2003), possibly due to the overlap in frequencies between the whale song and the low-frequency active sonar. A similar compensatory effect for the presence of low frequency vessel noise has been suggested for right whales; right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.*, 2007). Killer whales off the northwestern coast of the United States have been observed to increase the duration of primary calls once a threshold in observing vessel density (*e.g.*, whale watching) was reached, which has been suggested as a response to increased masking noise produced by the vessels (Foote *et al.*, 2004). In contrast, both sperm and pilot whales potentially ceased sound production during the Heard Island feasibility test (Bowles *et al.*, 1994), although it cannot be absolutely determined whether the inability to acoustically detect the animals was due to the cessation of sound production or the displacement of animals from the area.

Avoidance

Avoidance is the displacement of an individual from an area as a result of the presence of a sound. It is qualitatively different from the flight response in its magnitude (*i.e.*, directed movement, rate of travel, etc.). Oftentimes avoidance is temporary, and animals return to the area once the noise has ceased. Longer term displacement is possible, however, which can lead to changes in abundance or distribution

patterns of the species in the affected region if they do not become acclimated to the presence of the sound (Blackwell *et al.*, 2004; Bejder *et al.*, 2006; Teilmann *et al.*, 2006). Acute avoidance responses have been observed in captive porpoises and pinnipeds exposed to a number of different sound sources (Kastelein *et al.*, 2001; Finneran *et al.*, 2003; Kastelein *et al.*, 2006a; Kastelein *et al.*, 2006b). Short term avoidance of seismic surveys, low frequency emissions, and acoustic deterrants has also been noted in wild populations of odontocetes (Bowles *et al.*, 1994; Goold, 1996; 1998; Stone *et al.*, 2000; Morton and Symonds, 2002) and to some extent in mysticetes (Gailey *et al.*, 2007), while longer term or repetitive/chronic displacement for some dolpin groups and for manatees has been suggested to be due to the presence of chronic vessel noise (Haviland-Howell *et al.*, 2007; Miksis-Olds *et al.*, 2007a).

Orientation

A shift in an animal's resting state or an attentional change via an orienting response represent behaviors that would be considered mild disruptions if occurring alone, and thus are placed at the bottom of the framework behavior list. As previously mentioned, the responses may co-occur with other behaviors; for instance, an animal may initially orient toward a sound source, and then move away from it. Thus, any orienting response should be considered in context of other reactions that may occur.

Life Function

Proximate life history functions are the functions that the animal is engaged in at the time of acoustic exposure. The disruption of these functions, and the magnitude of the disruption, is something that must be considered in determining how the ultimate life history functions are affected. Consideration of the magnitude of the effect to each of the proximate life history functions is dependent upon the life stage of the animal. For example, an animal on a breeding ground which is sexually immature will suffer relatively little consequence to disruption of breeding behavior when compared to an actively displaying adult of prime reproductive age.

The ultimate life functions are those that enable an animal to contribute to the population (or stock, or species, etc.) and which are related to the animal's *fitness*. The impact to ultimate life functions will depend on the nature and magnitude of the perturbation to proximate life history functions. Depending on the severity of the response to the stressor, acute perturbations may have nominal to profound impacts on ultimate life functions. For example, unit-level use of sonar by a vessel transiting through an area that is utilized for foraging, but not for breeding, may disrupt feeding by exposed animals for a brief period of time. Because of the brevity of the perturbation, the impact to ultimate life functions may be negligible. By contrast, weekly training over a period of years may have a more substantial impact because the stressor is chronic. Assessment of the magnitude of the stress response from the chronic perturbation would require an understanding of how and whether animals acclimate to a specific, repeated stressor and whether chronic elevations in the stress response (*e.g.*, cortisol levels) produce fitness deficits.

The proximate life functions are loosely ordered in decreasing severity of impact. Mortality (survival) has an immediate effect, in that no future reproductive success is feasible and there is no further addition to the population resulting from reproduction. Severe injuries may also lead to reduced survivorship (longevity) and prolonged alterations in behavior. The latter may further affect an animal's overall reproductive success and reproductive effort. Disruptions of breeding have an immediate impact on reproductive effort and may impact reproductive success. The magnitude of the effect will depend on the duration of the disruption and the type of behavior change that was provoked. Disruptions to feeding and migration can affect all of the ultimate life functions; however, the impacts to reproductive effort and success are not likely to be as severe or immediate as those incurred by mortality and breeding disruptions.

3.7.3.2 Background Information for Explosives and Modeling Analysis

Some of the Navy's training exercises include the underwater detonation of explosives. When an explosive detonates, a physical shock front rapidly compresses the explosive material. As this front passes through the explosive, it triggers a chemical reaction, turning the solid of the explosive into gaseous products and liberating a large amount of energy. An accompanying pressure wave, called a "shock wave" is also produced which then passes into the surrounding medium. Noise associated with the blast is also transmitted into the surrounding medium. The shock wave (impulsive characteristic of sound) and blast noise (acoustic characteristic of sound) are of the most concern to marine animals. Beyond a short distance from the blast (generally 3-10 diameters of the explosive charge), thermal and direct detonation effects from the explosion are significantly reduced or eliminated (Viada *et al*., 2008). The main sources of impact outside the immediate vicinity of the explosion are the shock wave and expanding gaseous reaction products. Generally, the original shock wave is the primary cause of harm to aquatic life. The expanding gases, if they break into the water column, can set up a pulsating bubble whose recurring pressure waves also may contribute significantly to damage (Viada *et al*., 2008).

The effects of an underwater explosion on marine mammals and sea turtles are dependent on several factors, including the size, type, and depth of both the animal and the explosive charge; the depth of the water column; and the standoff distance between the explosive charge and the animal, as well as the sound propagation properties of the environment. Impacts to marine species are a result of physiological responses (generally the destruction of tissues at air-fluid interfaces) to both the type and strength of the acoustic signature and shock wave generated by an underwater explosion. Behavioral impacts are also expected, though the type and severity of these effects are more difficult to define due to limited studies addressing the behavioral effects of explosives on marine mammals and other aquatic species. Potential effects can range from brief acoustic effects (such as behavioral disturbance), tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to death of the animal (Yelverton *et al*., 1973; O'Keefe and Young, 1984; DoN, 2001). Non-lethal injury includes slight injury to internal organs and the auditory system; however, delayed lethality may be a result of individual or cumulative sublethal injuries (DoN, 2001). Immediate lethal injury would be a result of massive combined trauma to internal organs as a direct result of close proximity to the point of detonation (DoN, 2001). In the following subsections, potential effects due to the exposure to underwater detonations is discussed in more detail.

The exercises that use explosives are BOMBEX (BOMBEX Hotbox), MINEX (Panama City and Corpus Christi UNDET Areas), small arms training with anti-swimmer grenades (UNDET Area E3), and diver training (Demolition Pond). Table 2.2-9 summarizes the number of events per year and specific areas where each occurs for each type of explosive ordnance used. Events can take place at any time of year and can be assumed to be evenly distributed across all four seasons.

Potential Impacts from Exposure to Underwater Detonations and High Explosive Ordnance

Direct Tissue Effects

Direct tissue responses to impulsive sound stimulation may range from tissue trauma (injury) to mechanical vibration or compression with no resulting injury. Any tissue injury would produce a stress response whereas a non-injurious stimulation may or may not.

Generally, blast injury, defined as biophysical and pathophysiological events and clinical syndromes that occur when a living body is exposed to a blast of any origin, comprises two categories: primary blast injury (PBI) and cavitation (Costanzo and Gordon, 1989; Office of the Surgeon General, 1991; DoN, 2001). Primary blast injury (PBI) occurs when the shock wave strikes and compresses the body, and energy from the blast is transferred directly from the transmitting medium (water) to the body

surface. Cavitation occurs when compression waves generated by an underwater explosion propagate to the surface and are reflected back through the water column as rarefaction waves. Subsequent rarefaction waves create a state of tension in the water column, causing cavitation (defined as the formation of partial vacuums in a liquid by high intensity sound waves) within a bounded area called the cavitation region (Viada *et al.*, 2008). In addition to these two avenues for impulsive effects, direct tissue damage can occur if the animal is close enough to the explosive source to be struck by the fragments or casing of the actual explosive device. Given current mitigation measures associated with underwater detonations, this scenario is highly unlikely.

Injury resulting from a shock wave takes place at boundaries between tissues of different density. Different velocities are imparted to tissue of different densities, and this can lead to their physical disruption. Blast effects are greatest at gas-liquid interfaces (Landsberg, 2000). Gas-containing organs, particularly the lungs, gastrointestinal tract, and the auditory system are susceptible in marine animals (Goertner, 1982; Hill, 1978; Yelverton *et al.*, 1973). The direct effects of cavitation on marine mammals and sea turtles is unknown, though it is assumed that cavitation created by detonation of a small charge could directly annoy or injure (primarily the auditory system and lungs) or increase the severity of PBI injuries in the cavitation region (DoN, 2001). Non-lethal injuries include minor injuries to the auditory system and certain internal organs.

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound related damage associated with the blast noise can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. Sound related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten, 1995). Sub-lethal impacts include hearing loss, which is caused by exposure to perceptible sounds. Severe damage, from the shock wave, to the ears can include rupture of the tympanic membrane (or tympanum in the case of sea turtles), fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear (NMFS, 2008). Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as prolonged exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten, 1995).

In addition to injuries to the ear, other sensitive organs are also affected by the shock wave from underwater detonations. For example, lung injuries, including laceration and rupture of the alveoli and blood vessels, can lead to hemorrhage, creation of air embolisms, and breathing difficulties. In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble (Reidenberg and Laitman, 2003). The gastrointestinal tract is also susceptible to trauma from underwater explosions. Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of the gut contents into the body cavity. Less severe gastrointestinal tract injuries include contusions, slight hemorrhaging, and petichia (Yelverton *et al.*, 1973). In underwater blast studies using cadaver marine mammals, Ketten *et al.* (2003) and Reidenberg and Laitman (2003), injury was consistent with what would be expected in live animals and included apparent hemorrhages at the blubber-muscle interface and in gas-containing organs and the gastrointestinal tract; ruptures of the liver and spleen; and contusions of the kidney. Ketten *et al.* (2003) noted distinct injury patterns to the blubber, melon, and jaw fats of cadaver bottlenose dolphins due to the differences in density, and hence sound speed velocity, of these tissues from adjoining tissues. Compression also appears to cause air to enter tissues adjacent to air spaces in dead marine mammals exposed to explosives (Reidenberg and Laitman, 2003). Slight injury to any of these organs would be considered recoverable and would not ultimately be debilitating to the individual.

Exposures of animals to high peak pressure shock waves can result in injuries including concussive brain damage; cranial, skeletal, or shell fractures; hemorrhage; or massive inner ear trauma (Ketten, 1995). Depending on the size of the animal (with small animals being more susceptible), extremely high shock wave pressure impulses may or may not be lethally injurious to internal organs. However, overall system shock and significant external tissue damage, as well as severe localized damage to the skeletal system, would be expected from such a shock wave. These injuries, if not themselves fatal, would probably put the animal at increased risk of predation, secondary infection, or disease (DoN, 2001).

Indirect Tissue Effects

Indirect tissue effects may also be possible from underwater detonations, by means of the impulsive shock wave or its associated acoustic energy. For example, hemorrhage of the gastrointestinal tract can be caused by the direct effect of the shock wave or indirectly by the excitation of radial oscillations of small gas bubbles normally present in the intestines (Richmond *et al.*, 1973 and Yelverton *et al.*, 1973).

A plausible mechanism for indirect tissue effects may be from behaviorally mediated bubble growth. Although this hypothesis was originally proposed in relation to the effects of sonar on marine mammals, the general pathway could also be applicable to underwater detonations. By this hypothesis, if the acoustic energy or impulsive force of an underwater detonation was great enough to startle marine mammals, it could trigger their flight response and cause them to react by changing their dive behavior (i.e. rapid ascent, staying at the surface or at depth longer to avoid exposure). Jepson *et al.* (2003) proposed that bubble formation might result from behavioral changes to normal dive profiles (such as accelerated ascent rate), causing excessive nitrogen supersaturation in the tissues (as occurs in decompression sickness). Because evidence of nitrogen bubble formation following a rapid ascent by marine mammals is arguable and requires further investigation, this EIS/OEIS makes no assumptions about it being a causative mechanism.

An alternative, but related hypothesis has also been suggested: stable micro-bubbles could become destabilized, or bubbles could be formed via cavitation following high level sound exposures, which could originate from impulsive sources. Under such a condition, bubble growth could then occur through static diffusion of gas out of the tissues. In this scenario, the marine mammal would need to be in a gas-supersaturated state for a long period of time for bubbles to become of a problematic size. While it is unlikely that the short duration of sonar pings or impulsive sounds from explosive sources would be long enough to drive bubble growth to any substantial size, such a phenomenon is within the realm of possibility. For a further discussion of these mechanisms refer back to the *Indirect Effects* section of the acoustic analysis.

Behavioral Effects

There have been few studies addressing the behavioral effect of explosives on marine mammals. While recognizing that the nature of shock waves produced by high explosives is different from that produced by airguns or MFAS, these sounds serve as the best proxy for assessing the effects of underwater detonations on marine life. Despite the difference in the character of the sound source, it is anticipated that the same general behavioral responses would result from explosive detonations. As a result, for a further discussion of the behavioral effects of underwater detonations on marine species, refer back to the *Behavior Block* section of the acoustic analysis.

Thresholds and Criteria for Impulsive Sound

Criteria and thresholds for estimating the exposures from a single explosive activity on marine mammals were established for the Seawolf Submarine Shock Test FEIS ("Seawolf") and subsequently used in the USS Winston S. Churchill (DDG-81) Ship Shock FEIS ("Churchill") (DoN, 1998 and 2001). NMFS adopted these criteria and thresholds in its final rule on unintentional taking of marine animals

occurring incidental to the shock testing (NMFS, 2001). Since the ship-shock events involve only one large explosive at a time, additional assumptions were made to extend the approach to cover multiple explosions for BOMBEX. In addition, this section reflects a revised acoustic criterion for small underwater explosions (*i.e.*, 23 pounds per square inch [psi] for peak pressure instead of previous acoustic criterion of 12 psi for peak pressure), which is based on the final rule issued to the Air Force by NMFS (NMFS, 2005b). As in the case of the NMFS Final Rule for recently permitted Navy training in the Jacksonville OPAREA (NMFS, 2009), in the absence of specifically developed criteria, criteria and thresholds for impact on protected marine mammals are used for protected sea turtles. Figure 3.7-4 depicts the acoustic impact framework used in this assessment.

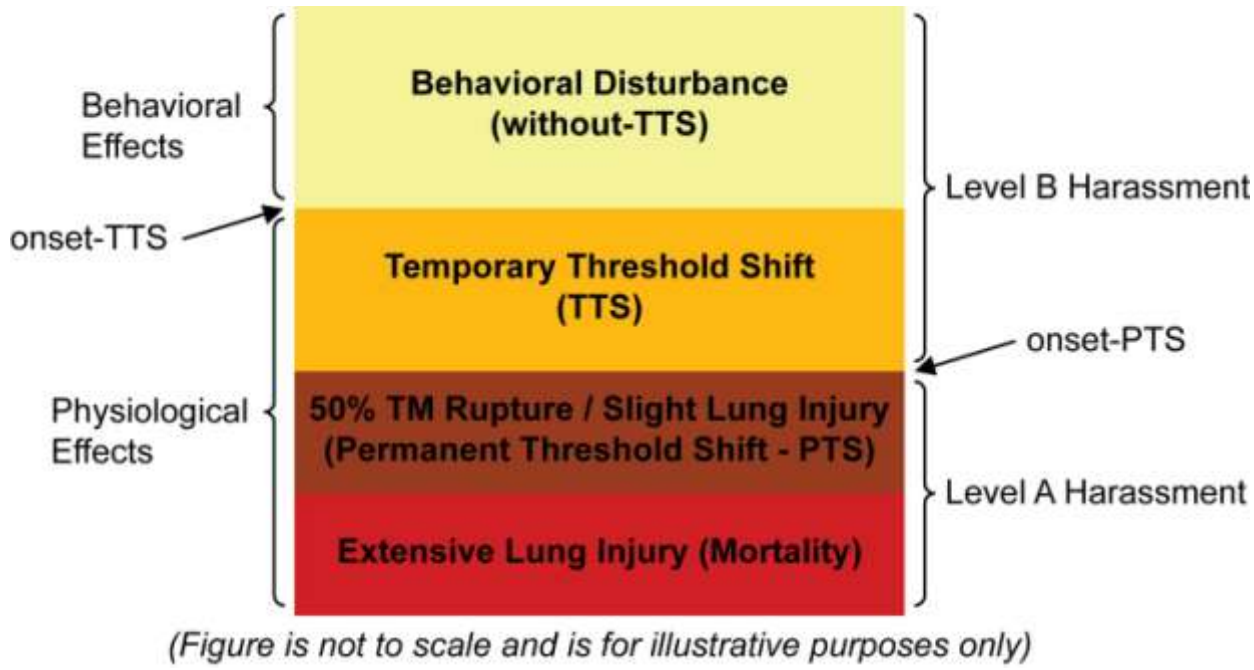

Figure 3.7-4 Physiological and Behavioral Acoustic Effects Framework for Explosives

Thresholds and Criteria for Injurious Physiological Effects

Single Explosion

For injury, the Navy uses dual criteria: eardrum rupture (*i.e.*, tympanic-membrane [TM] rupture) and onset of slight lung injury. These criteria are considered indicative of the onset of injury. The threshold for TM rupture corresponds to a 50% rate of rupture (*i.e.*, 50% of animals exposed to the level are expected to suffer TM rupture); this is stated in terms of an Energy Flux Density Level (EL) value of 1.17 in.-lb/in.^{2} (about 205 dB re: 1 μPa^2-s). This recognizes that TM rupture is not necessarily a serious or life-threatening injury, but is a useful index of possible injury that is well correlated with measures of permanent hearing impairment (Ketten [1998] indicates a 30% incidence of PTS at the same threshold).

The threshold for onset of slight lung injury is calculated for a small animal (a dolphin calf weighing 26.9 lbs), and is given in terms of the "Goertner modified positive impulse," indexed to 13 psi-ms (DoN, 2001). This threshold is conservative since the positive impulse needed to cause injury is proportional to animal mass, and therefore, larger animals require a higher impulse to cause the onset of injury. This analysis assumed the marine species populations were 100% small animals. The criterion

with the largest potential impact range (most conservative), either TM rupture (energy threshold) or onset of slight lung injury (peak pressure threshold), will be used in the analysis to determine injurious physiological exposures.

For mortality, the Navy uses the criterion corresponding to the onset of extensive lung injury. This is conservative in that it corresponds to a 1percent chance of mortal injury, and yet any animal experiencing onset severe lung injury is counted as a lethal exposure. For small animals, the threshold is given in terms of the Goertner modified positive impulse, indexed to 30.5 psi-ms. Since the Goertner approach depends on propagation, source/animal depths, and animal mass in a complex way, the actual impulse value corresponding to the 30.5 psi-ms index is a complicated calculation. To be conservative, the analysis used the mass of a calf dolphin (at 26.9 lbs) for 100 percent of the populations.

Multiple Explosions

For this analysis, the use of multiple explosions only applies to the MK-82 and MK-83 HE bombs used in BOMBEX or the MK3A2 anti-swimmer grenades used during small arms training. Since BOMBEX or small arms training events require multiple explosions, the Churchill approach had to be extended to cover multiple sound events at the same training site. For multiple exposures, accumulated energy over the entire training time is the natural extension for energy thresholds since energy accumulates with each subsequent shot (explosion); this is consistent with the treatment of multiple arrivals in Churchill. For positive impulse, it is consistent with Churchill to use the maximum value over all impulses received.

Thresholds and Criteria for Non-Injurious Physiological Effects

The Navy criterion for non-injurious harassment is TTS — a slight, recoverable loss of hearing sensitivity (DoN, 2001). For this assessment, there are dual criteria for TTS, an energy threshold and a peak pressure threshold. The criterion with the largest potential impact range (most conservative), either the energy threshold or peak pressure threshold, will be used in the analysis to determine non-injurious TTS exposures.

Single Explosion – TTS-Energy Threshold

The first threshold is a 182 dB re: 1 μPa^2-s maximum EL in any 1/3-octave band at frequencies above 100 Hertz (Hz) for toothed whales/sea turtles and in any 1/3-octave band above 10 Hz for baleen whales. For large explosives, as in the case of the Churchill FEIS, frequency range cutoffs at 10 and 100 Hz make a difference in the range estimates. For small explosives (< 1500-lb NEW), as what was modeled for this analysis, the spectrum of the shot arrival is broad, and there is essentially no difference in impact ranges for toothed whales/sea turtles or baleen whales.

The TTS energy threshold for explosives is derived from the Space and Naval Warfare Systems Center (SSC) pure-tone tests for TTS (Schlundt *et al.*, 2000; Finneran and Schlundt, 2004). The pure-tone threshold (192 decibels [dB] as the lowest value) is modified for explosives by (a) interpreting it as an energy metric, (b) reducing it by 10 dB to account for the time constant of the mammal ear, and (c) measuring the energy in 1/3-octave bands, the natural filter band of the ear. The resulting threshold is 182 dB re: 1 μPa^2-s in any 1/3-octave band. The energy threshold usually dominates and is used in the analysis to determine potential non-injurious exposures for single explosion ordnance.

Single Explosion – TTS-Peak Pressure Threshold

The second threshold applies to all species and is stated in terms of peak pressure at 23 psi (about 225 dB re: 1 μPa). This criterion was adopted for Precision Strike Weapons (PSW) Testing and Training by Eglin Air Force Base (AFB) in the Gulf of Mexico (NMFS, 2005b). It is important to note that for small shots near the surface (such as in this analysis), the 23-psi peak pressure threshold generally will

produce longer impact ranges than the 182-dB energy metric. Furthermore, it is not unusual for the TTS impact range for the 23-psi pressure metric to actually exceed the behavioral impact range for the 177-dB energy metric.

Multiple Explosions - TTS

For multiple explosions, accumulated energy over the entire training time is the natural extension for energy thresholds since energy accumulates with each subsequent shot/detonation. This is consistent with the energy argument in Churchill. For peak pressure, it is consistent with Churchill to use the maximum value over all impulses received.

Thresholds and Criteria for Behavioral Effects

Single Explosion

For a single explosion, to be consistent with Churchill, TTS is the criterion for non-injurious physiological exposure. In other words, because behavioral disturbance for a single explosion is likely to be limited to a short-lived startle reaction, use of the TTS criterion is considered sufficient protection and therefore, behavioral effects are not considered for single explosions.

Multiple Explosions – Sub-TTS

For this analysis, the use of multiple explosions only applies to BOMBEX and small arms training using MK3A2 anti-swimmer grenades. Because multiple explosions would occur within a discrete time period (four bombs per exercise at an interval of three to nine minutes between bombs), a new acoustic criterion – behavioral disturbance (sub-TTS) – is used to account for behavioral effects significant enough to be judged as harassment, but occurring at lower noise levels than those that may cause TTS.

The threshold is based on test results published in Schlundt *et al.* (2000), with derivation following the approach of the Churchill FEIS for the energy-based TTS threshold. The original Schlundt *et al.* (2000) data and the report of Finneran and Schlundt (2004) are the basis for thresholds for behavioral disturbance. As reported by Schlundt *et al.* (2000), instances of altered behavior generally began at lower exposures than those causing TTS; however, there were many instances when subjects exhibited no altered behavior at levels above the onset-TTS levels. Regardless of reactions at higher or lower levels, all instances of altered behavior were included in the statistical summary.

The behavioral disturbance (sub-TTS) threshold for tones is derived from the SSC tests, and is found to be 5 dB below the threshold for TTS, or 177 dB re: 1 μPa^2-s maximum energy flux density level in any 1/3-octave band at frequencies above 100 Hz for toothed whales/sea turtles and in any 1/3-octave band above 10 Hz for baleen whales. As stated previously for TTS, for small explosives (< 1500-lb NEW), as what was modeled for this analysis, the spectrum of the shot arrival is broad, and there is essentially no difference in impact ranges for toothed whales/sea turtles or baleen whales.

Summary of Thresholds and Criteria for Impulsive Sound

Table 3.7-4 summarizes the effects, criteria, and thresholds used in the assessment for impulsive sounds. The criterion for behavioral disturbance (sub-TTS) used in this analysis is based on the use of multiple explosives that only take place during a BOMBEX or small arms training (MK3A2 grenades) event.

Acoustic Environment

Sound propagation (the spreading or attenuation of sound) in the oceans of the world is affected by several environmental factors: water depth, variations in sound speed within the water column, surface roughness, and the geo-acoustic properties of the ocean bottom. These parameters can vary widely with location.

TABLE 3.7-4
EFFECTS, CRITERIA, AND THRESHOLDS FOR IMPULSIVE SOUND

Effect	Criterion	Metric	Threshold
Mortality	Onset of Extensive Lung Injury	Goertner modified positive impulse	indexed to 30.5 psi-ms (assumes 100% small animal at 26.9 lbs)
Injurious Physiological	50% Tympanic Membrane Rupture-PTS	Energy flux density	1.17 in.-lb/in.^{2} (about 205 dB re: 1 μPa^2-s)
Injurious Physiological	Onset Slight Lung Injury	Goertner modified positive impulse	indexed to 13 psi-ms (assumes 100% small animal at 26.9 lbs)
Non-injurious Physiological	TTS	Greatest EL in any 1/3-octave band (above 100 Hz for toothed whales/sea turtles and above 10 Hz for baleen whales) - for total energy over all exposures	182 dB re: 1 μPa^2-s
Non-injurious Physiological	TTS	Peak pressure for any single exposure	23 psi
Non-injurious Behavioral	Behavioral Disturbance sub-TTS	Greatest energy flux density level in any 1/3-octave (above 100 Hz for toothed whales/sea turtles and above 10 Hz for baleen whales) - for total energy over all exposures (multiple detonations only)	177 dB re: 1 μPa^2-s

TTS = Temporary Threshold Shift
PTS = Permanent Threshold Shift

Four types of data are used to define the acoustic environment for each analysis site:

- **Seasonal Sound Velocity Profiles (SVP)** – Plots of propagation speed (velocity) as a function of depth, or SVPs, are a fundamental tool used for predicting how sound will travel. Seasonal SVP averages were obtained for each training area.
- **Seabed Geo-acoustics** – The type of sea floor influences how much sound is absorbed and how much sound is reflected back into the water column.
- **Wind Speeds** – Several environmental inputs, such as wind speed and surface roughness, are necessary to model acoustic propagation in the prospective training areas.
- **Bathymetry Data** – Bathymetry data are necessary to model acoustic propagation and were obtained for each of the training areas.

Acoustic Effects Analysis

BOMBEX

The acoustic effects analysis for BOMBEX is presented in the following section. A more in-depth effects analysis may be found in Appendix J.

Modeling was completed for three explosive sources involved in BOMBEX, each assumed detonation at 1-m depth. The NEW used in simulations of the MK-82, MK-83 and MK-84 is 192.2 lbs, 415.8 lbs, and 945 lbs, respectively.

The MK-84 bomb is dropped one at a time and therefore is modeled as a single detonation event. More specifically, the behavioral disturbance (sub-TTS) criterion for multiple explosions was not used.

Determining the zone of influence (ZOI) for the thresholds in terms of total EFD, impulse, peak pressure and 1/3-octave bands EFD must treat the sequential detonations differently than the single detonations. For the MK-82 and MK-83, two factors are involved for the sequential detonations that deal with the spatial and temporal distribution of the detonations as well as the effective accumulation of the resultant acoustics. In view of the ZOI determinations, the sequential detonations are modeled as a single point event with only the EFD summed incoherently:

$$Total\,EFD\,db = 10\log_{10}\sum_{i=1}^{n} 10^{(EFD_i/10)}$$

Tables 3.7-5 and 3.7-6 show the ZOI results of the model estimation. The ZOI, when multiplied by the animal densities and total number of events (Table 2.2-9), provides the exposure estimates for that animal species for the given HE ordnance type.

BOMBEX is restricted to one location (BOMBEX Hotbox). In addition to other mitigation measures, (see Chapter 5) aircraft will survey the target area for marine mammals and sea turtles before and during the exercise. Aircraft will not fire on the target until the area is surveyed and determined to be free of marine mammals. The exercise will be suspended if any marine mammals enter the buffer area (5,100-yd [4,663-m] radius around target). The implementation of mitigation measures like these effectively reduce exposures in the ZOI.

MINEX

The Comprehensive Acoustic System Simulation/Gaussian Ray Bundle (OAML, 2002) model, modified to account for impulse response, shock-wave waveform, and nonlinear shock-wave effects, was run for acoustic-environmental conditions derived from the Oceanographic and Atmospheric Master Library (OAML) standard databases. The explosive source was modeled with standard similitude formulas, as in the Churchill FEIS.

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TABLE 3.7-5
ESTIMATED ZOIS (SQUARE KILOMETER [KM^2]) USED IN EXPOSURE CALCULATIONS FOR BOMBEX (A-S [AT-SEA]) IN THE GOMEX RANGE COMPLEX

Area	Ordnance	Estimated ZOI @ 177 dB re 1 μPa^2-sec (multiple detonations only)				Estimated ZOI @ 182 dB re 1 μPa^2-sec or 23 psi				Estimated ZOI @ 205 dB re 1 μPa^2-sec or 13 psi				Mortality ZOI @ 30.5 psi			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
GOMEX																	
BOMBEX Hotbox	MK-82* (192.2 lbs NEW)	69.52	67.89	73.97	75.67	36.48	36.88	38.09	39.72	1.99	1.99	1.99	2.09	<0.01	<0.01	<0.01	<0.01
BOMBEX Hotbox	MK-83 * (415.8 lbs NEW)	98.93	115.93	161.39	173.27	55.53	76.82	137.33	158.07	4.84	4.84	4.84	4.98	<0.01	<0.01	<0.01	<0.01
BOMBEX Hotbox	MK-84 (945 lbs NEW)	NA	NA	NA	NA	9.52	9.73	13.04	9.12	0.57	0.57	0.57	0.57	<0.01	<0.01	<0.01	<0.01

**ZOIs for MK82 and MK-83 bombs are modeled as multiple detonations (4 bombs dropped at same location).*

NA: The MK-84 bomb is modeled as a single detonation and therefore the behavioral disturbance criterion does not apply.

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Estimated ZOIs varied as much within a single area as from one area to another, which had been the case for the Virtual At Sea Training/IMPASS (DoN, 2003). There was, however, little season dependence. As a result, the ZOIs are stated as mean values with a percentage variation. Generally, in the case of ranges determined from energy metrics, as the depth of water increases, the range shortens. Table 3.7-6 shows the ZOI results of the model estimation.

TABLE 3.7-6
ESTIMATED ZOIS (KM^2) USED IN EXPOSURE CALCULATIONS FOR MINEX

Threshold*	ZOIs			
	5-lb NEW	10-lb NEW	20-lb NEW	60-lb NEW
Estimated ZOI @ 13 psi	0.03 km^2 ± 10%	0.07 km^2 ± 10%	0.13 km^2 ± 10%	0.4 km^2 ± 10%
Estimated ZOI @ 182 dB re 1 μPa^2-sec	0.2 km^2 ± 25%	0.4 km^2 ± 25%	0.8 km^2 ± 25%	2.5 km^2 ± 25%

** Note: The ZOI resulting from the 13 psi-ms criterion was larger than the ZOI resulting from the 205 dB re 1 uPa^2-s (1/3 octave band) criterion, and was therefore used in the analysis to calculate injurious exposures (MMPA-Level A). The ZOI resulting from the 182 dB re 1 uPa^2-s (1/3 octave band) criterion was larger than the ZOI resulting from the 13 psi-ms criterion, and was therefore used in the analysis to calculate non-injurious exposures (MMPA-Level B).*

The total ZOI, when multiplied by the animal densities and total number of events (Table 2.2-9), provides the exposure estimates for that animal species for each specified charge. Because of the time lag between detonations, it is highly unlikely, even if a marine mammal were present (not accounting for mitigation) that the marine mammal would be within the small exposure zone for more than one detonation. The results for exposures at the 13 psi criterion were very low and extrapolation showed that there would be zero mortality exposures, so modeling was not completed for the 30.5 psi-msec mortality criterion.

Underwater detonations are restricted to two general areas (Panama City and Corpus Christi MINEX Boxes) (Figures 2.1-1 and 2.1-3, respectively). In addition to other mitigation measures (see Chapter 5), observers will survey the target area for marine mammals and sea turtles for 30 minutes prior through 30 minutes post detonation. Detonations will be suspended if a marine mammal enters the Zone of Influence and will only restart after the area has been clear for a full 30 minutes. Table 3.7-7 is a list of marine mammal dive times that are documented. The majority of documented research has noted that most marine mammals complete dives averaging less than 30 minutes. For those species that are likely to occur in these training areas, a 30 minute shutdown period represents an adequate amount of time to assess marine mammal movements within the designated area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

Small Arms Training

Modeling was completed for the MK3A2 explosive anti-swimmer grenades, which assumed a 6 ft detonation depth. The NEW used in simulations of the MK3A2 grenade is 0.5 lb.

Determining the ZOI for the thresholds in terms of total energy flux density (EFD), impulse, peak pressure and 1/3-octave bands EFD must treat the sequential explosions differently than the single detonations. For the MK3A2, two factors are involved for the sequential explosives that deal with the spatial and temporal distribution of the detonations as well as the effective accumulation of the resultant acoustics. In view of the ZOI determinations, the sequential detonations are modeled as a single point event with only the EFD summed incoherently:

$$Total\,EFD\,db = 10\log_{10}\sum_{i=1}^{n} 10^{(EFD_i/10)}$$

Table 3.7-8 shows the ZOI results of the model estimation. The ZOI, when multiplied by the animal densities (see Section 3.7.1.2) and total number of events, provides the exposure estimates for that animal species. Grenade use is restricted to one location (UNDET Area E3) (see Figure 2.1-3). In addition to other mitigation measures (see Chapter 5), lookouts will visually survey the target area for marine mammals and sea turtles. The exercise will not be conducted until the area is clear and will suspend the exercise if any enter the buffer area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

TABLE 3.7-7
MARINE MAMMAL DIVE TIMES

Common Name	*Scientific Name*	Average Dive Duration (min)	Maximum Dive Duration (min)	Citations
Mysticeti (baleen whales)				
Northern Atlantic right whale	*Eubalaena glacialis*	11.5 - 12.2		Goodyear, 1995; Baumgartner and Mate, 2003
Humpback whale	*Megaptera novaeangliae*	8.2	21	Dolphin, 1988 ; Schreer and Kovacs, 1997
Minke whale	*Balaenoptera acutorostrata*	4.43		Stern, 1992
Byrde's whale	*Balaenoptera brydei*	8	20	Wynne and Schwartz, 1999
Sei whale	*Balaenoptera boreali*		20	Lockyer and Waters, 1986 ; Martin, 1990
Fin whale	*Balaenoptera physalus*	5.5	14	Croll *et al*., 2001 ; Lockyer and Waters, 1986 ; Watkins *et al*., 1981
Blue whale	*Balaenoptera musculus*	6.6	18	Croll et al., 2001; Lagerquist et al., 2000
Odontoceti (toothed whales)				
Sperm whale	*Physeter macrocephalus*	35.9 - 37	73	Amano and Yoshioka, 2003 Watkins *et al*., 1993; Omura, 1950; Watkins *et al*., 1993

TABLE 3.7-7
MARINE MAMMAL DIVE TIMES (Continued)

Common Name	*Scientific Name*	Average Dive Duration (min)	Maximum Dive Duration (min)	Citations
Pygmy sperm whale	*Kogia breviceps*		12 -17.7	Evans, 1987; Hohn *et al*., 1995; Scott *et al*., 2001
Dwarf sperm whale	*Kogia sima*		43	Breese and Tershy, 1993
Cuvier's beaked whale	*Ziphius cavirostris*	28.6	68	Barlow, 1999; Baird *et al*., 2004; Barlow et al., 1997
Sowerby's beaked whale	*Mesoplodon bidens*	12 - 29		Hooker and Baird, 1999
Blainville's beaked whale	*Mesoplodon densirostris*		23	Baird *et al*., 2004
Rough-toothed dolphin	*Steno bredanensis*		15	Miyazaki and Perrin, 1994
Bottlenose dolphin	*Tursiops truncatus*		8	Evans, 1987; Ridgway and Harrison, 1986
Pantropical spotted dolphin	*Stenella attenuata*		4.7	Perrin *et* al., 1987 Scott *et al*., 1993
Atlantic spotted dolphin	*Stenella frontalis*		5 - 6	Davis *et al*., 1996
Spinner dolphin	*Stenella longirostris*		3.5	Wursig *et al*., 1994
Common dolphin	*Dephinus delphis*		5	Heyning and Perrin 1994; Evans, 1971
Atlantic white-sided dolphin	*Lagenorhynchus acutus*		4	Mate *et al*., 1994
Risso's dolphin	*Grampus griseus*		30	Clarke, 1996
False killer whale	*Pseudorca crassidens*	8 - 12		Ligon and Baird, 2001
Killer whale	*Orcinus orca*		10.4 - 15	Baird *et al*., 2005; Schreer and Kovacs, 1997
Long-finned pilot whale	*Globicephala melas*	8.1		Baird *et al*., 2002
Short-finned pilot whale	*Globicephala macrorhynchus*		27	Baird *et al*., 2003

TABLE 3.7-7
MARINE MAMMAL DIVE TIMES (Continued)

Common Name	*Scientific Name*	Average Dive Duration (min)	Maximum Dive Duration (min)	Citations
Harbor porpoise	*Phocoena phocoena*		5.35	Westgate *et al*., 1995; Otani *et al*., 1998; 2000
Pinnipedia (seals, sea lions, walruses)				
Harbor seal	*Phoca vitulina*		7	Schreer and Kovacs, 1997
Gray seal	*Halichoerus grypus*		32	Schreer and Kovacs, 1997
Harp seal	*Pagophilus groenlandicus*		16	Schreer and Kovacs, 1997
Sirenia (manatees and dugongs)				
West Indian manatee	*Trichechus manatus*		6	Schreer and Kovacs, 1997

3.7.3.3 No Action Alternative

Vessel Movements

Overview

The No Action Alternative includes vessel movements. These involve transit to and from port to the various components of the GOMEX Range Complex (*e.g.*, OPAREAs, UNDET Area E3, Harbor Security Group Machine Gun Area), as well as vessel movements into, within, and through these distinct components. Vessel movements have the potential to affect marine mammals by directly striking or disturbing individual animals. The probability of vessel and marine mammal interactions occurring in the GOMEX Range Complex is dependent upon several factors including numbers, types, and speeds of vessels; the regularity, duration, and spatial extent of operations; the presence/absence and density of marine mammals; and protective measures implemented by the Navy. Currently, the number of Navy vessels operating in the GOMEX Range Complex varies based on training schedules and can range from 0 to about 10 vessels at any given time (exclusive of small boats decribed below). Vessel sizes range from small boats (<35 ft) for a harbor security boat to 1,092 ft for a nuclear aircraft carrier (CVN). Operations involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to 2 weeks. These operations are widely dispersed throughout the waters of the GOMEX Range Complex, which is an area encompassing 17,440 nm^2. Some training operations are strictly vessel movements, such as Man Overboard Drills, Tow/Be Towed Exercises, Underway Replenishment, Aircraft Carrier Flight Operations, and use of the transit lanes by submarines when surfaced; these types of operations are all analyzed under the impacts from vessel movement. The proposed action also includes non-training related vessel movements which are unpredictable as to their occurrence in a year such as, but not limited to, storm evasion, deployment transits, and movements in the basin to rearrange for repairs/berthing/loading/off-loading from designated piers. Most vessel movements occur in the offshore OPAREAs, but vessel movements associated with MESG training in UNDET Area E3 and Commander Naval Installations Command (CNIC) harbor security group training in the Panama City OPAREA occur between shore and 12 nautical miles (nm), including the nearshore zone (<3 nm).

TABLE 3.7-8
ESTIMATED ZOIS (SQUARE KILOMETER [KM^2]) USED IN EXPOSURE CALCULATIONS FOR SMALL ARMS TRAINING IN THE GOMEX RANGE COMPLEX

Area	Ordnance	Estimated ZOI @ 177 dB re 1 μPa^2-sec (multiple detonations only)				Estimated ZOI @ 182 dB re 1 μPa^2-sec or 23 psi				Estimated ZOI @ 205 dB re 1 μPa^2-sec or 13 psi				Mortality ZOI @ 30.5 psi			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
GOMEX																	
UNDET Area E3	MK3A2 grenade	4.94	5.45	4.71	5.81	1.80	2.18	1.96	3.27	0.09	0.09	0.09	0.10	<0.01	<0.01	<0.01	<0.01

During training, speeds generally range from 10 to 14 knots; however, ships/craft can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. It is necessary for vessels/craft to operate at higher speeds during specific events, such as, but not limited to, pursuing and overtaking hostile vessels, evasive maneuvers, and maintenance/ performance checks, such as ship trials. During these types of events ships may often operate at high speeds (high end of the vessel's speed capability). In all cases, the vessels/craft will be operated in a safe manner consistent with the local conditions.

Also, it should be noted that a variety of smaller craft, such as service vessels for routine operations and opposition forces used during training events will be operating within the study area. Small craft types, sizes and speeds vary. The Navy's rigid hull inflatable boat (RHIB) is one representative example of a small craft that may be used during training exercises. By way of example, the Naval Special Warfare RHIB is 35 feet in length and has a speed of 40+ knots. Other small craft, such as those used in maritime security training events, are of similar length and speed to the RHIB and often resemble, and often are, recreational fishing boats (*i.e.*, a 30 - 35 foot center console boat with twin outboard engines).

Vessel movement within the GOMEX Range Complex is quantified as the number of steaming days per year by summing the number of steaming hours proposed, dividing by 24 hours per day, and rounding to the nearest 10 days. The Navy logs about 180 total vessel days within the waters of the GOMEX Range Complex during a typical year.

Disturbance Associated with Vessel Movements

Vessel noise is ubiquitous in the marine environment and marine mammals are frequently exposed to vessels engaged in research, ecotourism, commercial and private use, and government activities. The presence of vessels has the potential to alter the behavior patterns of marine mammals. It is difficult to differentiate between responses to vessel sound and visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals. Anthropogenic sound has increased in the marine environment over the past 50 yrs (Richardson *et al.*, 1995; NRC, 2003) and can be attributed to vessel traffic, marine dredging and construction, oil and gas drilling, geophysical surveys, sonar, and underwater explosions (Richardson *et al.*, 1995).

Marine mammals react to vessels in a variety of ways. Some respond negatively by retreating or engaging in antagonistic responses while other animals ignore the stimulus altogether (Watkins, 1986; Terhune and Verboom, 1999). The ESA-listed marine mammal species that occur in the waters of the GOMEX Range Complex are not generally documented to approach vessels in their vicinity. The predominant reaction is neutral or avoidance behavior rather than attraction behavior. Additional information regarding each listed species and some non-listed species is provided below.

Although very few data exist examining the relationship between vessel presence and significant impact to the North Atlantic right whale, it is thought that any impacts would be minor and/or temporary in nature (NMFS, 2005a). North Atlantic right whales continually utilize habitats in high ship traffic areas along the east coast of the U.S. and Canada (Nowacek *et al.*, 2004). Studies show that North Atlantic right whales have little, if any, reaction (including avoidance) to sounds of vessel approaching or the presence of the vessels themselves (Terhune and Verboom, 1999; Nowacek *et al.*, 2004). In addition, North Atlantic right whales are protected through measures such as the 457-m (500-yd) no-approach limit, which affords them additional protection and help to mitigate the impact vessel traffic might have on behavior or distribution (NMFS, 1997).

Fin whales have been observed altering their swimming patterns by increasing speed and heading away from the vessels as well as altering their breathing patterns in response to an approaching vessel (Jahoda *et al.*, 2003). Observations have shown that when vessels remained 100 m or farther from fin and humpback whales, they were largely ignored (Watkins, 1981). Only when vessels approached more closely did the fin whales in the study alter their behavior by increasing time at the surface and engaging in evasive maneuvers. In this study, humpback whales did not exhibit any avoidance behavior (Watkins, 1981); however, in other instances humpback whales did react to vessel presence. In a study of regional vessel traffic, Baker *et al.* (1983) found that when vessels were in the area the respiration patterns of the humpback whales changed. The whales also exhibited two forms of behavioral avoidance when vessels were between 0 and 2,000 m from the whales (Baker *et al.*, 1983): 1) horizontal avoidance (changing direction and/or speed) when vessels were between 2,000 and 4,000 m away, or 2) vertical avoidance (increased dive times and change in diving pattern).

Based on existing studies, it is likely that fin and humpback whales would have little reaction to vessels that maintain a reasonable distance from the animals. The distance that will provoke a response varies based on many factors including, but not limited to, vessel size, geographic location, and individual animal tolerance levels (Watkins, 1981; Baker *et al.*, 1983; Jahoda *et al.*, 2003). Should the vessels approach close enough to invoke a reaction, animals may engage in avoidance behavior and/or alter their breathing patterns. Reactions exhibited by the whales would be temporary in nature. They would be expected to return to their pre-disturbance activities once the vessel leaves the area.

There is little information on blue whale or sei whale response to vessel presence (NMFS, 1998a; NMFS, 1998b). Sei whales have been observed ignoring the presence of vessels and passing close to the vessels (Weinrich *et al.*, 1986). The response of blue and sei whales to vessel traffic is assumed to be similar to that of the other baleen whales, ranging from avoidance maneuvers to disinterest in the presence of vessels. Any behavioral response should be short-term in nature.

Sperm whales generally have little to no reaction to ships, except on close approaches (within several hundred meters); however, some did show avoidance behavior such as quick diving (Würsig *et al.*, 1998). In the presence of whale watching and research boats, changes in respiration and echolocation patterns were observed in male sperm whales (Richter *et al.*, 2006). Disturbance from boats does not generally result in a change in behavior patterns and is short-term in nature (Magalhães *et al.*, 2002).

Species of delphinids can vary widely in their reaction to vessels. Many exhibit mostly neutral behavior, but there are frequent instances of observed avoidance behaviors (Hewitt, 1985; Würsig *et al.*, 1998). In addition, approaches by vessels can elicit changes in behavior, including a decrease in resting behavior or change in travel direction (Bejder *et al.*, 2006). Alternately, many of the delphinid species exhibit behavior indicating attraction to vessels. This can include solely approaching a vessel (observed in harbor porpoises and minke whales) (David, 2002), but many species such as common, rough-toothed and bottlenose dolphins are frequently observed bow riding or jumping in the wake of a vessel (Norris

and Prescott, 1961; Shane *et al.*, 1986; Würsig *et al.*, 1998; Ritter, 2002). These behavioral alterations are short-term and would not result in any lasting effects.

Kogia spp. and ziphiids show strong adverse reactions to vessels. They engage in quick diving behavior and avoidance maneuvers (Würsig *et al.*, 1998).

The presence of vessels has the potential to alter the behavior patterns of West Indian manatees. West Indian manatees respond to vessel movement via acoustic and possibly visual cues (Miksis-Olds *et al.*, 2007b; Nowacek *et al.*, 2004). West Indian manatees tend to move away from the approaching vessel, by increasing their rate of swimming speed and moving toward deeper water (Nowacek *et al.*, 2004). The degree of response varies with individual West Indian manatees and may be more pronounced in areas of deeper water, where they are more easily able to locate the direction of the approaching vessel (Nowacek *et al.*, 2004). This disturbance is a temporary response to the approaching vessel. West Indian manatees have also been shown to seek out areas with a lower density of vessels (Buckingham *et al.* 1999). West Indian manatees react (*i.e.*, exhibit a clear behavioral response) to vessels within distances of 25 to 50 m, but it is unclear at what distance the West Indian manatees first detect the presence of vessels (Nowacek *et al.*, 2004). Vessel traffic and recreational activities that disturb West Indian manatees may cause them to leave preferred habitats and may alter biologically important behaviors such as feeding, suckling, or resting (Haubold *et al.*, 2006). The overall distribution of West Indian manatees may be affected by areas of high recreational boat activity (Buckingham *et al.*, 1999).

Vessel traffic related to the proposed activity would pass near marine mammals only on an incidental basis. Most of the studies mentioned previously examine the reaction of animals to vessels that approach and intend to follow or observe an animal (*e.g.*, whale watching vessels and research vessels). Reactions to vessels not pursuing the animals, such as those transiting through an area or engaged in training exercises, may be similar but would likely result in less stress to the animal because they would not intentionally approach animals. In fact, Navy mitigation measures include several provisions to avoid approaching marine mammals (see Chapter 5 for a detailed description of mitigation measures). Listed cetacean species generally pay little attention to transiting vessel traffic as it approaches although they may engage in last minute avoidance maneuvers (Laist *et al.*, 2001). As previously noted, all quick avoidance maneuvers are short-term alterations and not expected to permanently impact an animal. Most studies have ascertained the short-term response to vessel sound and vessel traffic (Watkins *et al.*, 1981; Baker *et al.*, 1983; Magalhães *et al.*, 2002); however, the long-term and cumulative implications of ship sound on marine mammals is largely unknown (NMFS, 2007c).

Marine mammals exposed to a passing Navy vessel may not respond at all or they may exhibit a short-term behavioral response that is not expected to cause the alteration or abandonment of natural behavior patterns. Human disturbance to wild animals may elicit similar reactions to those caused by natural predators (Gill *et al.*, 2001; Beale and Monaghan, 2004). Behavioral responses may also be accompanied by a physiological response (Romero, 2004), although this is very difficult to study in the wild due to, among other things, the (1) desirability of a blood sample from which to measure stress-induced hormone release; (2) logistical constraints associated with attaching to marine mammals devices that monitor heart rate and body temperature fluctuations; and (3) cost of performing such experiments (Reeder and Kramer, 2005). Short-term exposures to stressors result in changes in immediate behavior (Frid, 2003). Repeated exposure to stressors, including human disturbance such as vessel disturbance and anthropogenic sound, can result in negative consequences to the health and viability of an individual or population (Nowacek *et al.*, 2004). For example, in individual bottlenose dolphins, chronic stress due to physical injury or disease resulted in morphological changes to the adrenal glands (Clark *et al.*, 2006). Although this study related to natural induced stressors, similar physiological changes may result from other types of stressors such as anthropogenic disturbance.

Chronic stress can result in decreased reproductive success (Lordi *et al.*, 2000; Beale and Monaghan, 2004), decreased energy budgets (Frid, 2003), displacement from habitats (Sutherland, 1993), and lower survival rates of offspring (Lordi *et al.*, 2000). The long-term implications of chronic stress on marine mammal species are not known.

Vessel movements under the No Action Alternative are not expected to result in chronic stress because Navy vessel density in the waters of the GOMEX Range Complex would remain low, and the Navy implements mitigation measures to avoid marine mammals. Vessel movements may affect baleen whales in the waters of the GOMEX Range Complex, but any potential effect may be discounted due to the extreme unlikelihood of these species occurring in the area. General disturbance associated with vessel movements may affect sperm whales in the waters of the GOMEX Range Complex. West Indian manatees are not expected to occur in the offshore waters of the GOMEX Range Complex and would not be affected by vessels movements in these areas. West Indian manatees are expected to occur in the nearshore zone and may be affected by vessel movements associated with MESG training in the UNDET Area E3 and CNIC harbor security group training in the Panama City OPAREA (Harbor Security Machine Gun Area). General disturbance associated with vessel movements is not expected to result in Level A or Level B harassment of marine mammals as defined by the MMPA. In accordance with NEPA, vessel disturbance in territorial waters would have no significant impact on marine mammals. Furthermore, vessel disturbance in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Vessel Strikes

Collisions with commercial and Navy ships can result in serious injury and may occasionally cause fatalities to cetaceans and West Indian manatees. Although the most vulnerable marine mammals may be assumed to be slow-moving cetaceans or those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (*e.g.*, sperm whale), fin whales are actually struck most frequently (Laist *et al.*, 2001). West Indian manatees are also particularly susceptible to vessel interactions and collisions with watercraft constitute the leading cause of mortality (USFWS, 2007m).

Laist *et al.* (2001) reviewed historical, stranding, and anecdotal records on the occurrence of collisions between motorized vessels and large whales (baleen and sperm whales) to quantify the frequency of these collisions as well as the characteristics (speed, size) of vessels that may be more likely to result in mortality. After reviewing these records (including stranding records from the U.S., Italy, France, South Africa and anecdotal records from mariners around the world) for evidence of ship strikes involving baleen and sperm whales, Laist *et al.* (2001) found that accounts of large whale ship strikes involving motorized boats in the area date back to at least the late 1800s, with approximately 15 incidents of a vessel colliding with a large whale between 1877 and 1950. Ship collisions with large whales remained infrequent until the 1950s, after which point reports became increasingly more frequent. Laist *et al.* (2001) report that both the number and speed of motorized vessels have increased over time for trans-Atlantic passenger services. They concluded that most strikes occur over or near the continental shelf, that ship strikes likely have a negligible effect on the status of most whale populations, but that for small populations (such as the North Atlantic right whale) or segments of populations the impact of ship strikes may be significant.

Although ship strikes may represent a small proportion of mortalities in whale populations, Laist *et al.* (2001) also concluded that, when considered in combination with other human-related mortalities in the area (*e.g.*, entanglement in fishing gear), these ship strikes may present a concern for whale populations.

Of 11 species known to be hit by ships, fin whales are struck most frequently; right whales, humpback whales, sperm whales, and gray whales are all hit commonly (Laist *et al.*, 2001). In some areas, one-third of all fin whale and right whale strandings appear to involve ship strikes. Sperm whales spend long periods (typically up to 10 minutes [min]; Jacquet *et al.*, 1998) "rafting" at the surface between deep dives. This could make them exceptionally vulnerable to ship strikes. Berzin (1972) noted that there were "many" reports of sperm whales of different age classes being struck by vessels, including passenger ships and tug boats. There were also instances in which sperm whales approached vessels too closely and were cut by the propellers (NMFS, 2006d).

In the Gulf of Mexico, sperm whales are of particular concern. Sperm whales spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives. In addition, some baleen whales such as the North Atlantic right whale seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.*, 2004). In comparison with other regions of the U.S., the Gulf of Mexico is the least common area for ship strikes of large whales (Jensen and Silber, 2003). Between 1972 and 1999, eight confirmed or possible large whale ship strikes were recorded in the Gulf of Mexico, including two that collided with Navy vessels; four of these resulted in mortality of the animal (Jensen and Silber, 2003) and one resulted in extensive damage to a Navy vessel (Laist *et al.*, 2001). It is not known whether the shipstrikes involving Navy vessels resulted in the mortality of the animal (Laist *et al.*, 2001; Jensen and Silber, 2003).

Accordingly, the Navy has adopted mitigation measures to reduce the potential for collisions with surfaced marine mammals (for more details refer to Chapter 5). These measures include the following:

- Using lookouts trained to detect all objects on the surface of the water, including marine mammals.
- Implementing reasonable and prudent actions to avoid the close interaction of Navy assets and marine mammals.
- Maneuvering to keep away from any observed marine mammal.

Navy shipboard lookouts (also referred to as "watchstanders") are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the Officer of the Deck (OOD) (*e.g.*, trash, a periscope, marine mammals, sea turtles) and all disturbances (*e.g.*, surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel serving as lookouts on station at all times (day and night) when a ship or surfaced submarine is moving through the water. Navy lookouts undergo extensive training in order to qualify as a lookout. This training includes on-the-job instruction under the supervision of an experienced lookout, followed by completion of the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects).

The Navy includes marine species awareness as part of its training for its bridge lookout personnel on ships and submarines. Lookouts are trained how to look for marine species, and report sightings to the OOD so that action may be taken to avoid the marine species or adjust the exercise to minimize effects to the species. Marine Species Awareness Training (MSAT) was updated in 2008, and the additional training materials are now included as required training for Navy ship and submarine lookouts. Additionally, all Commanding Officers (COs) and Executive Officers (XOs) of units involved in training exercises are required to undergo marine species awareness training. This training addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information to aid in avoiding interactions with marine species.

West Indian manatees are particularly susceptible to vessel collisions due to their propensity for very shallow waters and their inability to move with haste (Calleson and Frohlich, 2007; Haubold *et al.*, 2006; Runge *et al.*, 2007; USFWS, 2001c; 2007m). Vessel collisions are the largest known source of human-caused mortality to adult West Indian manatees (USFWS, 2007m), accounting for approximately 25% of all manatee deaths recorded in Florida since 1976 (Calleson and Frohlich, 2007). The large percentage of West Indian manatees in Florida that bear scars from previous collisions indicates that sub-lethal effects of vessel traffic are also a concern. Non-lethal injuries may reduce the breeding success of wounded females and may permanently remove some animals from the breeding population (Haubold *et al.*, 2006).

Based on the implementation of Navy mitigation measures and the relatively low density (180 steaming days/yr) of Navy ships in the GOMEX Range Complex, the likelihood that a vessel strike would occur is very low. Vessel collisions may affect baleen whales in the GOMEX Range Complex, but any potential effect may be discounted due to the low occurrence of these species in the area. Vessel collisions may affect sperm whales in the GOMEX Range Complex.

The probability of a West Indian manatee encountering a Navy vessel in the offshore waters of the GOMEX Range Complex is extremely low based on a combination of factors. West Indian manatees are not expected to occur more than 12 nm offshore or in relatively deep waters of the GOMEX Range Complex where most of the vessel movements occur. West Indian manatee occurrence becomes less common north and west of peninsular Florida (Fertl *et al.*, 2005). No vessel operations occur in areas that provide foraging habitat for the West Indian manatee. In addition, the Navy has adopted mitigation measures to reduce the potential for collisions with marine mammals. These measures are described in detail in Chapter 5. The low probability of West Indian manatee and Navy vessel co-occurrence outside of 12 nm and the use of mitigation measures indicate that vessel collisions are extremely unlikely to occur. Therefore, vessel collisions would have no effect on West Indian manatees in the offshore waters of the GOMEX Range Complex.

West Indian manatees are expected to occur in the nearshore zone and may be affected by vessel collisions associated with shallow water training in the GOMEX Range Complex (*i.e.*, MESG and CNIC harbor security group) that occurs within 12 nm of the shoreline. The boats associated with this training are small (< 30 m) and have the ability to travel at high speeds. Vessels transiting to and from ports to the offshore portion of the GOMEX Range Complex also pose a hazard to West Indian manatees. The risk to West Indian manatees from vessel collision increases nearer to shore (due to higher likelihood of manatee occurrence) and at higher vessel speeds (USFWS, 2001c). Vessels in transit to and from ports as well as small boat use associated with MESG in the UNDET Area E3 and CNIC training in the Panama City OPAREA (Harbor Security Machine Gun Area) may affect West Indian manatees; however, the low probability of West Indian manatee and Navy vessel co-occurrence and the use of mitigation measures (Chapter 5) indicate that vessel collisions are unlikely to occur.

In accordance with NEPA, vessel movements in territorial waters would have no significant impact on marine mammals. Furthermore, vessel movements in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Aircraft Overflight

Overview

The GOMEX Study Area consists of large swaths of special use airspace associated with the four OPAREAs. Many of the training activities that occur throughout the Range Complex involve some form of aircraft, including both sub- and super-sonic fixed-wing aircraft, as well as rotary-wing aircraft (helicopters). These aircraft may create shadows or downdrafts at the surface of the water, and they will

produce noise that may be transmitted through the water. Aircraft can affect marine mammals in two ways: (1) disturbance behavior/startle response to the presence of an aircraft or resulting downdraft while the animal is at the surface, and (2) exposure to noise from fixed-wing aircraft and helicopters while the animals are at the surface or at depth.

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been addressed by Urick (1972), Young (1973), Richardson *et al.* (1995), Eller and Cavanagh (2000), Laney and Cavanagh (2000), and others. Sound is transmitted from an airborne source to a receptor underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in shallow water; (3) lateral (evanescent) transmission through the interface from the airborne sound field directly above; and (4) scattering from interface roughness due to wave motion.

Aircraft sound is refracted upon transmission into water because sound waves move faster through water than through air (a ratio of about 0.23:1). Based on this difference, the direct sound path is totally reflected if the sound reaches the surface at an angle more than 13° from vertical. As a result, most of the acoustic energy transmitted into the water from an aircraft arrives through a relatively narrow cone with a 26° apex angle extending vertically downward from the aircraft (Figure 3.7-5). The intersection of this cone with the surface traces a "footprint" directly beneath the flight path, with the width of the footprint being a function of aircraft altitude. The sound pressure field is actually doubled at the air-to-water interface because of the large difference in the acoustic properties of water and air. For example, a sonic boom with a peak pressure of 10 pounds per square foot (psf) at the sea surface becomes an impulsive wave in water with a maximum peak pressure of 20 psf. The pressure and sound levels then decrease with increasing depth.

Figure 3.7-5 Characteristics of sound transmission through air-water interface.

Eller and Cavanagh (2000) modeled estimates of sound pressure level as a function of time at selected underwater locations (receiver animal depths of 2, 10, and 50 m) for F-18 aircraft subsonic overflights (250 kts) at various altitudes (300, 1,000, and 3,000 m). As modeled for all deep water scenarios, the sound pressure levels ranged from approximately 120 to 150 dB referenced to 1 micropascal (dB re 1 µPa). They concluded that it is difficult to construct cases (for any aircraft at any altitude in any propagation environment) for which the underwater sound is sufficiently intense and long lasting to cause harm to any form of marine life.

The maximum overpressures calculated for F/A-18 aircraft supersonic overflights range from 5.2 psf at 3,048 m (10,000 ft) to 28.8 psf at 305 m (1,000 ft) (Ogden, 1997). Even a sonic boom that generated maximum overpressure of 50 psf in air (which is at the high end of the spectrum for normal flight conditions) would become an impulsive wave in water with a maximum peak pressure of 100 psf or about 0.7 psi. Therefore, even the most powerful sonic booms would produce a peak pressure in water well below the level that would cause harassment or injury to marine mammals or sea turtles (Laney and Cavanagh, 2000).

Fixed-Wing Aircraft Overflights

Under the No Action Alternative a total of 5,223 fixed-wing aircraft sorties are expected to occur each year over the Gulf of Mexico. More than three-quarters of these (76%) are associated with basic flight instruction. These flight instruction sorties (3,865/yr) occur in W-228 associated with the Corpus Christi OPAREA. All of the non-flight instruction sorties occur in W-151 and W-155 associated with the Pensacola/Panama City OPAREAs and W-92 and W-54 associated with the New Orleans OPAREA. F/A-18 aircraft make 73% of the non-flight instruction sorties. Exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the transitory and dispersed nature of the overflights; repeated exposure to individual animals over a short period of time (hours or days) is extremely unlikely. Furthermore, the sound exposure levels would be relatively low to marine mammals that spend the majority of their time underwater.

Most observations of cetacean responses to aircraft overflights are from aerial scientific surveys that involve aircraft flying at relatively low altitudes and low airspeeds. Mullin *et al.* (1991) reported that sperm whale reactions to aerial survey aircraft (standard survey altitude of 229 m [750 ft]) were not consistent. Some sperm whales remained on or near the surface the entire time the aircraft was in the vicinity, while others dove immediately or a few minutes after the sighting. Smultea *et al.* (2008) reported that a group of sperm whales responded to a circling aircraft (altitude of 244 m [800 ft] to 335 m [1,100 ft]) by moving closer together and forming a fan-shaped semi-circle with their flukes to the center and their heads facing the perimeter (a defensive response). Several sperm whales in the group were observed to turn on their sides, apparently to look up toward the aircraft. Smultea *et al.* (2008) reported that observed reactions of sperm whales to brief fixed-wing aircraft overflights were short-term and probably of no long-term biological significance. Richter *et al.* (2006) reported that the number of sperm whale blows per surfacing interval increased when recreational whale-watching aircraft were present, but the changes in ventilation were small and probably of little biological consequence. The presence of whale-watching aircraft also apparently caused sperm whales to turn more sharply but did not affect blow interval, surface time, time to first click, or the frequency of aerial behavior (Richter *et al.*, 2006). A review of behavioral observations of baleen whales indicates that whales will either demonstrate no behavioral reaction to an aircraft or, occasionally, display avoidance behavior such as diving (Koski, 1998).

Most of the aircraft overflight exposures analyzed in the studies mentioned above are different than Navy aircraft overflights. Survey and whale watching aircraft are expected to fly at lower altitudes than typical Navy fixed-wing overflights. Exposure durations would be longer for aircraft intending to

observe or follow an animal. These factors might increase the likelihood of a response to survey or whale watching aircraft. Exposure to Navy overflights would be very brief, but the noise levels might be higher based on aircraft type and airspeed.

Marine mammals exposed to low-altitude fixed-wing aircraft overflights could exhibit a short-term behavioral response such as altering course or diving, but not to the extent where natural behavioral patterns such as migration, breeding, and feeding would be abandoned or significantly altered. Fixed-wing aircraft overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed to low altitude overflights based on the infrequent and dispersed nature of these overflights. Fixed-wing aircraft overflights may affect ESA-listed cetaceans, but these effects are discountable. Aircraft overflights will not affect manatees since no aircraft operations included in the No Action Alternative are proposed for shallow waters of the Panama City OPAREA where manatees may occur. In accordance with NEPA, aircraft overflights in territorial waters would have no significant impact on marine mammals. Furthermore, aircraft overflights in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Helicopter Overflights

Under the No Action Alternative a total of 38 helicopter sorties are expected to occur each year within W-151, W-155, and the Corpus Christi OPAREA. Unlike fixed-wing aircraft, helicopter training operations often occur at low altitudes (75 to 100 feet), which increase the likelihood that marine mammals would respond.

Very little data are available regarding reactions of cetaceans to helicopters. One study observed that sperm whales showed no reaction to a helicopter until the whales encountered the downdrafts from the propellers (Clarke, 1956). Other species such as bowhead whale and beluga whales show a range of reactions to helicopter overflights, including diving, breaching, change in direction or behavior, and alteration of breathing patterns, with belugas exhibiting behavioral reactions more frequently than bowheads (38% and 14% of the time, respectively) (Patenaude *et al.*, 2002). These reactions were less frequent as the altitude of the helicopter increased to 150 m or higher. Manatees have been shown to exhibit behavioral reactions to helicopters flying below 100 m by abandoning resting behavior and fleeing to deeper water (Rathbun, 1988).

Marine mammals exposed to a low-altitude helicopter overflights could exhibit a short-term behavioral response, but not to the extent where natural behavioral patterns would be abandoned or significantly altered. Helicopter overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed. Helicopter overflights may affect ESA-listed cetaceans, but these effects are discountable. Helicopter overflights will not affect West Indian manatees since no helicopter operations under the No Action Alternative are proposed for shallow waters of the Panama City OPAREA where West Indian manatees are expected to occur. In accordance with NEPA, helicopter overflights in territorial waters would have no significant impact on marine mammals. Furthermore, helicopter overflights in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Munitions Use/Non-explosive Practice Munitions

Navy training operations in the GOMEX Study Area under the No Action Alternative include firing a variety of weapons and employ a variety of non-explosive training rounds and explosive rounds, including bombs, naval gun shells, cannon shells, and small caliber ammunition.

Munitions Use/NEPM Strikes

The majority of ordnance fired in the GOMEX Study Area consists of non-explosive training rounds (Tables 2.2-4 and 2.2-5). Training exercises that involve munitions use/NEPM use take place in several training areas (see Table 2.2-8 for a summary of ordnance use by training area). Ordnance use does not occur in the New Orleans OPAREA. Non-explosive ordnance is used in W-151A/B, W-155A, the Harbor Security Group Machine Gun Area, and MINEX Box E3. The use of ordnance in these areas has the potential to affect marine mammals.

Direct ordnance strikes and disturbance associated with sound from firing are potential stressors to marine mammals. Ingestion of expended ordnance is also a potential concern for some marine mammals and is analyzed below under the expended materials section. The primary focus of this section is potential exposure of marine mammals at or near the water's surface which could result in injury or mortality.

The potential for marine mammals to be struck by fired ordnance was evaluated using statistical probability modeling as described in Appendix I. Model input values include ordnance use data (frequency and type) and marine mammal density data for each season and training area where ordnance use occurs. The model calculates the probability of a marine mammal being struck and the number of exposures (marine mammal/ordnance strikes) for the given season and training area. The model outputs for marine mammal/ordnance strikes are biased by the following assumptions and data/model limitations:

- The model is two-dimensional and assumes that all marine mammals would be at or near the surface 100% of the time, when in fact, marine mammals spend up to 90% of their time under the water (Costa, 1993).
- The model does not take into account standard mitigation measures used by the Navy to avoid and minimize marine mammal ordnance strikes.
- The model assumes the animal is stationary and does not account for any movement of the marine mammal or any potential avoidance of the training.

The ordnance strike model is not expected to produce false negatives because the assumptions will more likely produce an overestimate of impacts. A model output of less than one exposure provides a high level of certainty that marine mammals would not be struck and that ordnance strikes would have no effect on marine mammals.

Appendix I provides the model output values for each group of marine mammals (for which density estimates are available) by training area where ordnance is fired or released. The only ESA-listed marine mammal with sufficient data to model density in the Gulf of Mexico is the sperm whale; the other ESA-listed cetacean species (blue, fin, sei, humpback, and North Atlantic right whales) are expected to occur substantially less frequently than the sperm whale. The use of the sperm whale as a conservative estimate of the probability of exposure for all ESA-listed cetacean species in the Gulf of Mexico is appropriate. All model output values for every marine mammal species are substantially less than one (Appendix I), indicating that marine mammal/ordnance strikes are extremely unlikely to occur. The probability of a direct ordnance strike is further reduced by Navy mitigation measures (see Chapter 5). The manatee is known to occur in the shallow waters of the northeastern Gulf of Mexico and has the potential to be affected by munition strikes as well. However, manatees do not usually occur very far offshore and are not expected to occur in the area where non-explosive ordnance use takes place.

Therefore, non-explosive ordnance would have no effect on ESA-listed marine mammals in the GOMEX Study Area. For all marine mammal species, non-explosive ordnance is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, non-explosive ordnance in territorial waters would have no significant impact on marine mammals. Furthermore, non-

explosive ordnance in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Munitions Use/NEPM Disturbance

Transmitted Gunnery Sound – Directly Into the Environment

A gun fired from a ship on the surface of the water propagates a blast wave away from the gun muzzle. This spherical blast wave reflects off and diffracts around objects in its path. As the blast wave hits the water, it reflects back into the air, transmitting a sound pulse back into the water in proportions related to the angle at which it hits the water.

Propagating energy is transmitted into the water in a finite region below the gun. A critical angle (about 13°, as measured from the vertical) can be calculated to determine the region of transmission in relation to a ship and gun (DoN, 2006).

The largest proposed shell size for these operations is a 5-inch shell. This will produce the highest pressure and all analysis will be done using this as a conservative measurement of produced and transmitted pressure, assuming that all other smaller ammunition sizes would fall under these levels.

Aboard the USS *Cole* in June 2000, a series of pressure measurements were taken during the firing of a 5-inch gun. Average pressure measured approximately 200 dB re 1 µPa at the point of the air and water interface. Based on the USS *Cole* data, down-range peak pressure levels at 100m (328ft) were calculated to be less than 186 dB re: 1 µPa (DoN, 2000) and as the distance increases, the pressure would decrease.

In reference to the energy flux density (EFD) harassment criteria, the EFD levels (greatest in any 1/3 octave band above 10 Hz) of a 5-in. gun muzzle blast were calculated to be 190 dB re: 1 μPa^2-sec directly below the gun muzzle decreasing to 170 dB re: 1 μPa^2-sec at 100 m (328 ft) into the water (DoN, 2006). The rapid dissipation of the sound pressure wave coupled with the mitigation measures implemented by the Navy (see Chapter 5 for details) to detect marine mammals in the area prior to conducting operations, will result in a blast from a gun muzzle having no effect on ESA-listed marine mammal species. For all marine mammal species, transmitted gunnery sound is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, transmitted gunnery sound in territorial waters would have no significant impact on marine mammals. Furthermore, transmitted gunnery sound in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Transmitted Gunnery Sound – Through Ship Hull

A gun blast will also transmit sound waves through the structure of the ship which can propagate into the water. The 2000 study aboard the USS *Cole* also examined the rate of sound pressure propagation through the hull of a ship (DoN, 2000). The structurally borne component of the sound consisted of low-level oscillations on the pressure time histories that preceded the main pulse due to the air blast impinging on the water (DoN, 2006).

The structural component for a standard round was calculated to be 6.19% of the air blast (DoN, 2006). Given that this component of a gun blast was a small portion of the sound propagated into the water from a gun blast and far less than the sound from the gun muzzle itself, the transmission of sound from a gun blast through the ship's hull will have no effect on ESA-listed marine mammal species. For all marine mammal species, transmission of sound from a gun blast through the ship's hull is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, transmission of sound from a gun blast through the ship's hull in territorial waters would have no significant impact on marine mammals. Furthermore, transmission of sound from a gun blast through

the ship's hull in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Underwater Detonations and High Explosive Ordnance

Overview

Some of the training conducted under the No Action Alternative would involve underwater detonations and the use of HE ordnance. Mine Countermeasures and Mine Neutralization exercises include underwater detonations that range in net explosive weight (NEW) from 0.00514-pound (lb) shots to 60-lb charges. These operations currently take place in the MINEX Boxes located in the Panama City OPAREA (Figure 2.1-1) and Corpus Christi OPAREA (Figure 2.1-3). However, these operations would no longer be conducted in the GOMEX Study Area under Alternatives 1 and 2. The No Action Alternative also includes underwater detonations (up to 1.25-lb NEW) in the NSA Panama City Demolition Pond (Figure 2.1-6) and use of anti-swimmer grenades in the Corpus Christi MINEX Box E3 (Figure 2.1-3). The use of HE ordnance under the No Action Alternative would be limited to dropping 52 HE bombs per year in the Hotbox, which is located more than 12 nm offshore in the Pensacola OPAREA (Figure 2.1-1) (see Table 2.2-9 for a summary of explosions by training area).

Effects from exposure to explosives vary depending on the level of exposure. Behavioral responses can include shorter surfacings, shorter dives, fewer blows per surfacing, longer intervals between blows (breaths), ceasing or increasing vocalizations, shortening or lengthening vocalizations, and changing frequency or intensity of vocalizations (NRC, 2005). However, it is not known how these responses relate to significant effects (*e.g.*, long-term effects or population consequences) (NRC, 2005). In addition, animals exposed to thresholds that equate to a TTS, may experience a slight, recoverable loss of hearing sensitivity.

Exposures that result in long-term injuries such as PTS may limit an animal's ability to find food, communicate with other animals, and/or interpret the environment around them. Impairment of these abilities can decrease an individual's chance of survival or impact their ability to successfully reproduce. Mortality of an animal will remove the animal entirely from the population as well as eliminate any future reproductive potential.

BOMBEX, MINEX, and Small Arms Training

An explosive analysis was conducted to estimate the number of marine mammals that could be exposed to impacts from explosions. Appendix J contains a technical report describing the scientific basis, methods, and assumptions of the explosive analysis. Table 3.7-9 provides a summary of the explosive analysis results for BOMBEX, MINEX and small arms training under the No Action Alternative.

TABLE 3.7-9
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa²-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa²-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Sperm whale				
BOMBEX training	1	1	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0
Atlantic spotted dolphin				
BOMBEX training	12	13	1	0
MINEX training	NA	6	1	0
Small Arms training	0	0	0	0
Total Exposures	12	19	2	0
Beaked whales				
BOMBEX training	0	0	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Bottlenose dolphin				
BOMBEX training	63	68	5	0
MINEX training	NA	11	2	0
Small Arms training	4	3	0	0
Total Exposures	67	84	7	0
Bryde's whale				
BOMBEX training	0	0	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0

TABLE 3.7-9 (CONTINUED)
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Clymene dolphin				
BOMBEX training	22	24	2	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	22	24	2	0
False killer whale				
BOMBEX training	1	1	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0
Fraser's dolphin				
BOMBEX training	1	1	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0
Killer whale				
BOMBEX training	0	0	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Kogia spp.				
BOMBEX training	2	2	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	2	2	0	0

TABLE 3.7-9 (CONTINUED)
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Melon-headed whale				
BOMBEX training	4	5	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	4	5	0	0
Pantropical spotted dolphin				
BOMBEX training	91	95	7	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	91	95	7	0
Pygmy killer whale				
BOMBEX training	1	1	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0
Risso's dolphin				
BOMBEX training	7	7	1	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	7	7	1	0
Rough-toothed dolphin				
BOMBEX training	0	0	0	0
MINEX training	NA	2	0	0
Small Arms training	0	0	0	0
Total Exposures	0	2	0	0

TABLE 3.7-9 (CONTINUED)
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa²-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa²-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Short-finned pilot whale				
BOMBEX training	3	3	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	3	3	0	0
Spinner dolphin				
BOMBEX training	113	120	9	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	113	120	9	0
Striped dolphin				
BOMBEX training	34	36	3	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	34	36	3	0

NA: MINEX is modeled as a single detonation event and therefore the behavioral disturbance criterion does not apply.

Sperm whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, false killer whales, Fraser's dolphins, *Kogia* spp., melon-headed whales, Pantropical spotted dolphins, pygmy killer whales, Risso's dolphins, short-finned pilot whales, spinner dolphins, and striped dolphins may be exposed at levels that could result in behavioral disturbance. Sperm whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, false killer whales, Fraser's dolphins, *Kogia* spp., melon-headed whales, Pantropical spotted dolphins, pygmy killer whales, Risso's dolphins, rough-toothed dolphins, short-finned pilot whales, spinner dolphins, and striped dolphins may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects. Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, Pantropical spotted dolphins, Risso's dolphins, spinner dolphins, and striped dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects. No marine mammal species are expected to be exposed at levels that could result in mortality.

Exposure estimates could not be calculated for several species (blue whale, fin whale, humpback whale, North Atlantic right whale, sei whale, and minke whale) because density data could not be calculated due to the limited available data for these species. However, the likelihood of exposure should be even

lower than that estimated for other species with given densities since they are less likely to occur in the Study Area. Therefore, no exposures are expected for these species. In addition to the low likelihood of exposure, mitigation measures presented in Chapter 5 will be implemented prior to the release of ordnance.

Effects on Marine Mammal Populations

Effects from the use of explosive ordnance are not anticipated to have lasting impacts on any marine mammal stocks and/or populations based on the following factors:

- Most exposures are within the non-injurious temporary threshold shift (TTS) or behavioral effects zones. Effects associated with these exposures are expected to be temporary.
- The exposure analysis predicts that no marine mammal species would be exposed to levels that could potentially result in mortality.
- Although the numbers presented in Table 3.7-9 represent estimated harassment as described above, they are probably overestimates as the model calculates harassment without taking into consideration standard mitigation measures.

The mitigation measures described in Chapter 5 are designed to reduce exposure of marine mammals to potential impacts to achieve the least practicable adverse affect on marine mammal species or populations. Lookouts will monitor the area before ordnance is used. Sperm whales will have high detection rates at the surface because of their large body size and pronounced blows. Because of large group sizes, it is likely that lookouts would detect Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, pantropical spotted dolphins, rough-toothed dolphins, and Risso's dolphins. Implementation of mitigation measures will likely reduce the potential effects to marine mammals.

Endangered Species Act Conclusions

Underwater detonations and HE ordnance use under the No Action Alternative may affect blue, fin, humpback, North Atlantic right, sei, and sperm whales. However, the effects on extralimital species, such as fin, North Atlantic right, sei, blue, and humpback whales are likely discountable due to the low occurrence of these species in the GOMEX study area. Manatees are not expected to occur in the Hotbox where HE ordnance is used, which is more than 12 nm offshore, therefore HE ordnance use under the No Action Alternative will have no effect on the manatee. Manatees may occur in the nearshore waters of the Corpus Christi and Panama City MINEX boxes, therefore underwater detonations under the No Action Alternative may affect the manatee.

Marine Mammal Protection Act Conclusions

Exposure estimates for underwater detonations and explosive ordnance use indicate the potential for Level A and Level B harassment as defined by MMPA. No marine mammals would be exposed to levels that would result in mortality. The Navy concludes that exposures to explosive ordnance and underwater detonations would result in short-term effects to most individuals exposed and would likely not affect annual rates of recruitment or survival of the species. Although there may be impacts to individual marine mammals, the impacts at the population, stock or species level would be negligible.

National Environmental Policy Act and EO 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under the No Action Alternative may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA there would be no significant impact to marine mammals from underwater detonations and explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there

would be no significant harm to marine mammals resulting from underwater detonations and explosive ordnance use during training exercises in non-territorial waters.

Diver Training

The only marine mammal species that has the potential to occur in the surrounding area of the Demo Pond is the West Indian Manatee. Manatees occur in the nearshore environments of the northern Gulf of Mexico, and therefore there is potential for manatees to occur near the Demolition Pond. However, due to the nearshore location, relatively isolated nature, and very small size of the pond itself (approximately 94 yd in diameter and 0-11 ft in depth), visual mitigation measures are sufficient to counter this potential. Manatees spend much of their time at or near the surface and would be easily visible if they were in the pond.

Under the No Action Alternative, underwater detonations in the Demolition Pond would have no effect on any listed marine mammal species. For all marine mammal species, underwater detonations in the Demo Pond are not expected to result in Level A or Level B harassment as defined by the MMPA and therefore will not likely affect annual rates of recruitment or survival of the species. In accordance with NEPA, underwater detonations in the Demo Pond in territorial waters would not result in significant impacts to marine mammals under the No Action Alternative.

Expended Materials

Ordnance Related Materials

Ordnance related materials include various sizes of non-explosive training rounds and shrapnel from explosive rounds. These solid metal materials would quickly move through the water column and settle to the sea floor. Ingestion of expended ordnance is not expected to occur in the water column because the ordnance sinks quickly. Materials on the seafloor may be ingested by marine mammals in the GOMEX Study Area. Some materials such as an intact non-explosive training bomb would be too large to be ingested by a marine mammal, but many materials such as cannon shells, small caliber ammunition, and shrapnel could be ingested. Records indicate that metal debris ingested by marine mammals is generally small (*e.g.*, fishhooks, bottle caps, metal spring) (Walker and Coe, 1990; Laist, 1997). The effects of ingesting solid metal objects on marine mammals are unknown. At least one report indicates that certain types of metal debris, in this case a lead sinker, may cause toxicosis in marine mammals (Zabka, 2006); however, this is an isolated case with a specific lead compound. Ordnance materials are made of different alloys than a sinker and would not necessarily cause a similar physiological reaction. Extensive literature searches revealed no studies related to potential toxic effects of ordnance ingestion by marine mammals. Ingestion of marine debris in general can cause digestive tract blockages or damage the digestive system (Gorzelany, 1998; Stamper *et al.*, 2006). Relatively small objects with smooth edges such a cannon shell or small caliber ammunition might pass through the digestive tract without causing harm, while a piece of metal shrapnel with sharp edges would be more likely to cause damage.

The potential for ordnance ingestion depends on species-specific feeding habitats. Manatees would not ingest ordnance because they feed on seagrass beds and benthic invertebrates along the coast where ordnance is not used. Blue, fin, and sei whales feed at the surface or in the water column and would not ingest ordnance from the bottom. While humpback whales feed predominantly by lunging through the water after krill and fish, there have been instances of humpback whales disturbing the bottom in an attempt to flush prey, the northern sand lance (*Ammodytes dubius*) (Hain *et al.*, 1995). Similarly, North Atlantic right whales feed primarily in the water column but some data suggest that they feed at or near the seafloor as well (Mate *et al.*, 1997). However, neither North Atlantic right or humpback whales are expected to occur in the GOMEX Study Area; should they occur, they would likely be individuals who

strayed from the known wintering grounds in the southeastern U.S. and West Indies, respectively, and are not expected to feed in this area. Their normal feeding grounds are at higher latitudes in the Atlantic Ocean (CETAP, 1982; Kenney and Winn, 1986; Whitehead *et al.*, 1992; Weinrich *et al.*, 1997). Ordnance ingestion under the No Action Alternative would have no effect on the manatee, blue whale, fin whale, humpback whale, North Atlantic right whale, or sei whale.

Although sperm whales feed predominantly on mesopelagic cephalopods, they also frequently feed on or near the bottom (Whitehead *et al.*, 1992). In doing so, animals will ingest non-food items such as rocks and sand (NMFS, 2006c). Sperm whales are known to incidentally ingest foreign objects while foraging (Walker and Coe, 1990), suggesting that the potential exists to ingest debris that has settled on the ocean floor as a result of the proposed actions. Operations involving expended ordnance and shrapnel under the No Action Alternative will occur in W-151A/B, W-151A/C, W-155A and W-155B associated with the Pensacola and Panama City OPAREAs. The majority of W-155B is seaward of the continental shelf break. Sperm whales display a strong offshore preference (Rice, 1989) and are mostly associated with waters over the continental shelf edge, continental slope, and offshore waters (CETAP, 1982; Hain *et al.*, 1985; Waring *et al.*, 2001; Davis *et al.*, 2002). Consequently, it is possible that a sperm whale would encounter and subsequently ingest a piece of expended ordnance in this area. Ordnance ingestion under the No Action Alternative may affect sperm whales.

Most non-listed marine mammal species feed at the surface or in the water column and would have a little chance of encountering expended ordnance on the bottom. Baleen and toothed whales, which feed at the surface or in the water column, would not be expected to ingest ordnance from the bottom. Beaked whales have exhibited bottom feeding behavior using suction feeding techniques (MacLeod *et al.*, 2003) and are known to incidentally ingest foreign objects while foraging (Walker and Coe, 1990). Although the potential exists for ingestion of expended ordnance, the amount of ordnance that an animal would encounter is low. Ordnance related materials are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, ordnance related materials would have no significant impact on marine mammals in territorial waters. Furthermore, ordnance related materials would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Target Related Materials

Targets are used in training exercises throughout the GOMEX Study Area; a total of 44 targets per year are expended into the marine environment under the No Action Alternative. A variety of at-sea targets may be used in the OPAREA, ranging from high-tech remotely operated airborne and surface targets (*e.g.*, airborne drones and Seaborne Powered Targets) to low-tech floating at-sea targets (*e.g.*, inflatable targets, 55-gallon metal drums) and towed banners. Many of the targets are designed to be recovered for reuse and are not destroyed during training because ordnance is set to detonate before impacting the target. The only expendable airborne targets used in the OPAREA are Tactical Air-Launched Decoys, which are non-powered, constructed of extruded aluminum, weigh about 400 pounds, and are about 7 feet long. Expendable targets such as floating at-sea inflatable targets are recovered after use and properly disposed of onshore. Some targets such as 55-gallon metal drums cannot be recovered and sink to the sea floor after use. Unrecoverable floating materials generated by target use are expected to be minimal. Descriptions of the targets used in the OPAREA and information on fate and transport are provided in Section 3.2.

As discussed above for ordnance related materials, species that feed on or near the bottom (*i.e.*, sperm whales and beaked whales) may encounter an expended target while feeding; however, the size of the target would prohibit any marine mammal from ingesting it. Therefore, the use of targets under the No Action Alternative would have no effect on marine mammals. Targets are not expected to result in

Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, targets would have no significant impact on marine mammals in territorial waters. Furthermore, targets would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Chaff Fibers, End Caps, and Pistons

Radiofrequency chaff (chaff) is an electronic countermeasure designed to reflect radar waves and obscure aircraft, ships, and other equipment from radar tracking sources. Chaff is composed of an aluminum alloy coating on glass fibers of silicon dioxide. The coating is about 99.4% aluminum by weight and contains negligible amounts of silicon, iron, copper, manganese, magnesium, zinc, vanadium, and titanium (USAF, 1997). These aluminum-coated glass fibers (about 60% silica and 40% aluminum by weight) range in lengths of 0.8 to 7.5 centimeters (cm) with a diameter of about 40 micrometers (µm). Chaff is released or dispensed from military vehicles in cartridges or projectiles that contain millions of chaff fibers. When deployed, a diffuse cloud of fibers is formed that is undetectable to the human eye. Chaff is a very light material that can remain suspended in air anywhere from 10 minutes to 10 hours and can travel considerable distances from its release point, depending on prevailing atmospheric conditions (USAF, 1997; Arfsten *et al.*, 2002). Doppler radar has tracked chaff plumes containing approximately 900 grams (g) of chaff drifting 322 km (200 miles [mi]) from the point of release with the plume covering a volume of greater than 1,667 cubic kilometers (km^3) (400 cubic miles [mi^3]) (Arfsten *et al.*, 2002).

Various types of chaff systems are used in the GOMEX Study Area. Fixed-wing aircraft use RR-144A/AL and RR-129A/L chaff cartridges, which contain about 150 g of chaff or about 5 million fibers. For each cartridge used, a plastic end cap and Plexiglas piston is released into the environment in addition to the chaff fibers. The end cap and piston are both round and are 1.3 in. in diameter and 0.13 in. thick (Spargo, 2007). A total of 3,680 of these chaff cartridges would be used per year in W-151A/B and W-155A (associated with the Panama City OPAREA) under the No Action Alternative. There are a total of 368 F/A-18 sorties using chaff each year; ten cartridges are released per sortie. This averages out to as much as 1,512 g of chaff released per day.

Ships use MK-214 or MK-216 Super Rapid Off-board Chaff. The MK-214 contains about 11 kilograms (kg) of chaff or more than 360 million fibers, while the MK-216 contains about 7.6 kg of chaff or more than 250 million fibers. A total of 60 MK-214 and 24 MK-216 cartridges will be used per year in W-151A/B and W-155A.

Based on the dispersion characteristics of chaff, large areas of open water within the Pensacola and Panama City OPAREAs would be exposed to chaff, but the chaff concentrations would be low. For example, Hullar *et al.* (1999) calculated that an 8 km (4.97 mi) by 12 km (7.46 mi) (96 square km [km^2] [37.1 square mi {mi^2}] or 28 nm^2) area would be affected by deployment of a single cartridge containing 150 g of chaff. The resulting chaff concentration would be about 5.4 g/nm^2. This corresponds to less than 179,000 fibers/nm^2 or less than 0.005 fibers/square foot (ft^2), assuming that each canister contains five million fibers.

The chaff concentrations that marine life could be exposed to following release of multiple cartridges (*e.g.*, following a single day of training) is difficult to accurately estimate because it depends on several unknown factors. First of all, specific release points are not recorded and tend to be random, and chaff dispersion in air depends on prevailing atmospheric conditions. After falling from the air, chaff fibers would be expected to float on the sea surface for some period of time depending on wave and wind action. The fibers would be dispersed further by sea currents as they float and slowly sink toward the bottom. Chaff concentrations in benthic habitats following release of a single cartridge would be lower

than the values noted above based on dispersion by currents and the enormous dilution capacity of the receiving waters.

Several literature reviews and controlled experiments have indicated that chaff poses little environmental risk except at concentrations substantially higher than those that could reasonably occur from military training use (USAF, 1997; Hullar *et al.*, 1999; Arfsten *et al.*, 2002). Nonetheless, some marine mammal species within the GOMEX Study Area could be exposed to chaff through direct body contact, inhalation, and ingestion. As discussed in more detail below, chemical alteration of water and sediment resulting from decomposition of chaff fibers is not expected to result in exposure.

Based on the dispersion characteristics of chaff it is likely that marine mammals would occasionally come in direct contact with chaff fibers while at the water's surface and while submerged, but such contact would be inconsequential. Chaff is similar in form to fine human hair (USAF, 1997). Due to its flexible nature and softness, external contact with chaff would not be expected to adversely affect most wildlife (USAF, 1997) and the fibers would quickly wash off shortly after contact. Given the properties of chaff, skin irritation is not expected to be a problem (USAF, 1997).

The potential exists for marine mammals to inhale chaff fibers if they are at the surface while chaff is airborne. Arfsten *et al.* (2002), Hullar *et al.* (1999), and USAF (1997) reviewed the potential effects of chaff inhalation on humans, livestock, and animals and concluded that the fibers are too large to be inhaled into the lung. If inhaled, the fibers are predicted to be deposited in the nose, mouth, or trachea and are either swallowed or expelled. However, these reviews did not specifically consider marine mammals. It is possible that marine mammals, particularly large whales, could inhale chaff fibers into the lung based on their size and respiratory system characteristics. In terrestrial environments chaff fibers could break into smaller particles by various physical processes. If resuspended, the small particles could be available for inhalation (USAF, 1997). However, this is not a concern in the marine environment because chaff fibers would not break up on the water's surface or be resuspended. Any effect of chaff inhalation on marine mammals is considered insignificant given the low concentration of airborne fibers (1.8 fibers/ft^2 for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point) and the fact that marine mammals spend significant time submerged.

Based on the small size of chaff fibers, it appears unlikely that marine mammals would confuse the fibers with prey items or purposefully feed on chaff fibers. However, marine mammals could occasionally ingest low concentrations of chaff incidentally from the surface, water column, or sea floor. While no studies have been conducted to evaluate the effects of chaff ingestion on marine mammals, the effects are expected to be negligible based on the low concentrations that could reasonably be ingested, the small size of chaff fibers, and available data on the toxicity of chaff and aluminum. In laboratory studies conducted by the University of Delaware (NRL, 1999), blue crabs and killifish were fed a food-chaff mixture daily for several weeks and no significant mortality was observed at the highest exposure treatment. Similar results were found when chaff was added directly to exposure chambers containing filter-feeding menhaden. Histological examination indicated no damage by chaff exposures. A study on calves that were fed chaff found no evidence of digestive disturbance or other clinical symptoms (USAF, 1997).

Silicon dioxide, also known as silica, is an abundant compound in nature that is prevalent in soils, rocks, and sand (USAF, 1997). Silicon is the third most abundant element in the earth's crust, making up approximately 28.2% by weight (Jefferson Lab, 2007). As such, the diet of benthic foraging marine animals that routinely ingest sediment while feeding likely contains relatively high concentrations of silicon dioxide. Silicon dioxide is chemically unreactive in the environment (USEPA, 1991) and the acute and chronic oral toxicity of silicon dioxide is low. No significant toxicity or mortality has been reported in animals given doses of up to 3,000 milligrams (mg)/kg of body weight per day (EVM,

2003). No observed adverse effect levels of 2,500 and 7,500 mg/kg of body weight per day were obtained for mice and rats, respectively in long-term studies (up to 24 months) (EVM, 2003). Aluminum is the third most abundant element in the earth's crust, making up approximately 8.2% by weight (Jefferson Lab, 2007). Similar to silicon dioxide, the diet of benthic foraging marine animals that routinely ingest sediment while feeding likely contains relatively high concentrations of aluminum. Aluminum toxicosis in domestic animals is largely expressed as secondary phosphorus deficiency, presumably because it binds phosphorus in an unabsorbable complex in the intestine (NRC, 1980). Signs of phosphorus deficiency have been observed in sheep, chicks, rats, and mice receiving high levels of dietary aluminum (NRC, 1980). Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and terrestrial mammals. Intestinal absorption of orally ingested aluminum salts was very poor, and the small amount absorbed was almost completely removed from the body by excretion in urine. Rats and mice presented with moderately high dietary aluminum content (160 to 335 mg/kg) excreted most of it in the feces (NRC, 1980). However, aluminum can be deposited in the liver, skeleton, brain, and other tissues, and the amount of aluminum retained is positively related to the amount consumed (NRC, 1980). High concentrations of aluminum have been found in the stomach content, liver, and brain of stranded gray whales (Varanasi *et al.*, 1993) and in the stomach content of subsistence harvested (presumably healthy) gray whales (Tilbury *et al.*, 2002), which appears to be consistent with the ingestion of sediments by this benthic foraging species. The aluminum concentrations in brain tissue of gray whales are within the range for some terrestrial mammals that may receive high concentrations of aluminum in their diets, suggesting a broad range in tolerance to aluminum in mammals (Varanasi *et al.*, 1993). Dietary aluminum normally has small effects on healthy birds and terrestrial mammals, and often high concentrations (>1,000 mg/kg) are needed to induce effects such as impaired bone development, reduced growth, and anemia (Nybø, 1996). Studies suggest that the maximum tolerable level of aluminum for cattle and sheep is about 1,000 mg/kg of body weight (NRC, 1980). A marine animal weighing 1 kg would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg (based on chaff consisting of 40% aluminum by weight and a 150 g chaff canister containing 5 million fibers). An adult male sperm whale weighing 40,800 kg would need to ingest more than 3 billion chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg. It is highly unlikely that a marine mammal would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (1.8 fibers/ft^2 for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Marine mammals would not be indirectly affected by changes in water quality resulting from the degradation of chaff in water. Any changes in water quality from chaff use would be negligible based on the low concentration of chaff, the slow rate at which it degrades in saltwater (USAF, 1997), and the enormous dilution capacity of the receiving waters of the OPAREAs. Available data indicate that chaff is relatively non-toxic in marine environments. Laboratory toxicity tests conducted using two marine indicator organisms (mysid shrimp and sheepshead minnow) indicated that chaff is not acutely toxic at concentrations greater than 1,000 mg per liter (L) (NRL, 1999). The bioavailability and toxicity of aluminum is relatively low in marine environments compared to freshwater environments because of the high pH levels and high calcium and sodium concentrations in saltwater (Lydersen and Lofgren, 2002). The U.S. Environmental Protection Agency (USEPA) has not designated aluminum as a priority pollutant and has not established ambient water quality criteria for aluminum in saltwater (USEPA, 2007). A review of numerous toxicological studies indicated that the principal components of chaff are unlikely to have significant effects on humans and the environment based on the general toxicity of the components, the dispersion patterns, and the unlikelihood of the components to interact with other substances in nature to produce synergistic toxic effects (USAF, 1997). Available evidence suggests that chaff use does not result in significant accumulation of aluminum in sediments after prolonged training. Sediment samples collected from an area of the Chesapeake Bay where chaff had been used

for approximately 25 years indicated that aluminum concentrations in sediments were not significantly different than background concentrations (Wilson *et al.*, 2002).

Chaff cartridge plastic end caps and pistons would also be released into the marine environment, where they would persist for long periods and could be ingested by marine mammals. Chaff end caps and pistons sink in saltwater (Spargo, 2007), which reduces the likelihood of ingestion by marine mammals at the surface or in the water column. As discussed above for ordnance related materials, the sperm whale is the only listed marine mammal species that is expected to routinely forage on or near the bottom. Sperm whales have been known to ingest anthropogenic debris similar to the end caps and pistons during the course of feeding (Walker and Coe, 1990; Laist, 1997); however, this does not always result in negative consequences to health or vitality (Walker and Coe, 1990). Walker and Coe (1990) theorized that for larger animals, such as beaked whales, it would take a high volume of foreign debris to result in death or debilitation resulting from impaction. This can be extrapolated to sperm whales as well.

Based on the small size of chaff end caps and pistons (1.3 in. diameter, 0.13 in. thick), it appears unlikely that sperm whales would confuse them with prey items or purposefully feed on them. The likelihood of a sperm whale ingesting an end cap or piston appears to be extremely low based on the number of pieces released per year (7,528 pieces/yr). Much of the expended material may occur seaward of the shelf break where sperm whales are likely foraging. However, if ingested, it is likely that the small (1.3 in. diameter, 0.13 in. thick), round end cap or piston would be excreted without causing harm. Sperm whales primarily feed on squid and their digestive systems are capable of excreting indigestible squid beaks. However, ingestion of foreign materials has been noted to result in negative consequences to marine mammals, including mortality, due to disruption of the digestive tract and/or intestinal blockage (Gorzelany, 1998; Stamper *et al.*, 2006). Documented instances of this are rare, particularly for smaller items (Walker and Coe, 1990; Laist, 1997). Although instances of impacts from ingestion of debris have been recorded, the low concentration and minimal likelihood that a sperm whale would ingest an end cap or piston make the potential effects discountable.

Chaff use under the No Action Alternative may affect blue, fin, humpback, North Atlantic right, sei, and sperm whales but would have no effect on manatees. Chaff is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, chaff would have no significant impact on marine mammals in territorial waters. Furthermore, chaff would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Self-Protection Flares

Self-protection flares consist of a magnesium/Teflon® formulation that, when ignited and released from an aircraft, burn for a short period of time (less than 10 sec) at very high temperatures. Flares release heat and light to disrupt tracking of Navy aircraft by enemy infrared tracking devices or weapons. Flares are designed to burn completely. Under normal operations, the only material that would enter the water would be a small, round plastic end cap (approximately 1.4 inch diameter). About 1,840 self-protection flares would be used during 368 sorties (5 flares/sortie) in W-151A/B per year under the No Action Alternative.

An extensive literature review and controlled experiments conducted by the U.S. Air Force revealed that self-protection flare use poses little risk to the environment or animals (USAF, 1997). Nonetheless, marine mammals within the vicinity of W-151A/B could be exposed to light generated by the flares and flare plastic end caps. The light generated by flares would have no effect on marine mammals based on short burn time, relatively high altitudes where they are used, and their widespread and infrequent use. Similar to chaff end caps and pistons, sperm whales are the only listed marine mammal species that

would potentially ingest flare end caps. Ingestion of flare end caps under the No Action Alternative may affect the sperm whale, but the effects would be considered discountable because ingestion is extremely unlikely to occur. Self-protection flares are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, flares would have no significant impact on marine mammals in territorial waters. Furthermore, flares would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Marine Markers

The MK-58 marine markers produce chemical flames and regions of surface smoke and are used as part of the training activities in the Demolition Pond and during BOMBEX in W-151A/C and W-155B. When the accompanying cartridge is broken, smoke is released. The smoke dissipates in the air, having little effect on the marine environment. The marker burns similar to a flare, producing a flame until all burn components have been used. While the light generated from the marker is bright enough to be seen up to 5 km (3 mi) away in ideal conditions, the resulting light would either be reflected off the water's surface or would enter the water and attenuate in brightness over depth. The point source of the light would be focused and be less intense than if an animal were to look to the surface and encounter the direct path of the sun. The MK-58 is composed of tin and contains two red phosphorus pyrotechnic candles and a seawater-activated battery. The MK-58 marine marker is 21.78 in. long and 5.03 in. in diameter, weighs 5.8 kg (12.8 lb), and produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes (The Ordnance Shop, 2007). The marker is not designed to be recovered. After the marker burns out, the tin canister would sink to the bottom and become encrusted and/or incorporated into the sediments. Approximately 34 marine markers would be used per year in the GOMEX Study Area and 9 in the Demolition Pond under the No Action Alternative.

It is unlikely that marine mammals would be exposed to any chemicals that produce either flames or smoke since these components are consumed in their entirety during the burning process. Animals are unlikely to approach and/or get close enough to the flame to be exposed to any chemical components.

Expended marine markers are a potential ingestion hazard for marine mammals while they are floating or after they sink to the bottom. However, the probability of ingestion is extremely low based on the low number of marine markers expended per year (34). Marine marker ingestion under the No Action Alternative may affect ESA-listed whales, but the effects would be considered discountable because ingestion is extremely unlikely to occur. Marine markers would have no effect on the manatee because these devices are used in offshore waters where this species is not expected to occur. The use of marine markers is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, there would be no significant impact to marine mammals from marine marker use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from use of marine markers during training exercises in non-territorial waters.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, the No Action Alternative includes the use of Mine Warfare devices towed through the water by helicopters and ships. In addition, remotely operated vehicles are used during Mine Neutralization training. These devices are currently used in the Panama City and Corpus Christi MINEX Boxes. The effects of underwater detonations associated with the use of these devices are analyzed below in the underwater detonation and high explosive ordnance section. The effects of Mine Warfare devices towed by ships and remotely operated vehicles are expected to be the same as those described above for vessel movements. This section analyzes the effects of the MK-103, which is towed through the water by a helicopter flying about 75 feet above the surface.

Mine Warfare devices towed through the water by helicopters present a potential strike risk to marine mammals. Helicopter crew members monitor the water's surface during training to identify and avoid any objects that might damage the equipment. Based on the low flight altitudes and relatively slow air speeds, it is likely that crew members would be able see marine mammals at or near the surface and avoid them. Marine mammals at or near the surface might see or hear the oncoming helicopter or feel the downdraft, which could initiate avoidance behavior. The water column disturbance and sound created by the towed Mine Warfare device would likely elicit short-term behavioral responses similar to those discussed for vessel movements and aircraft overflights. While the potential exists for marine mammals to be struck by a towed MIW device, there are no documented instances of this occurring in the Study Area.

Towed devices would have no effect on ESA-listed marine mammals because: (1) towed devices would be used in areas located shoreward of the shelf break, where sperm whales and extralimital listed-whales are not expected to occur and (2) towed devices would not be used in shallow nearshore waters where manatees are expected to occur. The probability of a towed device striking non-listed marine mammals would be extremely low based on mitigation measures. The use of towed devices is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, towed device use in territorial waters would have no significant impact on marine mammals. Furthermore, towed device use in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

3.7.3.4 Alternative 1

Vessel Movements

The total number of vessel steaming days for the GOMEX Study Area would not change under Alternative 1. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 1. Vessel movements may affect ESA-listed whales, but would have no effect on the manatee. Vessel movements are not expected to result in Level A or Level B harassment of marine mammals as defined by the MMPA. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on marine mammals. Furthermore, vessel movements in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Aircraft Overflights

Alternative 1 includes approximately 5,316 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 93 sorties per year (1.8%) compared to the No Action Alternative. The additional sorties would be associated with bombing exercises in W-151 and W-155 and would involve flights below 3,000 feet. Helicopter sorties would decrease from 38 to 18 per year under Alternative 1. The increase in fixed-wing sorties would increase the potential for behavioral disturbance from sound and shadow effects. Behavioral reactions to fixed-wing aircraft would be the same as discussed for the No Action Alternative. Aircraft overflights may affect ESA-listed marine mammals, but the effects are expected to be insignificant. Aircraft overflights are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, aircraft overflights would have no significant impact on marine mammals in territorial waters. Furthermore, aircraft overflights would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Munitions Use/Non-explosive Practice Munitions

The amount of NEPM used would increase in the GOMEX Study Area under Alternative 1 (Tables 2.2-7 and 2.2-8). These changes would result in increased potential for marine mammal/NEPM strikes compared to the No Action Alternative. However, ordnance strike modeling predicts that no marine

mammals would be exposed to direct NEPM strikes under Alternative 1 (see Appendix I). Additionally, Navy mitigation measures further reduce the probability of ordnance-related exposure. The use of NEPM would have no effect on ESA-listed marine mammal species. NEPM use is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, NEPM would have no significant impact on marine mammals in territorial waters. Furthermore, NEPM would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Underwater Detonations and High Explosive Ordnance

Alternative 1 would include changes in underwater detonations and HE ordnance use in the GOMEX Study Area.

MINEX

Underwater detonations associated with Mine Warfare exercises in the Panama City and Corpus Christi Underwater Detonation Boxes would no longer occur under Alternative 1. As such, underwater detonations associated with Mine Warfare exercises would have no impact on any marine mammals under Alternative 1.

Diver Training

Underwater detonations in the Demolition Pond would not change under Alternative 1. Therefore, the analysis for underwater detonations in the Demolition Pond under the No Action Alternative is applicable to Alternative 1.

BOMBEX and Small Arms Training

Alternative 1 would include an increase in the number of HE bombs dropped in the W-155 A/B Hotbox from 52 to 155 per year. Therefore, the potential for marine mammals to be exposed to impacts associated with HE ordnance use would increase under Alternative 1. Small arms training would not change under Alternative 1. An explosive analysis was conducted to estimate the number of marine mammals that could be exposed to impacts from explosions. Table 3.7-10 provides a summary of the explosive analysis results under Alternative 1.

Sperm whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, false killer whales, Fraser's dolphins, killer whales, *Kogia* spp., melon-headed whales, Pantropical spotted dolphins, pygmy killer whales, Risso's dolphins, short-finned pilot whales, spinner dolphins, and striped dolphins may be exposed at levels that could result in behavioral disturbance. Sperm whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, false killer whales, Fraser's dolphins, killer whales, *Kogia* spp., melon-headed whales, Pantropical spotted dolphins, pygmy killer whales, Risso's dolphins, short-finned pilot whales, spinner dolphins, and striped dolphins may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects. Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, melon-headed whales, Pantropical spotted dolphins, Risso's dolphins, short-finned pilot whales, spinner dolphins, and striped dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects. No marine mammal species are expected to be exposed at levels that could result in mortality.

TABLE 3.7-10
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Sperm whale				
BOMBEX training	2	2	0	0
Small Arms training	0	0	0	0
Total Exposures	2	2	0	0
Atlantic spotted dolphin				
BOMBEX training	35	36	2	0
Small Arms training	0	0	0	0
Total Exposures	35	36	2	0
Beaked whales				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Bottlenose dolphin				
BOMBEX training	162	173	12	0
Small Arms training	4	3	0	0
Total Exposures	166	176	12	0
Bryde's whale				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0

TABLE 3.7-10 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa²-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa²-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Clymene dolphin				
BOMBEX training	63	67	4	0
Small Arms training	0	0	0	0
Total Exposures	63	67	4	0
False killer whale				
BOMBEX training	4	4	0	0
Small Arms training	0	0	0	0
Total Exposures	4	4	0	0
Fraser's dolphin				
BOMBEX training	3	3	0	0
Small Arms training	0	0	0	0
Total Exposures	3	3	0	0
Killer whale				
BOMBEX training	0	1	0	0
Small Arms training	0	0	0	0
Total Exposures	0	1	0	0
Kogia spp.				
BOMBEX training	5	5	0	0
Small Arms training	0	0	0	0
Total Exposures	5	5	0	0
Melon-headed whale				
BOMBEX training	13	13	1	0
Small Arms training	0	0	0	0
Total Exposures	13	13	1	0
Pantropical spotted dolphin				
BOMBEX training	291	300	20	0
Small Arms training	0	0	0	0
Total Exposures	291	300	20	0
Pygmy killer whale				
BOMBEX training	1	2	0	0
Small Arms training	0	0	0	0
Total Exposures	1	2	0	0

TABLE 3.7-10 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa²-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa²-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Risso's dolphin				
BOMBEX training	19	20	1	0
Small Arms training	0	0	0	0
Total Exposures	19	20	1	0
Rough-toothed dolphin				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Short-finned pilot whale				
BOMBEX training	9	9	1	0
Small Arms training	0	0	0	0
Total Exposures	9	9	1	0
Spinner dolphin				
BOMBEX training	320	335	22	0
Small Arms training	0	0	0	0
Total Exposures	320	335	22	0
Striped dolphin				
BOMBEX training	97	102	7	0
Small Arms training	0	0	0	0
Total Exposures	97	102	7	0

Exposure estimates could not be calculated for several species (blue whale, fin whale, humpback whale, North Atlantic right whale, sei whale, and minke whale) because density data could not be calculated due to the limited available data for these species. However, the likelihood of exposure should be even lower than that estimated for other species with given densities since they are less likely to occur in the Study Area. Therefore, no exposures are expected for these species. In addition to the low likelihood of exposure, the mitigation measures presented in Chapter 5 will be implemented prior to release of ordnance.

Effects on Marine Mammal Populations

Effects from the use of explosive ordnance are not anticipated to have lasting impacts on any marine mammal stocks and/or populations based on the following factors:

- Most exposures are within the non-injurious temporary threshold shift (TTS) or behavioral effects zones. Effects associated with these exposures are expected to be temporary.
- The exposure analysis predicts that no marine mammal species would be exposed to levels that could potentially result in mortality.
- Although the numbers presented in Table 3.7-10 represent estimated harassment as described above, they are probably overestimates as the model calculates harassment without taking into consideration standard mitigation measures.

The mitigation measures described in Chapter 5 are designed to reduce exposure of marine mammals to potential impacts to achieve the least practicable adverse affect on marine mammal species or populations. Lookouts will monitor the area before ordnance is used. Sperm whales will have high detection rates at the surface because of their large body size and pronounced blows. Because of large group sizes, it is likely that lookouts would detect Atlantic spotted dolphins, bottlenose dolphins, Clymene, Pantropical spotted dolphins, rough-toothed dolphin, and Risso's dolphins. Implementation of mitigation measures will likely reduce the potential effects to marine mammals.

Endangered Species Act Conclusions

Underwater detonations and HE ordnance use under Alternative 1 may affect blue, fin, humpback, North Atlantic right, sei, and sperm whales. However, the effects on extralimital species, such as fin, North Atlantic right, sei, blue, and humpback whales are likely discountable due to the low occurrence of these species in the GOMEX study area. Manatees are not expected to occur in the Hotbox where HE ordnance is used, which is more than 12 nm offshore, therefore HE ordnance use under Alternative 1 will have no effect on the manatee. . Manatees may occur in the nearshore waters of the Corpus Christi UNDET Area E3 box, where small arms training occurs, therefore underwater detonations under Alternative 1 may affect the manatee.

Marine Mammal Protection Act Conclusions

Exposure estimates for underwater detonations and explosive ordnance use indicate the potential from Level A and Level B harassment as defined by MMPA. No marine mammals would be exposed to levels that would result in mortality. The Navy concludes that exposures to explosive ordnance and underwater detonations would result in short-term effects to most individuals exposed and would likely not affect annual rates of recruitment or survival of the species. Although there may be impacts to individual marine mammals, the impacts at the population, stock or species level would be negligible.

National Environmental Policy Act and EO 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under the Alternative 1 may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA there would be no significant impact to marine mammals from underwater detonations and explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from underwater detonations and explosive ordnance use during training exercises in non-territorial waters.

Military Expended Materials

With the exception of NEPM and marine markers, the amount of military expended materials entering the marine environment would not change under Alternative 1 (Table 2.2-7). Alternative 1 includes expenditure of an additional 24,000 cannon shell rounds in the Hotbox. As discussed for the No Action Alternative, only sperm whales and beaked whales would be potentially exposed to expended NEPM via ingestion from foraging on the bottom. Ordnance related materials may affect the sperm whale.

Ordnance-related materials are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, ordnance related materials would have no significant impact on marine mammals in territorial waters. Furthermore, ordnance related materials would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Alternative 1 includes an increase in the number of marine markers used in the Study Area (from 34 to 124 per year). The probability of ingestion would remain extremely low based on the low number of marine markers expended per year. Marine marker ingestion under the No Action Alternative may affect the sperm whale, but the effects would be considered discountable because ingestion is extremely unlikely to occur. The use of marine markers is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, there would be no significant impact to marine mammals from marine marker use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from use of marine markers during training exercises in non-territorial waters.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 1. Therefore, the effects described for the No Action Alternative would no longer occur.

3.7.3.5 Alternative 2

Vessel Movements

The total number of vessel steaming days for the GOMEX Study Area would not change under Alternative 2. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 2. Vessel movements may affect ESA-listed whales, but would have no effect on the manatee. Vessel movements are not expected to result in Level A or Level B harassment of marine mammals as defined by the MMPA. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on marine mammals. Furthermore, vessel movements in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Aircraft Overflights

Alternative 2 includes approximately 5,318 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 95 sorties per year (1.8%) compared to the No Action and an increase of 2 sorties per year compared to Alternative 1. Helicopter sorties would decrease from 38 to 18 per year under Alternative 2 (same as Alternative 1). Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. Aircraft overflights may affect ESA-listed marine mammals, but the effects are expected to be insignificant. Aircraft overflights are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, aircraft overflights would have no significant impact on marine mammals in territorial waters. Furthermore, aircraft overflights would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Munitions Use/Non-explosive Practice Munitions

The amount of NEPM used would increase in the GOMEX Study Area under Alternative 2 (Tables 2.2-7 and 2.2-8). These changes would result in increased potential for marine mammal/NEPM strikes compared to the No Action Alternative. However, ordnance strike modeling predicts that no marine mammals would be exposed to direct NEPM strikes under Alternative 2 (see Appendix I). Additionally, Navy mitigation measures further reduce the probability of ordnance-related exposure. The use of

NEPM would have no effect on ESA-listed marine mammal species. NEPM use is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, NEPM would have no significant impact on marine mammals in territorial waters. Furthermore, NEPM would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Underwater Detonations and High Explosive Ordnance

Alternative 2 would include changes in HE ordnance use in the GOMEX Study Area.

MINEX

Underwater detonations associated with Mine Warfare exercises in the Panama City and Corpus Christi Underwater Detonation Boxes would no longer occur under Alternative 2, as was the case for Alternative 1. As such, underwater detonations associated with Mine Warfare exercises would have no impact on any marine mammals under Alternative 2.

Diver Training

Underwater detonations in the Demolition Pond would not change under Alternative 2. Therefore, the analysis for underwater detonations in the Demolition Pond under the No Action Alternative and Alternative 1 is applicable to Alternative 2.

BOMBEX and Small Arms Training

Alternative 2 includes a 92 percent decrease in the number of HE bombs dropped (4 per year) relative to the No Action Alternative (52 per year) and a 97 percent decrease relative to Alternative 1 (155 per year). As a result, the potential for marine mammals to be exposed to HE ordnance would decrease substantially under Alternative 2 compared to the No Action Alternative and Alternative 1. Small arms training would not change under Alternative 2.

An explosive analysis was conducted to estimate the number of marine mammals that could be exposed to impacts from explosions under Alternative 2. Table 3.7-11 provides a summary of the explosive analysis results under Alternative 2.

TABLE 3.7-11
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Sperm whale				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Atlantic spotted dolphin				
BOMBEX training	1	1	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0

TABLE 3.7-11 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Beaked whales				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Bottlenose dolphin				
BOMBEX training	6	6	0	0
Small Arms training	4	3	0	0
Total Exposures	10	9	0	0
Bryde's whale				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Clymene dolphin				
BOMBEX training	3	3	0	0
Small Arms training	0	0	0	0
Total Exposures	3	3	0	0
False killer whale				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Fraser's dolphin				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Killer whale				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Kogia spp.				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0

TABLE 3.7-11 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR MARINE MAMMALS IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Melon-headed whale				
BOMBEX training	1	1	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0
Pantropical spotted dolphin				
BOMBEX training	14	12	1	0
Small Arms training	0	0	0	0
Total Exposures	14	12	1	0
Pygmy killer whale				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Risso's dolphin				
BOMBEX training	1	1	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0
Rough-toothed dolphin				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Short-finned pilot whale				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Spinner dolphin				
BOMBEX training	14	13	1	0
Small Arms training	0	0	0	0
Total Exposures	14	13	1	0
Striped dolphin				
BOMBEX training	4	4	0	0
Small Arms training	0	0	0	0
Total Exposures	4	4	0	0

Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, melon-headed whales, Pantropical spotted dolphins, Risso's dolphins, spinner dolphins, and striped dolphins may be exposed at levels that could result in behavioral disturbance. Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, melon-headed whales, Pantropical spotted dolphins, Risso's dolphins, spinner dolphins, and striped dolphins may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects. Pantropical spotted dolphins and spinner dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects. No marine mammal species are expected to be exposed at levels that could result in mortality.

Exposure estimates could not be calculated for several species (blue whale, fin whale, humpback whale, North Atlantic right whale, sei whale, and minke whale) because density data could not be calculated due to the limited available data for these species. However, the likelihood of exposure should be even lower than that estimated for other species with given densities since they are less likely to occur in the Study Area. Therefore, no exposures are expected for these species. In addition to the low likelihood of exposure, the mitigation measures presented in Chapter 5 will be implemented prior to release of ordnance.

Effects on Marine Mammal Populations

Effects from the use of explosive ordnance are not anticipated to have lasting impacts on any marine mammal stocks and/or populations based on the following factors:

- Most exposures are within the non-injurious temporary threshold shift (TTS) or behavioral effects zones. Effects associated with these exposures are expected to be temporary.
- The exposure analysis predicts that no marine mammal species would be exposed to levels that could potentially result in mortality.
- Although the numbers presented in Table 3.7-11 represent estimated harassment as described above, they are probably overestimates as the model calculates harassment without taking into consideration standard mitigation measures.

The mitigation measures described in Chapter 5 are designed to reduce exposure of marine mammals to potential impacts to achieve the least practicable adverse affect on marine mammal species or populations. Lookouts will monitor the area before ordnance is used. Sperm whales will have high detections rates at the surface because of their large body size and pronounced blows. Because of large group sizes, it is likely that lookouts would detect Atlantic spotted dolphins, bottlenose dolphins, Clymene, Pantropical spotted dolphins, rough-toothed dolphin, and Risso's dolphins. Implementation of mitigation measures will likely reduce the potential effects to marine mammals.

Endangered Species Act Conclusions

Underwater detonations and HE ordnance use under Alternative 2 may affect blue, fin, humpback, North Atlantic right, sei, and sperm whales. However, the effects on extralimital species, such as fin, North Atlantic right, sei, blue, and humpback whales are likely discountable due to the low occurrence of these species in the GOMEX study area. Manatees are not expected to occur in the Hotbox where HE ordnance is used, which is more than 12 nm offshore, therefore HE ordnance use under Alternative 2 (Preferred Alternative) will have no effect on the manatee. Manatees may occur in the nearshore waters of the Corpus Christi UNDET Area E3 box, where small arms training occurs, therefore underwater detonations under Alternative 2 (Preferred Alternative) may affect the manatee.

Marine Mammal Protection Act Conclusions

Exposure estimates for underwater detonations and explosive ordnance use indicate the potential for Level A and Level B harassment as defined by MMPA. No marine mammals would be exposed to

levels that would result in mortality. The Navy concludes that exposures to explosive ordnance and underwater detonations would result in short-term effects to most individuals exposed and would likely not affect annual rates of recruitment or survival of the species. Although there may be impacts to individual marine mammals, the impacts at the population, stock or species level would be negligible.

National Environmental Policy Act and EO 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under the Alternative 2 (Preferred Alternative) may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA there would be no significant impact to marine mammals from underwater detonations and explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from underwater detonations and explosive ordnance use during training exercises in non-territorial waters.

Military Expended Materials

With the exception of non-explosive practice bombs, the amount of military expended materials entering the marine environment under Alternative 2 would be the same as Alternative 1 (Table 2.2-7). Non-explosive practice bombs are too large to present an ingestion risk to marine mammals. Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 2. Therefore, towed Mine Warfare devices would have no impact on any marine mammals under Alternative 2.

3.7.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to marine mammals.

3.7.5 Summary of Environmental Effects (NEPA and EO 12114)

3.7.5.1 Endangered Species Act

Table 3.7-12 provides a summary of the Navy's determination of effect for Alternative 2 and federally listed marine mammals that occur in the GOMEX Study Area. The analysis presented indicates that actions may affect ESA-listed whales and the West Indian manatee. However, the effects on extralimital species (fin, North Atlantic right, sei, blue, and humpback whales) are likely discountable due to the low occurrence of these species in the GOMEX Study Area. The GOMEX Study Area does not contain designated critical habitat for any listed marine mammal species. The Navy requested early ESA Section 7 consultation with NMFS to ensure Alternative 2 (the Preferred Alternative) would not likely jeopardize ESA-listed whales. The Navy then submitted to NMFS a Biological Evaluation for the GOMEX Range Complex on 8 January 2009 to initiate consultation for ESA-listed whales. An addendum to the Biological Evaluation was submitted to NMFS on 31 July 2009. NMFS signed the Programmatic Biological and Conference Opinions on 22 November 2010. The Navy also submitted to USFWS a Biological Evaluation for the GOMEX Range Complex on 7 January 2009 to initiate consultation for the West Indian manatee. In a letter dated 9 March 2009 the USFWS provided concurrence with the Navy's determination that Alternative 2 may affect, but is not likely to adversely affect the West Indian manatee. Copies of correspondence with NMFS and USFWS are in Appendix C.

3.7.5.2 Marine Mammal Protection Act

The analysis presented above indicates that several species of marine mammals could be exposed to impacts associated with underwater detonations and HE ordnance use under the No Action Alternative, Alternative 1, and Alternative 2 that could result in Level A or Level B harassment as defined by MMPA provisions applicable to the Navy. Exposure estimates for the No Action Alternative, Alternative 1, and Alternative 2 are provided in Tables 3.7-9; 3.7-10 and 3.7-11, respectively. Underwater detonations associated with MINEX would be eliminated under Alternative 2 and the number of HE bombs would be reduced from 52 to 4 under Alternative 2. Consequently, the number of species exposed and the number of exposures to underwater detonations and HE ordnance would be reduced substantially under Alternative 2. Effects from the use of explosive ordnance are not anticipated to have lasting impacts on any marine mammal population. Other stressors associated with the No Action Alternative, Alternative 1, and Alternative 2 are not expected to result in Level A or Level B harassment.

Effects from the use of explosive ordnance under Alternative 2 (the Preferred Alternative) are not anticipated to have lasting impacts on any marine mammal stocks and/or populations based on the following factors:

- Most exposures are within the non-injurious TTS or behavioral effects zones. Effects associated with these exposures are expected to be temporary and only a small percentage of the local population would be exposed.
- The exposure analysis predicts that no marine mammals would be exposed to levels that would result in mortality.
- Although the numbers presented in Table 3.7-11 represent estimated harassment and injury, as described above, they are probably overestimates as the model calculates harassment without taking into consideration standard mitigation measures.

The Navy submitted to NMFS an application for a Letter of Authorization under MMPA (letter dated 16 October 2008; Appendix C) for Alternative 2 (the Preferred Alternative). As discussed in its Proposed Rule published (insert date), NMFS will consider authorizing additional Level B harassment events for selected marine mammal species.

3.7.5.3 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.7-13, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on marine mammals in territorial waters in accordance with NEPA. Furthermore, in accordance with Executive Order 12114 the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to marine mammals in non-territorial waters.

TABLE 3.7-12
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED MARINE MAMMALS THAT OCCUR IN THE GOMEX STUDY AREA FOR ALTERNATIVE 2 (PREFERRED ALTERNATIVE)

Stressor	Blue Whale	Fin Whale	Humpback Whale	North Atlantic Right Whale	Sei Whale	Sperm Whale	West Indian Manatee
Vessel Movements							
Vessel Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Vessel Collisions	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Aircraft Overflights							
Aircraft Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Munitions Use/Non-explosive Practice Munitions (NEPM)							
Munitions Use/NEPM Strikes	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Munitions Use/NEPM Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Underwater Explosions/High Explosive (HE) Use							
High Explosive Use (Bombs)	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Underwater Explosions (Demolition Pond)	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Grenades (UNDET Area E3)	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Expended Materials							
Ordnance Related Materials	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect	No Effect
Target Related Materials	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Chaff	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Self-Protection Flares	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect	No Effect
Marine Markers	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect

TABLE 3.7-13
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE MAMMALS IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Low potential for vessel strikes.	Same as U.S. Territory.
Aircraft Overflights	Potential for short-term behavioral responses to overflights.	Same as U.S. Territory.
Non-explosive Practice Munitions	No effect based on extremely low probability of direct strikes.	Same as U.S. Territory.
Underwater Detonation and High Explosive Ordnance	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality, for MINEX training and small arms training. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected.	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality, for BOMBEX training. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected.
Military Expended Materials	Low potential for ingestion of ordnance related materials and chaff or flare plastic end caps or pistons.	Same as U.S. Territory.
Towed Mine Warfare Devices	Low potential for towed device strikes.	Same as U.S. Territory.
Impact Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.
Alternative 1		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action.	Same as U.S. Territory.
Non-Explosive Practice Munitions	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.

TABLE 3.7-13 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE MAMMALS IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Underwater Detonation and High Explosive Ordnance	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality, for small arms training. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Decrease compared to No Action based on elimination of MINEX UNDETs.	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality, for BOMBEX training. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Increase compared to No Action based on increase in HE BOMBEX.
Military Expended Materials	Slight increase compared to No Action.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable. Towed Mine Warfare devices would not be used under Alternative 1.	Not applicable. Towed Mine Warfare devices would not be used under Alternative 1.
Impact Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.
Alternative 2		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action Alternative.	Same as U.S. Territory.
Non-Explosive Practice Munitions	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.
Underwater Detonation and High Explosive Ordnance	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality, for small arms training. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Decrease compared to No Action based on elimination of MINEX UNDETs.	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality, for BOMBEX training. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Decrease compared to No Action based on reduction in HE BOMBEX.
Military Expended Materials	Slight increase compared to No Action.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable. Towed Mine Warfare devices would not be used under Alternative 2.	Not applicable. Towed Mine Warfare devices would not be used under Alternative 1.
Impact Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.

3.8 SEA TURTLES

3.8.1 Introduction and Methods

3.8.1.1 Regulatory Framework

Endangered Species Act

The Endangered Species Act (ESA) established protection over and conservation of threatened and endangered species. An "endangered" species is a species that is in danger of extinction throughout all or a significant portion of its range, while a "threatened" species is one that is likely to become endangered within the foreseeable future throughout all or in a significant portion of its range. The USFWS and NMFS jointly administer the ESA and are also responsible for the listing of species (*i.e.*, the labeling of a species as either threatened or endangered). The USFWS has primary management responsibility for management of terrestrial and freshwater species, including nesting sea turtles. The NMFS has primary responsibility for sea turtles in the marine environment.

The ESA requires federal agencies to conserve listed species and consult with the USFWS and/or NMFS to ensure that proposed actions that may affect listed species or critical habitat are consistent with the requirements of the ESA. The ESA specifically requires agencies not to "take" or "jeopardize the continued existence of" any endangered or threatened species, or to destroy or adversely modify habitat critical to any endangered or threatened species. Under Section 9 of the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Harm is further defined by USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by USFWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR §17.3). The USFWS or NMFS may authorize incidental take of listed species by a federal agency by issuing an Incidental Take Statement under Section 7 of the ESA. Under Section 7 of the ESA, "jeopardize the continued existence of" means to engage in any action that would be expected to reduce appreciably the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution (50 CFR §402.02).

All six species of sea turtles that potentially occur in the GOMEX Study Area are listed as threatened or endangered under the ESA. For purposes of ESA compliance, the Navy analyzed effects of the action to make a determination of effect for listed species (*e.g.*, no effect or may affect). The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998). "No effect" is the appropriate conclusion when a listed species will not be affected, either because the species will not be present or because the project does not have any elements with the potential to affect the species. "No effect" does not include a small effect or an effect that is unlikely to occur: if effects are insignificant (in size), discountable (extremely unlikely), or wholly beneficial a "may affect" determination is appropriate. Insignificant effects relate to the magnitude or extent of the impact (*i.e.*, they must be small and would not rise to the level of a take of a species). Discountable effects are those extremely unlikely to occur and based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

The Navy completed the ESA Section 7 formal consultation process with NMFS to determine if the action would adversely affect ESA-listed sea turtles in the marine environment or jeopardize the continued existence of a listed species. Copies of correspondence with NMFS are provided in Appendix C of this Final EIS/OEIS. The Navy has determined that the action would have no effect on sea turtles in the terrestrial environment. Therefore, ESA Section 7 consultation with USFWS for sea

turtles is not required. The Navy has completed ESA Section 7 informal consultation for other species under USFWS jurisdiction.

National Environmental Policy Act and Executive Order 12114

In addition to addressing ESA requirements, potential effects were analyzed in accordance with the National Environmental Policy Act (NEPA) to determine if the action would result in significant impacts to sea turtles in territorial waters and in accordance with Executive Order (EO) 12114 to determine if the action would result in significant harm to sea turtles in non-territorial waters.

For purposes of NEPA and EO 12114, the Navy considered context and intensity to determine the significance of effects. Context refers to the affected environment in which the action would occur and intensity refers to the severity of impacts. The Navy considered several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. When considering the intensity, the Navy evaluated factors such as the duration of effects (*e.g.*, short-term, long-term, temporary, permanent); degree of controversy; degree of highly uncertain effects or unique or unknown risks; precedent-setting effects; cumulative effects; adverse effect on ESA-listed species or designated critical habitat; and whether the action threatens a violation of law or requirements imposed for the protection of the environment were also considered. The potential for adverse effects to be observed at the population or species level was a primary factor considered by the Navy in determining the significance of effects to sea turtles. While the factors outlined above for ESA were considered in making NEPA and EO 12114 significance conclusions, it should be recognized that the terminology used to characterize effects varies under these Acts. For example, take of an individual sea turtle under ESA does not necessarily equate to a significant impact under NEPA. Rather, the Navy considered the context and intensity of effects, and population-level effects in making its significance conclusions for sea turtles.

3.8.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for sea turtles is the same as the approach described for marine mammals in Section 3.7.1.2.

Study Area

The GOMEX Study Area is described in Section 1.5 and is shown in Figure 1.5-1. The GOMEX Study Area is analogous to the "action area," for purposes of analysis under Section 7 of the ESA.

Data Sources

A comprehensive and systematic review of relevant literature and data was conducted to complete this analysis for sea turtles. These data sources are described in Section 3.7.1.2.

Estimated Sea Turtle Densities

The density estimates that were used in previous Navy environmental documents have been recently updated to provide a compilation of the most recent data and information on the occurrence, distribution, and density of sea turtles. The updated density estimates presented in this Final EIS/OEIS are derived from *the Navy OPAREA Density Estimates (NODEs) for the GOMEX OPAREA* report (DoN, 2007a).

Density estimates for sea turtles were modeled using available line-transect survey data. Using the model-based approach, density estimates were calculated for each species within areas containing survey effort. A relationship between these density estimates and the associated environmental

parameters such as depth, slope, distance from the shelf break, sea surface temperature (SST), and chlorophyll *a* (chl *a*) concentration was formulated using generalized additive models (GAMs). This relationship was then used to generate a two-dimensional density surface for the region by predicting densities in areas where no survey data exist.

The analysis for sea turtles were based on sighting data collected through aerial surveys conducted by the Southeast Fisheries Science Center between 1992 and 1998. For specifics of data used in these analyses refer to DoN (2007a). All spatial models and density estimates were reviewed by and coordinated with NMFS Science Center technical staff and scientists with the University of St. Andrews, Scotland, Centre for Environmental and Ecological Modeling (CREEM).

Density estimates were generated for the leatherback turtle, loggerhead turtle, and the group "hardshell turtles", which includes Kemp's ridley, green, hawksbill, olive ridley, and unidentified hardshell turtles. These species were pooled together because the numbers of sightings for each species or group were not sufficient to allow spatial modeling. The "hardshell turtle" category did not include leatherback turtles since identification is not difficult. The NODE report did not include density estimates for waters less than 10 m deep.

Table 3.8-1 summarizes the density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex.

TABLE 3.8-1
SEASONAL DENSITY ESTIMATES FOR SEA TURTLES IN THE GOMEX STUDY AREA TRAINING AREAS WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Loggerhead Turtle				
Hotbox	0.00472	0.00472	0.00472	0.00472
Corpus Christi MINEX	0.00302	0.00302	0.00302	0.00302
Corpus Christi E3 Box	0.01627	0.01627	0.01627	0.01627
Panama City On Shelf MINEX	0.05292	0.05292	0.05292	0.05292
Panama City Off Shelf MINEX	0.04565	0.04565	0.04565	0.04565
Hardshell Turtles[(1)]				
Hotbox	0.00067	0.00067	0.00067	0.00067
Corpus Christi MINEX	0.00346	0.00346	0.00346	0.00346
Corpus Christi E3 Box	0.00242	0.00242	0.00242	0.00242
Panama City On Shelf MINEX	0.00529	0.00529	0.00529	0.00529
Panama City Off Shelf MINEX	0.00414	0.00414	0.00414	0.00414
Leatherback Turtle				
Hotbox	0.00679	0.00679	0.00679	0.00679
Corpus Christi MINEX	0.00005	0.00005	0.00005	0.00005
Corpus Christi E3 Box	0.00000	0.00000	0.00000	0.00000
Panama City On Shelf MINEX	0.00455	0.00455	0.00455	0.00455
Panama City Off Shelf MINEX	0.00610	0.00610	0.00610	0.00610

Source: (DoN, 2007a). [(1)]*Hardshell turtle density estimates include all sightings of unidentified hardshell turtles, Kemp's ridley, green, hawksbill, and extralimital occurrences of the olive ridley turtle.*

3.8.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that would be considered stressors to sea turtles. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that would be considered stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws,

regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Final EIS/OEIS. As summarized in Table 3.8-2, potential stressors to sea turtles include vessel movements (disturbance and collisions), aircraft overflights (disturbance), munitions use/non-explosive practice munitions (NEPM) (disturbance and strikes), underwater detonations and high explosive (HE) ordnance (explosions), military expended materials, which includes ordnance related materials, targets, chaff, self-protection flares, and marine markers (entanglements, ingestion, and habitat alteration), and towed Mine Warfare devices. The potential effects of these stressors on sea turtles are analyzed in detail in Section 3.8.3.

3.8.2 Affected Environment

3.8.2.1 Regional Overview

Although six sea turtle species have the potential to occur, five sea turtle species are known to occur regularly in the GOMEX Range Complex (Table 3.8-2). Deoxyribonucleic acid (DNA) analyses of three stranded carcasses in the vicinity of the GOMEX Range Complex recently confirmed the extralimital occurrence of the olive ridley turtle in the Gulf of Mexico (Foley *et al.*, 2003) (Table 3.8-3). The five regularly occurring species all have documented nesting on the beaches adjacent to the GOMEX Range Complex. No critical habitat for sea turtles has been designated within the boundaries of the GOMEX Range Complex.

TABLE 3.8-2
SUMMARY OF POTENTIAL STRESSORS TO SEA TURTLES IN THE GOMEX STUDY AREA

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Mine Warfare (MIW)							
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓		✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓

TABLE 3.8-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEA TURTLES IN THE GOMEX STUDY AREA

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Surface Warfare (SUW)							
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓		✓	✓	
BOMBEX A-S	W-151 A/C; W-155B		✓	✓		✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓	✓		✓	
GUNEX (Surface-to-Surface) (S-S) (Ship)	W-151 A/B; W-155A	✓		✓		✓	
GUNEX S-S (Boat)	Panama City OPAREA	✓		✓		✓	
GUNEX S-S (Boat)	Corpus Christi UNDET Box E3	✓		✓	✓	✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓					
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓				
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓			✓	✓	
Air Warfare (AW)							
Air Intercept Control (AIC)	W-151; W-155		✓				
Amphibious Warfare (AMW)							

TABLE 3.8-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEA TURTLES IN THE GOMEX STUDY AREA

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Firing Exercise (Surface-to-Surface) with Integrated Maritime Portable Acoustic Scoring and Simulator System (FIREX with IMPASS) (no HE ordnance)	W-151A/B; W-155A	✓		✓		✓	
Electronic Combat (EC)							
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓			✓	
Chaff Exercises (CHAFFEX)	Brownwood MOAs						
Flare Exercises (FLAREX)	W-155A/B		✓			✓	
Flare Exercises (FLAREX)	Brownwood MOAs						
Mission Area Training[1]							
Mission Area Flight Training	W-92; W-54		✓				
Basic Flight Instruction	W-228; R-2908		✓				
Salvage Diver Training	NSA Panama City Demolition Pond				✓	✓	
Underwater Demolitions	NSA Panama City Demolition Pond				✓	✓	
Security Force Training	NSA Panama City Demolition Pond				✓	✓	
Diver Training	NSA Panama City Demolition Pond				✓	✓	

[1]Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

TABLE 3.8-3
ESA-LISTED SEA TURTLE SPECIES THAT OCCUR IN THE GOMEX STUDY AREA

Common Name	Scientific Name	Status
Order Testudines Suborder Cryptodira Family Cheloniidae		
Loggerhead turtle	*Caretta caretta*	THREATENED[1]
Kemp's ridley turtle	*Lepidochelys kempii*	ENDANGERED
Green turtle	*Chelonia mydas*	THREATENED[2]
Hawksbill turtle	*Eretmochelys imbricata*	ENDANGERED
Olive ridley turtle	*Lepidochelys olivacea*	THREATENED[3]
Family Dermochelyidae		
Leatherback turtle	*Dermochelys coriacea*	ENDANGERED

[1] *As a species, loggerhead turtles are currently listed as threatened; however, the Northwest Atlantic Distinct Population Segment of loggerheads is currently proposed for endangered status (75 FR 12598 March 16, 2010).*

[2] *As a species, the green turtle is listed as threatened; however, the Florida and Mexican Pacific coast nesting populations are listed as endangered. It should be noted that not all green turtles found in the GOMEX Range Complex come from the Florida population.*

[3] *As a species, the olive ridley is listed as threatened; however, the Pacific nesting population in Mexico is listed as endangered*

Sea turtles may occur throughout the northern Gulf of Mexico during all seasons due to the availability of preferred shallow and deep water habitats. Available occurrence data indicate that sea turtle distribution in the GOMEX Range Complex ranges from the shallow waters over the inner continental shelf to the deep waters overlying the abyssal plain. Occurrence records from the deepest waters of the GOMEX Range Complex are primarily from fisheries bycatch and are predominately leatherback and loggerhead sea turtles. Occurrence records show a lack of turtles in the offshore waters of western Florida in the fall, but this lack of turtles may be related to the lack of fishing and survey effort in that season and area rather than the absence of sea turtles in these deeper waters. It is clear that leatherback turtles occur primarily in the deep water, oceanic habitats of the Gulf of Mexico while loggerhead turtles are found in both the deep, oceanic and shallower, shelf waters. The other hard-shelled turtles occur in continental shelf waters.

3.8.2.2 Loggerhead Turtle (*Caretta caretta*)

The loggerhead turtle is a large hard-shelled sea turtle named for its disproportionately large head. The average straight carapace length of an adult female loggerhead is between 90 and 95 cm and the average mass is 100 to 150 kg (Dodd, 1988; NMFS and USFWS, 1998a). Adults are mainly reddish-brown in color on top and yellowish underneath.

The diet of a loggerhead turtle changes with the age and size of the turtle (Godley *et al.*, 1998). Post-hatchlings found in masses of *Sargassum* forage on zooplankton, jellyfish, larval shrimp and crabs, and gastropods (Carr and Meylan, 1980; Richardson and McGillivary, 1991; Witherington, 1994). Juvenile and subadult loggerhead turtles are omnivorous, foraging on pelagic crabs, mollusks, jellyfish, and vegetation captured at or near the surface (Dodd, 1988). Adult loggerheads are generalized carnivores that forage on nearshore benthic invertebrates (mollusks, crustaceans, and coelenterates) and sometimes fish (Dodd, 1988).

On average, loggerhead turtles spend over 90 percent of their time underwater (Byles, 1988; Renaud and Carpenter, 1994; Narazaki *et al.*, 2006). Loggerheads tend to remain at depths shallower than 100 m (Houghton *et al.*, 2002; Polovina *et al.*, 2003; Hawkes *et al.*, 2006; Narazaki *et al.*, 2006; McClellan *et al.*, 2007). Routine dive depths are typically shallower than 30 m (Houghton *et al.*, 2002), although dives of up to 233 m were recorded for a post-nesting female loggerhead off Japan (Sakamoto *et al.*, 1990). Routine dives typically last from 4 to 120 min, with Byles reporting suspected continuous submergence for nearly 24 hrs for one individual (Byles, 1988; Sakamoto *et al.*, 1990; Renaud and Carpenter, 1994; Bentivegna *et al.*, 2003; Dodd and Byles, 2003)

Status and Management—The loggerhead sea turtle is the most abundant sea turtle occurring in U.S. waters and is currently classified as threatened under the ESA. NMFS and the USFWS have recently determined that the loggerhead is composed of nine distinct population segments (DPSs) that qualify as ''species'' for the purpose of listing under the ESA and have issued a proposed rule to designate the Northwest Atlantic DPS as endangered (75 FR 12598, March 16, 2010).

There are five identified nesting subpopulations in the Northwest Atlantic DPS – (1) Northern U.S. (Florida/Georgia border to southern Virginia); (2) Peninsular Florida (Florida/Georgia border south through Pinellas County, excluding the islands west of Key West, Florida); (3) Dry Tortugas (islands west of Key West, Florida); (4) Northern Gulf of Mexico (Franklin County, Florida, west through Texas); and (5) Greater Caribbean (Mexico through French Guiana, the Bahamas, Lesser and Greater Antilles). The Peninsular Florida nesting subpopulation is the largest loggerhead rookery in the Northwest Atlantic DPS (and the second largest in the world), followed by the Northern U.S., Northern Gulf of Mexico, and Dry Tortugas subpopulations (Ehrhart et al., 2003; Witherington et al., 2006a). The Peninsular Florida and Northern Gulf of Mexico sub-populations occur within the GOMEX Range Complex.

Habitat—The loggerhead turtle occurs worldwide in habitats ranging from coastal estuaries to waters far beyond the continental shelf (Dodd, 1988). The species may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. The shallow bays and sounds of the eastern Gulf of Mexico (*e.g.*, Chandeleur Sound, Mobile Bay, Escambia Bay, and Tampa Bay) likely serve as important developmental habitats for late juvenile loggerheads (Lohoefener *et al.*, 1990; USAF, 1996; Davis *et al.*, 2000). Juvenile loggerheads are also known to inhabit offshore waters in the Gulf of Mexico where they are often associated with artificial reefs and oil platforms (Fritts *et al.*, 1983; Davis *et al.*, 2000). These offshore habitats provide juveniles with an abundance of prey, as well as sheltered locations where they can rest (Rosman *et al.*, 1987). The feeding behavior of adult loggerhead turtles is more benthic-oriented so adults are more likely to be found in nearshore waters. The neritic zone not only provides crucial foraging habitat, but can also provide inter-nesting and overwintering habitat. Tagging data reveal that migratory routes may be coastal or may involve crossing deep ocean waters and an oceanic route may be taken even when a coastal route is an option (Schroeder *et al.*, 2003).

Distribution—Loggerhead turtles are found in subtropical and temperate waters throughout the world (NMFS and USFWS, 1991a). The population numbers in the thousands throughout inner continental shelf waters of the U.S. Atlantic and the Gulf of Mexico from southern Florida to southern Texas. Based on aerial survey data, it is estimated that only 12 percent of all western North Atlantic loggerheads reside in the eastern Gulf of Mexico and that the vast majority of these individuals occur in waters along the west coast of Florida (TEWG, 1998; Davis *et al.*, 2000). Loggerhead abundance in deeper continental slope waters of the eastern Gulf of Mexico increases during the winter, as the temperatures of inshore and nearshore waters approach the lower thermal limits of this species (Davis *et al.*, 2000).

A summary of the generally accepted life-history model for the species can be found in Musick and Limpus (1997), Bolten and Witherington (2003), and Hawkes *et al.* (2006). Hatchlings travel to oceanic habitats, often occurring in *Sargassum* drift lines (Carr, 1986, 1987; Witherington and Hirama, 2006). When juveniles reach sizes between 40 and 60 cm carapace length (about 14 yrs old), some individuals begin recruiting to the neritic zone (benthic habitat in shallow coastal waters). Other individuals may remain in the oceanic habitat or move between oceanic and neritic habitats (Musick and Limpus, 1997; Laurent *et al.*, 1998). Turtles either may utilize the same neritic developmental habitat all through maturation, or they may move among different areas and finally settle in an adult foraging habitat. At sexual maturity (about 30 yrs old), adults switch from subadult to adult neritic foraging habitats which may be closer to the nesting beach (Musick and Limpus, 1997; Godley *et al.*, 2003). In direct contrast with the accepted life-history model for this species, Hawkes *et al.* (2006) recently reported that tagging work at the Cape Verde Islands (Africa) revealed two distinct adult foraging strategies that appear to be linked to body size. The larger turtles foraged in coastal waters, whereas smaller individuals foraged oceanically. Likewise, off Japan, epipelagic foraging has been recorded for adult female loggerheads (Hatase *et al.*, 2002). Hawkes *et al.* (2006) also found that movements of adult loggerheads off Cape Verde were in part driven by local surface currents, with active movement by individuals to remain in areas of high productivity.

Loggerhead turtles nest almost exclusively in warm-temperate regions throughout the world and nesting in the tropics is uncommon (TEWG, 2000). Females typically nest on continental coastlines adjacent to warm-temperate currents. This pattern is evident along Alabama and western Florida coasts in the northern Gulf of Mexico that are adjacent to the Loop Current (Dodd, 1988). Much lower levels of loggerhead nesting have been recorded throughout coastal Texas, but primarily on North and South Padre Islands (Hildebrand, 1983).

GOMEX Range Complex Loggerhead Turtle Occurrence—Loggerhead turtles occur regularly in the Gulf of Mexico (DoN, 2007b). In general, loggerhead turtles can be found during all seasons in both continental shelf and slope waters of the GOMEX Range Complex. Loggerheads are the most often sighted and stranded species of sea turtle in the northern Gulf of Mexico throughout the year. Sighting and nesting surveys have demonstrated that the density and abundance of loggerhead turtles is much greater in the northeastern Gulf of Mexico than in the northwestern Gulf of Mexico (Fritts *et al.*, 1983; Landry and Costa, 1999; Davis *et al.*, 2000). Loggerhead turtles are occasionally associated with offshore oil platforms and banks in the western portion of the GOMEX Range Complex (Lohoefener *et al.*, 1990; Gitschlag and Herczeg, 1994) but are more often documented in association with natural and artificial reefs off of Florida (Rosman *et al.*, 1987; Davis *et al.*, 2000).

GOMEX Range Complex Loggerhead Turtle Density—The density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.8-1. Methods and results are detailed in the GOMEX NODE report (DoN, 2007a). Loggerhead abundance and density in the GOMEX Range Complex will be greater in the northeastern Gulf of Mexico than the northwestern Gulf of Mexico, mainly due to higher levels of loggerhead nesting along the coast of Florida. However, loggerheads may be found during all seasons in both the nearshore and offshore waters of the GOMEX Range Complex.

3.8.2.3 Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley is the smallest living sea turtle species. This species has a straight carapace length of approximately 60 to 70 cm (with shell length and width being nearly equal) and weigh about 45 kg (USFWS and NMFS, 1992; Gulko and Eckert, 2004). The carapace is rounded or somewhat heart-shaped and distinctly light gray.

Kemp's ridley turtles feed primarily on portunids and other types of crabs, but are also known to prey on mollusks, shrimp, fish, jellyfish, and plant material (Marquez-M., 1994; Frick *et al.*, 1999). Blue crabs and spider crabs are important prey species for the Kemp's ridley (Lutcavage and Musick, 1985; Keinath *et al.*, 1987; Seney and Musick, 2005). Kemp's ridleys may also feed on shrimp fishery bycatch (Landry and Costa, 1999).

Few data are available on maximum dive duration for Kemp's ridleys. Satellite-tagged juvenile Kemp's ridley turtles demonstrate different mean surface intervals and dive depths depending on whether the individual is located in shallow coastal areas (short surface intervals) or in deeper, offshore areas (longer surface intervals). Dive times range from a few seconds to a maximum of 167 min, with routine dives lasting between 16.7 and 33.8 min (Mendonça and Pritchard, 1986; Renaud, 1995). Renaud and Williams (2005) noted seasonal differences in dive durations, with longer dives (> 30 min) during the winter and dive duration of 15 min the remainder of the year. Sasso and Witzell (2006) reported longer dives at night than during the day for this species. Over a 12-hr period, Kemp's ridleys spend as long as 96 percent of their time submerged (Byles, 1989; Gitschlag, 1996; Renaud and Williams, 2005; Sasso and Witzell, 2006).

Status and Management—The Kemp's ridley turtle is classified as endangered under the ESA and is considered the world's most endangered sea turtle species (USFWS and NMFS, 1992). The worldwide population declined from tens of thousands of nesting females in the late 1940s to approximately 300 nesting females in 1985 (TEWG, 2000). From 1985 to 1999, the number of nests at Rancho Nuevo, Tamaulipas (eastern coast of Mexico), increased at a mean rate of 11.3 percent per year (TEWG, 2000). Positive trends in 2005 were recorded in Rancho Nuevo, Tamaulipas (6,947 nests), Barra del Tordo (701 nests), and Barra de Tepehuajes (1,610 nests) (USFWS, 2005). Nesting levels at Padre Island National Seashore in Texas, the site of a Kemp's ridley head-starting and imprinting program from 1978 to 1988, show a slow but steady rise throughout time (Shaver and Wibbels, 2007).

Habitat—Kemp's ridley turtles occur in open-ocean and *Sargassum* habitats of the North Atlantic Ocean as post-hatchlings and small juveniles (Manzella *et al.*, 1991; Witherington and Hirama, 2006). They move as large juveniles and adults to benthic, nearshore feeding grounds along the U.S. Atlantic and Gulf of Mexico coasts (Morreale and Standora, 2005). Habitats frequently utilized include warm-temperate to subtropical sounds, bays, estuaries, tidal passes, shipping channels, and beachfront waters where preferred food, including the blue crab, occurs (Lutcavage and Musick, 1985; Landry and Costa, 1999; Seney and Musick, 2005). Models indicate that the most suitable habitats are less than 10 m in bottom depth with sea surface temperatures between 22° and 32°C (Coyne *et al.*, 2000). Seagrass beds and mud bottom, as well as live bottom, are important developmental habitats (Schmid and Barichivich, 2006). Postnesting Kemp's ridleys travel along coastal corridors generally shallower than 50 m in bottom depth (Morreale *et al.*, 2007). In the western Gulf of Mexico, the coastal waters off western Louisiana and eastern Texas provide preferred habitats for benthic feeding (Landry *et al.*, 1996). Renaud (1995) discovered that an adult Kemp's ridley turtle may travel along the entire Gulf of Mexico coast of the U.S. while looking for optimal foraging habitat.

Distribution—Kemp's ridley turtles are restricted to the North Atlantic Ocean (Marquez-M., 1994). They occur primarily in the Gulf of Mexico and in moderate numbers along the U.S. northeast coast to Nova Scotia, Canada (Lazell, 1980; Morreale *et al.*, 1992). Oceanic transport of post-hatchling Kemp's ridley turtles is primarily controlled by the hydrography in the Gulf of Mexico (Collard, 1990a). Some juveniles are probably retained in the northern Gulf of Mexico until they migrate inshore and become demersal (*i.e.*, bottom-dwelling). Others may be swept out of the Gulf of Mexico by the Loop and Florida Currents and are then carried north along the U.S. Atlantic coast by the Gulf Stream (Collard and Ogren, 1990). Juveniles migrate to developmental habitats on the U.S. Atlantic continental shelf

when they reach a size of approximately 20 to 30 cm (Lazell, 1980; Lee and Palmer, 1981; Lutcavage and Musick, 1985; Barnard *et al.*, 1989; Weber, 1995). Adults appear to remain in the Gulf of Mexico, with an occasional occurrence in the Atlantic Ocean (Weber, 1995).

Nesting primarily occurs on a single beach at Rancho Nuevo, Tamaulipas, Mexico, although additional nesting activity has been documented in Texas, Alabama, Florida, South Carolina, and North Carolina (Meylan *et al.*, 1990; USFWS and NMFS, 1992; Weber, 1995; Foote and Mueller, 2002; Phillips, 2005). Kemp's ridley turtles that nest in south Texas are likely a mixture of returnees from a head-start project and the wild stock (Shaver and Caillouet, 1998). In the 2006 nesting season, 101 Kemp's ridley nests were found on the Texas coast (NPS, 2006). This exceeds the previous record of 51 nests on Texas beaches in 2005 (NPS, 2006).

GOMEX Range Complex Kemp's Ridley Turtle Occurrence—Kemp's ridley turtles occur regularly in the Gulf of Mexico. Kemp's ridley turtles may occur in shallow (< 50 m) continental shelf waters of the northern Gulf of Mexico year-round. Tidal passes and beachfront environments are their most preferred habitats in this region (Landry and Costa, 1999). Although few sighting records are recorded for winter and spring, the number of stranding, nesting, and fisheries bycatch records for these seasons confirms the species' year-round presence throughout the nearshore waters of the northern Gulf. The low number of sighting records is likely due to low survey effort and poor sightability of this species rather than lack of animals. Kemp's ridley turtles are very difficult to sight during aerial and shipboard surveys, especially during times of the year when sighting conditions are not optimal (Shoop and Kenney, 1992; Keinath *et al.*, 1996). It is likely that Kemp's ridley turtles may occur in all waters of the GOMEX Range Complex during the year, particularly in the inner shelf waters.

GOMEX Range Complex Hardshell Turtle Density— The density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.8-1. Methods and results are detailed in the GOMEX NODE report (DoN, 2007a). Kemp's ridley turtles are known to nest along the coast of Mexico and Texas. Kemp's ridleys also utilize nearshore waters throughout the year as foraging habitat. Therefore Kemp's ridley density will be greatest in nearshore waters of the western Gulf of Mexico throughout the year. However, they may occur in nearshore waters (< 50m) throughout the entire Gulf of Mexico year round.

3.8.2.4 Green Turtle (*Chelonia mydas*)

The green turtle is the second largest hard-shelled sea turtle in the Atlantic Ocean and the Gulf of Mexico; adults commonly reach 100 cm in carapace length and 150 kg in mass (NMFS and USFWS, 1991b). Adult carapaces range in color from solid black to gray, yellow, green, and brown in muted to conspicuous patterns; the plastron is a much lighter yellow to white. Hatchlings are distinctively black on the dorsal surface and white on the ventral.

Very young green turtles are preferentially carnivorous (Bjorndal, 1985; 1997). Salmon *et al.* (2004) reported that posthatchling green turtles were found to feed near the surface on floating turtle grass (*Thalassia* spp.) and *Sargassum* spp. or at shallow depths on ctenephores and unidentified gelatinous eggs but ignored large jellyfish (*Aurelia* spp.) off southeastern Florida. Adult green turtles feed primarily on seagrasses (*e.g.*, turtle grass, manatee grass, shoal grass, and eelgrass), macroalgae, and reef-associated organisms (Burke *et al.*, 1992; Bjorndal, 1997). They also consume jellyfish, salps, and sponges (Mortimer, 1995; Bjorndal, 1997).

Green turtles typically make dives shallower than 30 m (Hays *et al.*, 1999; Hochscheid *et al.*, 1999; Hays *et al.*, 2000; Godley *et al.*, 2002; Hatase *et al.*, 2006). Green turtles are known to forage and also rest at depths of 20 to 50 m (Balazs, 1980; Brill *et al.*, 1995).

Status and Management—Green turtles worldwide are classified as threatened, with the Florida and Mexican Pacific coast nesting populations listed as endangered under the ESA. There is designated critical habitat for this species in the coastal waters around Culebra Island, Puerto Rico (NMFS, 1998c). There is no estimate of the total number of green turtles in the Gulf of Mexico (NMFS and USFWS, 1991b). From 1989 to 2003, green turtle nesting along the coast of Florida showed a gradual increase (FMRI-FFWCC, 2004).

Habitat—Post-hatchling and early juvenile green turtles reside in open ocean convergence zones where they spend an undetermined amount of time in the pelagic environment (Carr, 1987; Witherington and Hirama, 2006). Once green turtles reach a carapace length of 20 to 25 cm, they migrate to shallow nearshore areas (< 50 m deep) where they spend the majority of their lives (Bjorndal and Bolten, 1988; NMFS and USFWS, 1991b; Ernst *et al.*, 1994). The optimal developmental habitats for foraging juveniles and adults are warm, shallow waters (3 to 5 m in bottom depth) located close to nearshore reefs or rocky areas with an abundance of submerged aquatic vegetation (Holloway-Adkins and Provancha, 2005; Witherington *et al.*, 2006b). In the Gulf of Mexico region, the preferred habitats of green turtles are located primarily along the coasts of southwestern Florida and southern Texas (Landry and Costa, 1999).

Distribution— The green turtle has a circumglobal distribution, occurring throughout tropical and, to a lesser extent, subtropical waters (Seminoff and MTSG, 2004). In U.S. Atlantic waters, green turtles may be found around the U.S. Virgin Islands (USVI), Puerto Rico, and the continental U.S. from Texas to Massachusetts (NMFS and USFWS, 1991b). Most sightings of individuals north of Florida are juveniles and occur during the warmest parts of the year (late spring to early fall) (Lazell, 1980; Burke *et al.*, 1992; Epperly *et al.*, 1995a).

As they grow, most green turtles move through a series of developmental feeding habitats, which are often separated by thousands of miles (Hirth, 1997). Adult green turtles are also known to undertake long migrations, the longest of which are between their foraging habitats and nesting beaches. The major Atlantic nesting colonies are located at Ascension Island (in the South Atlantic Ocean, about mid-way between South America and Africa), Aves Island (in the Caribbean Sea, about 180 km west of Guadalupe), and on the beaches of Costa Rica and Suriname (in central and South America, respectively) (NMFS and USFWS, 1991b). Most nesting in the Gulf of Mexico region occurs along the southern Florida and Mexican beaches, with scattered records from the Florida Panhandle, Alabama, and Texas (NMFS and USFWS, 1991b; Meylan *et al.*, 1995; USAF, 1996). The greatest concentration of nesting activity in the vicinity of the GOMEX Range Complex occurs in Monroe County, Florida, which includes most of the Florida Keys and the Dry Tortugas (Meylan *et al.*, 1995). Green turtles rank second behind loggerheads in the number of nests laid on U.S. beaches per year (Dodd, 1995; Meylan *et al.*, 1995).

GOMEX Range Complex Green Turtle Occurrence—Green turtles occur regularly in the Gulf of Mexico. In the northern Gulf of Mexico, they are most likely to reside in inshore waters (*e.g.*, lagoons, channels, inlets, and bays) where seagrass beds and macroalgae are abundant. These areas include Texas's Laguna Madre and most of Florida's Gulf coast estuaries, such as Pensacola Bay, St. Joseph Bay, Tampa Bay, and Charlotte Harbor. Green turtles may occur in outer continental shelf (OCS) waters of the Gulf of Mexico during reproductive or developmental migrations. Suitable nesting beaches are located throughout the region, from the shores of northern Mexico and southern Texas in the western Gulf of Mexico to southern Florida and the Florida Panhandle in the eastern Gulf of Mexico.

GOMEX Range Complex Hardshell Turtle Density— The density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.8-1. Methods and results are detailed in the GOMEX NODE report (DoN, 2007a). Density estimates for

green turtles are expected to be higher in nearshore and inshore waters of the Gulf of Mexico than deeper waters. Green turtles utilize nearshore seagrasses for foraging habitat and are known to nest throughout the GOMEX Range Complex.

3.8.2.5 Hawksbill Turtle (*Eretmochelys imbricata*)

The hawksbill turtle is a small to medium-sized turtle; adults range between 65 and 90 cm in carapace length and typically weigh around 80 kg (Witzell 1983). Hawksbills are distinguished from other sea turtles on the basis of their hawk-like beaks, posteriorly overlapping carapace scutes, and two pairs of claws on their flippers (NMFS and USFWS, 1993).

Post-hatchlings and early juveniles are believed to utilize *Sargassum* spp. habitats, but little is known about their diets during this stage (Witzell, 1983). Hawksbills are considered to be omnivorous during the later juvenile stage, feeding on encrusting organisms such as sponges, tunicates, bryozoans, algae, mollusks, and a variety of other items such as crustaceans and jellyfish (Bjorndal, 1997). Older juveniles and adults are more specialized, feeding primarily on sponges, which comprise as much as 95 percent of their diet in some locations (Witzell, 1983; Meylan, 1988).

Hawksbills may have one of the longest routine dive times of all the sea turtles. Starbird *et al.* (1999) reported that inter-nesting females at Buck Island, USVI, averaged 56.1 min dives with a maximum dive time of 73.5 min. Storch *et al.* (2006) reported mean dive times of 57.3 min in the USVI before a hurricane and 42 min during the hurricane. Data from time-depth recorders indicate that foraging dives of immature hawksbills in Puerto Rico range from 8.6 to 14 min in duration, with a mean depth of 4.7 m (Van Dam and Diez, 1996). These individuals were found to be most active during the day. Changes in water temperature have an effect on the behavioral ecology of hawksbill turtles, with an increase in nocturnal dive duration when water temperatures decrease during the winter (Storch *et al.*, 2005).

Status and Management—Hawksbill turtles are classified as endangered under the ESA and are second only to the Kemp's ridley in terms of endangerment (NMFS and USFWS, 1993; Bass, 1994). There is designated critical habitat for the species in the Caribbean that includes the waters surrounding Mona and Monito islands, Puerto Rico (NMFS and USFWS, 1998b). There are approximately 3,072 – 5,603 nesting females within the Atlantic Ocean (insular Caribbean, western Caribbean, southwestern Atlantic, and Eastern Atlantic) (NMFS and USFWS, 2007). In U.S. waters, hawksbill populations are noted as neither declining nor showing indications of recovery (Plotkin, 1995). Only five regional populations worldwide remain with more than 1,000 females nesting annually (Seychelles, Mexico, Indonesia, and two in Australia) (Meylan and Donnelly, 1999). Little is known about the status of this species in the Gulf of Mexico (Dodd, 1995).

Habitat—Hawksbill turtles inhabit oceanic waters as post-hatchlings and small juveniles, where they are sometimes associated with driftlines and floating patches of *Sargassum* spp. (Parker, 1995; Witherington and Hirama, 2006). The developmental habitats for juvenile benthic-stage hawksbills are the same as the primary feeding grounds for adults. They include tropical, nearshore waters associated with coral reefs, hard bottoms, or estuaries with mangroves (Musick and Limpus, 1997). Coral reefs are optimal hawksbill habitat for juveniles, sub-adults, and adults (NMFS and USFWS, 1993; Diez and Van Dam, 2003). In neritic habitats, resting areas for late juvenile and adult hawksbills are typically located in deeper waters, such as sandy bottoms at the base of a reef flat (Houghton *et al.*, 2003). Late juveniles generally reside on shallow reefs less than 18 m deep; however, as they mature into adults, hawksbills move to deeper habitats and may forage to depths greater than 90 m. Benthic-stage hawksbills are seldom found in waters beyond the continental or insular shelf, unless they are in transit between distant foraging and nesting grounds (NMFS and USFWS, 1993).

Distribution—Hawksbill turtles are circum-tropical in distribution, generally occurring from 30°N to 30°S within the Atlantic, Pacific, and Indian oceans (Witzell, 1983). In the Atlantic Ocean, this species is found throughout the Gulf of Mexico, the Greater and Lesser Antilles, and southern Florida, as well as along the mainland of Central America south to Brazil (NMFS and USFWS, 1993). The hawksbill is rare north of Florida (Lee and Palmer, 1981; Keinath *et al.*, 1991; Parker, 1995; Plotkin, 1995). Originally thought to be a non-migratory species, due to the close proximity of suitable nesting beaches to coral reef feeding habitats and high rates of local recapture, hawksbills are now known to travel long distances over the course of their lives (Meylan, 1999).

Other than the olive ridley, the hawksbill has the fewest reports of individuals in the Gulf of Mexico (Hildebrand, 1983), and Florida is the only state where hawksbills are sighted with any regularity (NMFS and USFWS, 1993). Stranded hawksbills that are reported in Texas tend to be either hatchlings or yearlings (Hildebrand, 1983; Amos, 1989). Hawksbill turtles that strand in Texas are believed to originate from nesting beaches in Mexico (Landry and Costa, 1999), carried by northerly currents away from their natal beaches northward into Texas (Amos, 1989; Collard and Ogren, 1990).

Hawksbills tend to nest in multiple, small, scattered colonies, with the most significant nesting in the western North Atlantic Ocean occurring along the Yucatan Peninsula, Mexico. An estimated 1,900 to 4,300 adult females comprise the Mexican Atlantic nesting population (Garduño-Andrade *et al.*, 1999). Hawksbill nesting within the continental U.S. is restricted to beaches in southern Florida and the Florida Keys, although even in these locations nesting is extremely rare (Dodd, 1995); however, hawksbill nesting in these areas may be underestimated due to the masking effects of thousands of loggerheads nesting along the same stretches of beach (Lund, 1985).

GOMEX Range Complex Hawksbill Turtle Occurrence—Hawksbill turtles occur regularly in the Gulf of Mexico. Like the green turtle, the hawksbill primarily inhabits shallow, nearshore waters off southern Florida. Small numbers of hawksbill occurrences are documented from winter to summer from southeastern Florida (Palm Beach, Broward, and Dade Counties) through the Florida Keys to coastal waters just northwest of Tampa Bay, where the northernmost stranding records occur, but the greatest number of hawksbill turtles is found off southern Florida in fall. Small populations of foraging juveniles and adults should recruit to coral reef and hard bottom habitats off southern Florida throughout the year. Further north and west, hawksbills are rarely observed in waters off the Florida Panhandle, Alabama, Mississippi, Louisiana, and Texas (Rabalais and Rabalais, 1980; Witzell, 1983; Rester and Condrey, 1996). Hawksbill sightings in these areas likely involve early juveniles that are born on nesting beaches in Mexico and have drifted north with the dominant currents (Landry and Costa, 1999). Aside from documentations of early juveniles associated with *Sargassum* mats and long-distance tag returns from migrating adult females, scientists know relatively little about the offshore distribution of this species in the GOMEX Range Complex.

GOMEX Range Complex Hardshell Turtle Density— The density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.8-1. Methods and results are detailed in the GOMEX NODE report (DoN, 2007a). Hawksbill turtle densities are expected to be higher in nearshore waters off southern Florida than the rest of the Gulf of Mexico. Hawksbills utilize the nearshore habitats for foraging, especially coral reefs and hard bottom habitats.

3.8.2.6 Olive Ridley Turtle (*Lepidochelys olivacea*)

The olive ridley is a small, hard-shelled sea turtle named for its olive green colored shell. Adults often measure between 60 and 70 cm in carapace length (NMFS and USFWS, 1998c). The olive ridley has a smaller head, a narrower carapace, and several more lateral carapace scutes than its relative, the Kemp's

ridley turtle. The olive ridley turtle eats a variety of benthic and pelagic prey items, with crustaceans and fish serving as their main food source (NMFS and USFWS, 1998c).

Status and Management—Olive ridleys are classified as threatened under the ESA, although the Mexican Pacific coast population is classified as endangered. Since listing under the ESA, a general decline in the abundance of this species has occurred (NMFS and USFWS, 1998c). For example, nesting populations in the western North Atlantic Ocean have declined more than 80 percent since 1967 (Reichart, 1993); however, in terms of absolute numbers, the olive ridley is considered the most abundant of the world's sea turtles, although there are no current estimates of worldwide abundance.

Habitat—Olive ridley turtles typically inhabit offshore waters, foraging either at the surface or at depth (up to 150 m). The habitat preferences of the olive ridley more closely parallel those of the leatherback sea turtle rather than those of its relative, the Kemp's ridley (NMFS and USFWS, 1998c). Olive ridleys and leatherbacks occupy oceanic habitats and nest primarily on the Pacific shores of the American tropics and in the Atlantic along the shores of the Guiana's. Both species also nest in moderate numbers in tropical West Africa and southern Asia and in relatively small numbers elsewhere.

Distribution—The olive ridley sea turtle is a pantropical species, occurring worldwide in tropical and warm temperate waters. In the Atlantic Ocean, the olive ridley occurs along the coasts of both Africa and South America but probably not in great abundance. Atlantic olive ridleys nest primarily in the French Guiana, Surinam, and Guyana; however, they are rarely found in the Caribbean Sea and have been documented in Puerto Rico, the Dominican Republic, and Cuba (Foley *et al.*, 2003). There does not appear to be overlap in the distribution of the olive ridley and its congener, the Kemp's ridley (Pritchard, 2007), within the Gulf of Mexico as the only documented cases of olive ridley's in the Gulf of Mexico come from the Florida Keys (Foley *et al.*, 2003).

GOMEX Range Complex Olive Ridley Turtle Occurrence—There are no olive ridley sighting records available for the GOMEX Range Complex. Only three occurrences have ever been documented in the vicinity of the GOMEX Range Complex, all of which are strandings. Originally identified as Kemp's ridley turtles, these individuals were later reclassified as olive ridleys following a review of photographic data and comparison of genetic samples (Foley *et al.*, 2003). These three stranding records represent the northernmost known occurrences of olive ridleys in the northwestern Atlantic Ocean and should, therefore, be considered extralimital. In the western North Atlantic, the species' center of distribution is located several thousands of kilometers to the south along the north coast of South America.

GOMEX Range Complex Hardshell Turtle Density— The density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.8-1. Methods and results are detailed in the GOMEX NODE report (DoN, 2007a). Density estimates for olive ridleys in the Gulf of Mexico should be extremely low. Olive ridleys are not expected to occur within the GOMEX Range Complex as only 3 occurrences have ever been documented within the area.

3.8.2.7 Leatherback Turtle (*Dermochelys coriacea*)

The leatherback turtle is the largest living sea turtle. Mature males and females can be as long as 2 m curved carapace length (CCL) (NMFS and USFWS, 1992). Specimens less than 145 cm CCL are considered to be juveniles (NMFS-SEFSC, 2001; Eckert, 2002). Adult leatherbacks weigh between 200 and 700 kg (NMFS and USFWS, 1992), although larger individuals are documented (Eckert and Luginbuhl, 1988). A leatherback's carapace is composed of a flexible layer of dermal bones underlying tough, oily connective tissue and smooth skin. The body is barrel-shaped and tapered to the rear with seven longitudinal dorsal ridges and is almost completely black with variable spotting.

Leatherbacks feed throughout the epipelagic and into the mesopelagic zones of the water column (Davenport, 1988; Eckert *et al.*, 1989; Grant and Ferrell, 1993; Salmon *et al.*, 2004; James *et al.*, 2005a). Prey is predominantly gelatinous zooplankton such as cnidarians (jellyfish and siphonophores) and tunicates (salps and pyrosomas) (NMFS and USFWS, 1992; Grant and Ferrell, 1993; Bjorndal, 1997; James and Herman, 2001; Salmon *et al.*, 2004).

The leatherback is the deepest diving sea turtle with a recorded maximum depth of 1,230 m (Hays *et al.*, 2004a), although most dives are much shallower (usually less than 200 m) (Hays *et al.*, 2004a; Sale *et al.*, 2006). Leatherbacks spend the majority of their time in the upper 65 m of the water column regardless of their behavior (Jonsen *et al.*, 2007). The aerobic dive limit for the leatherback turtle is estimated between 33 and 67 min (Southwood *et al.*, 1999; Hays *et al.*, 2004b; Wallace *et al.*, 2005). Leatherbacks dive deeper and longer in the lower latitudes versus the higher (south versus the north) (James *et al.*, 2005b). In northern waters, they are also known to dive to waters with temperatures just above freezing (James *et al.*, 2006; Jonsen *et al.*, 2007). James *et al.* (2006) noted considerable variability in surface time, both within and among leatherbacks. Dives in the north are punctuated by longer surface intervals (equating to much more time spent at the surface per 24-hr period), with individuals spending up to 50 percent of their time at or near the surface in northern foraging areas, perhaps in part to thermoregulate (*i.e.*, bask).

Status and Management—Leatherback turtles are classified as endangered under the ESA. Critical habitat for leatherbacks is designated in the Caribbean at Sandy Point, St. Croix, USVI (NMFS, 1979). A review is currently underway by NMFS to revise critical habitat designation for the leatherback turtle to possibly include additional habitat on the west coast of the U.S. There are an estimated 20,000 to 30,000 leatherbacks in the North Atlantic Ocean (Coren, 2000). The worldwide population of leatherbacks in 1995 was approximately 34,500 nesting females, with confidence limits of 26,200 to 42,900 (Spotila *et al.*, 1996). Nesting populations in southern Florida; Culebra, Puerto Rico; and the USVI are believed to be increasing due to heightened protection and monitoring of the nesting habitat over the past 20 years (Hillis-Starr *et al.*, 1998; Fleming, 2001; FFWCC-FMRI, 2004).

Habitat—Throughout their lives, leatherbacks are essentially oceanic, yet they enter into coastal waters for foraging and reproduction. There is limited information available regarding the habitats utilized by post-hatchling and early juvenile leatherbacks as these age classes are entirely oceanic (NMFS and USFWS, 1992). These life stages are restricted to waters greater than 26°C and, therefore, spend much time in tropical waters (Eckert, 2002). Late juvenile and adult leatherback turtles are known to range from mid-ocean to the continental shelf and nearshore waters (Schroeder and Thompson, 1987; Shoop and Kenney, 1992; Grant and Ferrell, 1993; Epperly *et al.*, 1995a,b). Juvenile and adult foraging habitats include both coastal feeding areas in temperate waters and offshore feeding areas in tropical waters (Frazier, 2001). Adults may also feed in cold waters at high latitudes (James *et al.*, 2006). The movements of adult leatherbacks appear to be linked to the seasonal availability of their prey and the requirements of their reproductive cycle (Collard, 1990b; Davenport and Balazs, 1991; Luschi *et al.*, 2006). The overall densities of leatherbacks in the eastern Gulf of Mexico on the shelf and on the slope were similar (Davis *et al.*, 2000). It has been suggested that the region from the Mississippi Canyon east to DeSoto Canyon is an important feeding habitat for leatherbacks (Davis and Fargion, 1996). Large numbers of leatherbacks have been sighted off the U.S. Gulf coast in association with concentrations of jellyfish (Leary, 1957; Shoop and Kenney, 1992).

Distribution—The leatherback turtle is distributed circumglobally in tropical, subtropical, and warm-temperate waters throughout the year and into cooler temperate waters during warmer months (NMFS and USFWS, 1992; James *et al.*, 2005c) as far north as Nova Scotia, Newfoundland, Labrador, Iceland, the British Isles, and Norway (Bleakney, 1965; Brongersma, 1972; Threlfall, 1978; Goff and Lien,

1988). The leatherback is the most oceanic and wide-ranging of sea turtles, undertaking extensive migrations along distinct depth contours for hundreds to thousands of kilometers (Morreale *et al.*, 1996; Hughes *et al.*, 1998). Adult leatherback turtles forage in temperate and subpolar regions in all oceans and migrate to tropical nesting beaches between 30°N and 20°S.

Leatherback nesting in the northwestern Atlantic Ocean occurs on isolated, coarse-grained mainland beaches in subtropical and tropical latitudes (USFWS and NMFS, 1992), and to a lesser degree on some islands, such as the Greater and Lesser Antilles. Nesting occurs along the coasts of South, Central, and North America from Brazil to the southeastern U.S. and throughout the West Indies, with significant nesting occurring in French Guiana, Suriname, and Costa Rica (Ernst *et al.*, 1994). Along the U.S. Atlantic and Gulf of Mexico coasts, leatherback turtle nesting occurs primarily on the beaches of Florida, with sporadic nesting occurring in Georgia, South Carolina, and as far north as North Carolina (USFWS and NMFS, 1992; Rabon *et al.*, 2003). Once the nesting season is complete, most leatherbacks leave the waters adjacent to their nesting beaches and travel to feeding grounds in more temperate waters.

GOMEX Range Complex Leatherback Turtle Occurrence—Leatherback turtles occur regularly in the Gulf of Mexico. Overall, the leatherback turtle is the most oceanic of all sea turtle species occurring in the GOMEX Range Complex. Leatherbacks use the deep, offshore waters of the GOMEX Range Complex (especially waters in the vicinity of DeSoto Canyon) for feeding, resting, and as migratory corridors (Landry and Costa, 1999; Davis *et al.*, 2000). Leatherbacks may also occur in shallow waters on the continental shelf and have been observed feeding on dense aggregations of jellyfish in nearshore waters off the Florida Panhandle, the Mississippi River Delta, and the Texas coast (Leary, 1957; Collard, 1990b; Lohoefener *et al.*, 1990). Leatherbacks may also enter the nearshore waters of the northern Gulf of Mexico to nest. In recent years, low levels of nesting activity have been documented on both Florida Panhandle and south Florida beaches (LeBuff, 1990; Meylan *et al.*, 1995).

GOMEX Range Complex Leatherback Turtle Density— The density estimates for training areas where explosive ordnance use may occur in the GOMEX Range Complex are provided in Table 3.8-1. Methods and results are detailed in the GOMEX NODE report (DoN, 2007a). The leatherback turtle is the most oceanic of all sea turtle species. They may occur in shallow waters but will generally be found in greater concentrations in deeper, offshore waters. Densities are expected to be greater in offshore waters unless large aggregations of jellyfish are found in nearshore waters or leatherbacks are nearshore for nesting purposes.

3.8.3 Environmental Consequences

3.8.3.1 Explosive Ordnance Exposure Analysis

The exercises that use explosives are BOMBEX (BOMBEX Hotbox), MINEX (Panama City and Corpus Christi UNDET Areas), small arms training with anti-swimmer grenades (UNDET Area E3) and diver training (Demolition Pond). Table 2.2-9 summarizes the number of events per year and specific areas where each occurs for each type of explosive ordnance used. Events can take place at any time of year and can be assumed to be evenly distributed across all four seasons.

Summary of Thresholds and Criteria for Sea Turtles

Documentation of PTS or TTS in sea turtles is extremely scarce; limited to scattered, solitary records that would be difficult to extrapolate to a population-wide generality. However, it is assumed that acoustic exposure may elicit a physiological or behavioral response (startle) to detonations. Presumably the same broad categories of responses that were examined for marine mammals may also apply here to sea turtles (See Section 3.7.3.1). Few experiments have been conducted to attempt to quantify explosive exposures on turtles; and unfortunately, the methods of these experiments do not allow for their results

to be analyzed due to the fact that sound exposure levels were not recorded or modeled in situ. Navy analysts have compared the injury levels reported by the best of these experiments to the injury levels that would be predicted using the modified Goertner method (Goertner, 1982). For this assessment, in the absence of criteria specifically set for sea turtles, the criteria for marine mammals, as established in the Churchill FEIS (DoN, 2001), are used to estimate potential exposures for turtles. Non-injurious effects are determined by either the dual physiological criteria for single detonations or by the behavioral criterion for multiple detonations. The criterion for behavioral disturbance used in this analysis is based on use of multiple explosives that only take place during a BOMBEX event (MK-82 or MK-83 bombs) or small arms training event (anti-swimmer grenades). Table 3.8-4 shows the criteria used in the assessment for impulsive sounds for sea turtles. Section 3.7.3.2 provides a more detailed explanation for each criteria level, metric, and threshold for small explosives and a full explanation of the acoustic affects analysis.

TABLE 3.8-4
EFFECTS, CRITERIA, AND THRESHOLDS FOR IMPULSIVE SOUNDS

Effect	Criterion	Metric	Threshold
Mortality	Onset of Extensive Lung Injury	Goertner modified positive impulse	indexed to 30.5 psi-msec (assumes 100% small animal at 26.9 lbs)
Injurious Physiological	50% Tympanic Membrane Rupture (PTS)	Energy flux density	1.17 in-lb/in^2 (about 205 dB re 1 μPa^2-sec)
Injurious Physiological	Onset Slight Lung Injury	Goertner modified positive impulse	indexed to 13 psi-msec (assumes 100% small animal at 26.9 lbs)
Non-Injurious Physiological	Temporary Threshold Shift (TTS)	Greatest energy flux density level in any 1/3-octave band (above 100 Hz for toothed whales/sea turtles and above 10 Hz for baleen whales) - for total energy over all exposures	182 dB re 1 μPa^2-sec
Non-Injurious Physiological	TTS	Peak pressure over all exposures	23 psi
Non-Injurious Behavioral	Behavioral Sub-TTS	Greatest energy flux density level in any 1/3-octave (above 100 Hz for sea turtles) - for total energy over all exposures (multiple explosions only)	177 dB re 1 μPa^2-sec

Acoustic Effects Analysis

Section 3.7.3.2 for marine mammals outlines the analysis and also applies here to sea turtles. In addition, a more in-depth effects analysis discussion can be found in Appendix J.

3.8.3.2 No Action Alternative

Vessel Movements

Overview

The No Action Alternative includes vessel movements. These involve transit to and from port to the various components of the GOMEX Range Complex (*e.g.*, OPAREAs, UNDET Area E3, Harbor Security Group Machine Gun Area), as well as vessel movements into, within, and through these distinct components. Vessel movements have the potential to affect sea turtles by directly striking or disturbing individual animals. The probability of vessel and sea turtle interactions occurring in the GOMEX Range Complex is dependent upon several factors including numbers, types, and speeds of vessels; the regularity, duration, and spatial extent of operations; the presence/absence and density of sea turtles; and protective measures implemented by the Navy. Currently, the number of Navy vessels operating in the GOMEX Range Complex varies based on training schedules and can range from 0 to about 10 vessels at any given time. Vessel sizes range from small boats (<35 ft) for a harbor security boat to 1,092 ft for a nuclear aircraft carrier (CVN). Operations involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to 2 weeks. These operations are widely dispersed throughout the waters of the GOMEX Range Complex, which is an area encompassing 11,714 nm^2. Some training operations are strictly vessel movements, such as Man Overboard Drills, Tow/Be Towed Exercises, Underway Replenishment, Aircraft Carrier Flight Operations, and use of the transit lanes by submarines when surfaced; these types of operations are all analyzed under the impacts from vessel movement. The proposed action also includes non-training related vessel movements which are unpredictable as to their occurrence in a year such as, but not limited to, storm evasion, deployment transits, and movements in the basin to rearrange for repairs/berthing/loading/off-loading from designated piers. Most vessel movements occur in the offshore OPAREAs, but vessel movements associated with MESG training in UNDET Area E3 and Commander Naval Installations Command (CNIC) harbor security group training in the Panama City OPAREA occur between shore and 12 nautical miles (nm), including the nearshore zone (<3 nm).

During training, speeds generally range from 10 to 14 knots; however, ships/craft can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. It is necessary for vessels/craft to operate at higher speeds during specific events, such as, but not limited to, pursuing and overtaking hostile vessels, evasive maneuvers, and maintenance/ performance checks, such as ship trials. During these types of events ships may often operate at high speeds (high end of the vessel's speed capability). In all cases, the vessels/craft will be operated in a safe manner consistent with the local conditions.

Also, it should be noted that a variety of smaller craft, such as service vessels for routine operations and opposition forces used during training events will be operating within the study area. Small craft types, sizes and speeds vary. The Navy's rigid hull inflatable boat (RHIB) is one representative example of a small craft that may be used during training exercises. By way of example, the Naval Special Warfare RHIB is 35 feet in length and has a speed of 40+ knots. Other small craft, such as those used in maritime security training events, are of similar length and speed to the RHIB and often resemble, and often are, recreational fishing boats (*i.e.*, a 30 - 35 foot center console boat with twin outboard engines).

Vessel movement within the GOMEX Range Complex is quantified as the number of steaming days per year by summing the number of steaming hours proposed, dividing by 24 hours per day, and rounding to the nearest 10 days. The Navy logs about 180 total vessel days within the waters of the GOMEX Range Complex during a typical year.

Disturbance Associated with Vessel Movements

The ability of turtles to detect approaching vessels via auditory and/or visual cues would be expected based on knowledge of their sensory biology (Bartol *et al.*, 2002; Bartol and Musick, 2003; Levenson *et al.*, 2004; Ketten and Bartol, 2006; Moein Bartol and Ketten, 2006). Little information is available on how turtles respond to vessel approaches. Hazel *et al.* (2007) reported that greater vessel speeds increased the probability turtles would fail to flee from an approaching vessel. Turtles fled frequently in encounters with a slow-moving (2.2 kt) vessel but infrequently in encounters with a moderate-moving (5.9 kt) vessel and only rarely in encounters with a fast-moving (10.3 kt) vessel. It is difficult to differentiate whether a sea turtle reacts to a vessel due to the produced sound, the presence of the vessel itself, or a combination of both.

Sea turtle hearing sensitivity is not well studied. Several studies using green, loggerhead, and Kemp's ridley turtles suggest sea turtles are most sensitive to low-frequency sounds, although this sensitivity varies slightly by species and age class (Ridgway *et al.*, 1969; Lenhardt *et al.*, 1994; Bartol, 1999; Ketten and Bartol, 2006). Sea turtles possess an overall hearing range of approximately 100 to 1,000 Hz, with an upper limit of 2,000 Hz (Ridgway *et al.*, 1969; Lenhardt *et al.*, 1994; Bartol, 1999; Ketten and Bartol, 2006). It is difficult to determine whether sea turtle response to vessel traffic is visual or auditory in nature. It is assumed sea turtles can hear approaching vessels based on their hearing range.

Hazel *et al.* (2007) found that sea turtles reacted to approaching vessels in a variety of ways. Benthic turtles launched upwards at a shallow angle and began swimming. The majority of the turtles swam away from the vessel while some swam along the vessel's track and some crossed in front of the vessel's track before swimming away. Sea turtle reaction time was greatly dependent on the speed of the vessel; sea turtles were able to react faster to slower moving vessels than to faster moving vessels. Sea turtle reactions to vessels elicited short-term responses.

Human disturbance to wild animals may elicit similar reactions to those caused by natural predators (Gill *et al.*, 2001; Beale and Monaghan, 2004). Behavioral responses may also be accompanied by a physiological response (Romero, 2004) although this is very difficult to study in the wild. Immature Kemp's ridley turtles have shown physiological responses to the acute stress of capture and handling through increased levels of corticosterone (Gregory and Schmid, 2001). In the short term, exposure to stressors results in changes in immediate behavior (Frid, 2003). For turtles, this can include intense behavioral reactions such as biting and rapid flipper movement (Gregory and Schmid, 2001). Repeated exposure to stressors, including human disturbance such as vessel disturbance and anthropogenic sound, can result in negative consequences to the health and viability of an individual or population (Gregory and Schmid, 2001). Although this study related to natural induced stressors, similar physiological changes may result from other types of stressors such as anthropogenic disturbance. Chronic stress can result in decreased reproductive success (Lordi *et al.*, 2000; Beale and Monaghan, 2004), decreased energy budgets (Frid, 2003), displacement from habitats (Sutherland and Crockford, 1993), and lower survival rates of offspring (Lordi *et al.*, 2000). At this time, it is unknown what the long-term implications of chronic stress may be on sea turtle species.

Sea turtles may become habituated to sounds, including high levels of ambient noise found in areas of high vessel traffic (Moein *et al.*, 1994; Hazel *et al.*, 2007). Moein *et al.* (1994) conducted a study using a fixed sound source to repel sea turtles away from hopper dredges. Three decibel levels (175, 177, and 179 dB re: 1 μPa at 1 m) were used for the study. It was found that while sea turtles avoided the sound upon first exposure, they appeared to habituate to the stimuli over a period of time (Lenhardt, 1994; Moein *et al.*, 1994). Adult loggerheads have been observed to initially respond (*i.e.*, increase swimming speeds) and avoid air guns when received levels range from 151 to 175 dB re: 1 μPa, but they eventually

habituate to these sounds (Lenhardt, 2002). One turtle in the study did exhibit TTS for up to two weeks after exposure to these levels (Lenhardt, 2002).

Sea turtles exposed to the general disturbance associated with a passing Navy vessel could exhibit a short-term behavioral response such as fleeing. Therefore, general ship disturbance under the No Action Alternative may affect ESA-listed sea turtles. In accordance with NEPA, general ship disturbance in territorial waters would have no significant impact on sea turtles. Furthermore, general ship disturbance in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Vessel Strikes

Vessel strikes can result in serious injury and may occasionally cause fatalities to sea turtles. Turtles swimming or feeding at or just beneath the surface of the water are particularly vulnerable to a vessel strike. According to the Florida Fish and Wildlife Conservation Commission (unpublished data) there has been a significantly increasing trend in the percent occurrence of propeller wounds among the loggerheads found dead or debilitated each year in Florida during 1986-2004.

Determining the potential for a vessel to strike a sea turtle is difficult because the probability of such an encounter depends on several unpredictable factors. The Navy considered quantifying potential impacts to sea turtles from vessel strikes as part of the EISs for the Navy's Virginia Capes, Navy Cherry Point, Jacksonville, and Gulf of Mexico Range Complexes. However, the Navy determined that a quantitative analysis was not appropriate based on several factors:

- A quantitative analysis assumes that all animals would be at or near the water's surface 100 percent of the time. This does not take into account diving behavior or dive profiles, and significantly overestimates the time an animal could be exposed to vessel strikes.
- Sea turtle underwater time and depth is expected to be highly variable based on many complex factors related to species, habitat, behavioral, and seasonal specifics. Based on a review of relevant literature, it was determined these factors cannot be accurately accounted for in a quantitative assessment.
- Conservation and protective measures implemented by the Navy in order to reduce potential strikes with sea turtles could not be quantified.

Currently, there are no data available to assess the efficacy of protective measures, and therefore, they cannot be incorporated into a quantitative assessment. Based on the limitations detailed above and the uncertainty associated with any quantitative exposure estimates, the Navy concluded a qualitative assessment be implemented to analyze potential impacts of vessel strikes on sea turtles.

The Navy has adopted standard operating procedures and mitigation measures to reduce the potential for collisions with surfaced sea turtles (for more details refer to Chapter 5). These mitigation measures include:

- Using lookouts trained to detect all objects on the surface of the water, including sea turtles.
- Implementing reasonable and prudent actions to avoid the close interaction of Navy assets and sea turtles.
- Maneuvering to keep away from any observed sea turtle.

Shallow water training in the GOMEX Range Complex (*i.e.*, MESG and CNIC harbor security group) occurs within 12 nm of the shoreline and includes nearshore (< 3 nm) boat movements. The boats associated with this training are small (< 30 m) and have the ability to travel at high speeds. The risk to sea turtles in shallow water foraging areas from vessel collision increases at higher vessel speeds (Hazel *et al.*, 2007). Small boat use associated with MESG and CNIC training may affect sea turtles. Visual

mitigation (Chapter 5) should help reduce the risk of vessel strikes to sea turtles; however, visual mitigation measures may be less effective at higher vessel speeds.

Increased vessel movement may occur near the ports within the GOMEX Range Complex (specifically Panama City and Corpus Christi). As these vessels transit to and from the ports, they may travel though shallow water foraging areas for sea turtles. Generally, naval vessels are not moving at high speeds as they enter and leave port. Visual mitigation (Chapter 5) should help reduce the risk of vessel strikes to sea turtles in port areas.

Based on the implementation of Navy mitigation measures and the low number of operations in the GOMEX Range Complex, the likelihood that a vessel strike would occur is very low. Vessel collisions may affect ESA-listed sea turtles in the GOMEX Range Complex under the No Action Alternative. In accordance with NEPA, vessel collisions would have no significant impact on sea turtles in territorial waters. Furthermore, vessel collisions would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Aircraft Overflights

Fixed-Wing Aircraft

The general aircraft overflight exposure information presented for marine mammals in Section 3.7 is also applicable to sea turtles. As discussed in Section 3.7, aircraft overflights would produce airborne noise and some of this energy would be transmitted into the water. Sea turtles could be exposed to noise associated with subsonic and supersonic fixed-wing aircraft overflights while at the surface or while submerged. In addition, low-flying aircraft passing overhead could create a shadow effect that could induce a reaction in sea turtles. It is difficult to differentiate between reactions to the presence of aircraft and reactions to sound. Exposure to elevated noise levels would be brief (seconds) and infrequent based on the transitory and dispersed nature of the overflights. Fixed-wing aircraft overflights may occur throughout the GOMEX Study Area, but sound exposure levels would be relatively low because a majority of the overflights would be above 914 m (3,000 feet).

Very little information regarding sea turtle reactions to fixed-wing aircraft overflights is available. Based on knowledge of their sensory biology (Ridgway *et al.*, 1969; Lenhardt *et al.*, 1994; Bartol, 1999; Bartol and Musick, 2003; Ketten and Bartol, 2006), sound from low flying aircraft could be heard by a sea turtle at or near the surface. Turtles might also detect low flying aircraft via visual cues such as the aircraft's shadow. Hazel *et al.* (2007) suggested that green turtles rely more on visual cues than auditory cues when reacting to approaching water vessels. This suggests that sea turtles might not respond to aircraft overflights based on noise alone. As discussed in Section 3.7, subsonic and supersonic fixed-wing aircraft overflights are not expected to generate underwater sound levels that would result in harm of sea turtles (Eller and Cavanagh, 2000; Laney and Cavanagh, 2000).

Sea turtles exposed to aircraft overflights may exhibit no response or behavioral reactions such as quick diving. Any behavioral avoidance reaction would be short-term and would not permanently displace animals or result in physical harm. Fixed-wing aircraft overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed to low altitude overflights. Therefore, fixed-wing aircraft overflights under the No Action Alternative may affect sea turtles, but the effects would be insignificant. In accordance with NEPA, aircraft overflights would have no significant impact on sea turtles in territorial waters. Furthermore, aircraft overflights would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Helicopters

Under the No Action Alternative a total of 38 helicopter sorties are expected to occur each year within W-151, W-155, and the Corpus Christi OPAREA. Animals would only be exposed to the sound and water disturbance if they are at or near the water surface. The sound exposure levels would be relatively low to sea turtles since they spend the majority or their time underwater. Unlike fixed-wing aircraft, helicopter training operations often occur at low altitudes (75 to 100 feet), which increase the likelihood that sea turtles would respond to helicopter overflights.

Based on results of a comprehensive literature review, no information regarding sea turtle reactions to helicopter overflights is available. However, based on knowledge of the auditory capabilities of turtles (Bartol and Musick, 2003; Levenson *et al.*, 2004; Ketten and Bartol, 2006; Moein Bartol and Ketten, 2006), as well as their response to visual cues (Hazel *et al.*, 2007) discussed in the fixed-wing aircraft overflights section, it is reasonable to assume that if exposed, sea turtles may react to helicopter overflights. In addition to the auditory and visual cues, animals may react to the disturbance of the water by the downdraft. Helicopter overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed. Helicopter overflights may affect sea turtles, but the effects would be insignificant. In accordance with NEPA, helicopter overflights would have no significant impact on sea turtles in territorial waters. Furthermore, helicopter overflights would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Munitions Use/Non-explosive Practice Munitions

Munitions Use/Non-explosive Practice Munitions Strikes

Current Navy training operations in the GOMEX Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, naval gun shells, naval medium caliber cannon ammunition, and small caliber ammunition. Training exercises that involve NEPM use take place in several training areas (see Table 2.2-8 for a summary of ordnance use by training area). NEPM use does not occur in the New Orleans OPAREA. NEPM is used in W-151A/B, W-155A, the Harbor Security Group Machine Gun Area, and Corpus Christi MINEX UNDET Box E3. The use of NEPM in these areas has the potential to affect sea turtles.

Direct NEPM strikes and disturbance associated with sound from firing weapons are potential stressors to sea turtles. Ingestion of expended NEPM is also a potential concern for some sea turtles and is analyzed below under military expended materials. The primary focus of this section is potential exposure of sea turtles at or near the water's surface, which could result in injury or mortality.

The potential for sea turtles to be struck by fired NEPM was evaluated using statistical probability modeling as described in Appendix I. Model input values include NEPM use data (frequency and type) and sea turtle density data for each season and training area where NEPM use occurs. The model calculates the probability of a turtle being struck and the number of exposures (sea turtle/NEPM strikes) for the given season and training area. The model outputs for sea turtle/NEPM strikes are biased by the following assumptions and data/model limitations:

- The model is two-dimensional and assumes that all sea turtles would be at or near the surface 100 percent of the time, when in fact, sea turtles spend the majority of their time under water - up to 96 percent (Lutcavage and Lutz, 1997).
- The model does not take into account mitigation measures used by the Navy to avoid and minimize sea turtle/NEPM strikes.
- The model assumes the animal is stationary and does not account for any movement of the sea turtle or any potential avoidance of the training.

The NEPM strike model is not expected to produce false negatives because the assumptions will more likely produce an overestimate of impacts. A model output of less than one exposure provides a high level of certainty that sea turtles would not be struck and that ordnance strikes would have no effect on sea turtles.

Appendix I provides the model output values for each group of sea turtles by training area where ordnance is fired or released. All model output values are substantially less than one (Appendix I), indicating that sea turtle/NEPM strikes are not expected to occur. The probability of a direct ordnance strike is further reduced by Navy mitigation measures (see Chapter 5). Therefore, NEPM strikes would have no effect on sea turtles in the GOMEX Study Area. In accordance with NEPA, NEPM strikes would have no significant impact on sea turtles in territorial waters. Furthermore, NEPM strikes would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Munitions Use/NEPM Disturbance

Transmitted Gunnery Sound – Directly Into the Environment

A gun fired from a ship on the surface of the water propagates a blast wave away from the gun muzzle. This spherical blast wave reflects off and diffracts around objects in its path. As the blast wave hits the water, it reflects back into the air, transmitting a sound pulse back into the water in proportions related to the angle at which it hits the water.

Propagating energy is transmitted into the water in a finite region below the gun. A critical angle (about 13°, as measured from the vertical) can be calculated to determine the region of transmission in relation to the ship and gun (DoN, 2006).

The largest proposed shell size for these operations is a 5-in. shell. This will produce the greatest pressure, and all analyses will be completed using this as a conservative estimate of produced and transmitted pressure, assuming all other smaller ammunition sizes would be less than these pressures.

Aboard the USS *Cole* in June 2000, a series of pressure measurements were taken during the firing of a 5-in. gun. Average pressure measured approximately 200 dB (dB re: 1 µPa) at the point of the air and water interface. Based on the USS *Cole* data, down-range peak pressure levels were calculated to be less than 186 dB re: 1 µPa at 100 m (DoN, 2000) and as the distance increases, the pressure would decrease.

In reference to the EFD harassment criteria, the EFD levels (greatest in any 1/3 octave band above 10 Hz) of a 5-in. gun muzzle blast were calculated to be 190 dB re: 1 μPa^2-s directly below the gun muzzle decreasing to 170 dB re: 1 μPa^2-s at 100 m (328 ft) into the water (DoN, 2006). The rapid dissipation of the sound pressure wave coupled with the mitigation measures implemented by the Navy (see Chapter 5 for details) to detect sea turtles in the area prior to implementing operations, would result in a blast from a gun muzzle having no effect on sea turtle species. In accordance with NEPA, transmitted gunnery sound would have no significant impact on sea turtles in territorial waters. Furthermore, transmitted gunnery sound would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Transmitted Gunnery Sound – Through Ship Hull

A gun blast will also transmit sound waves through the structure of the ship that can propagate into the water. The 2000 study aboard the USS *Cole* also examined the rate of sound pressure propagation through the hull of a ship (DoN, 2000). The structurally borne component of the sound consisted of low-level oscillations on the pressure time histories that preceded the main pulse due to the air blast impinging on the water (DoN, 2006)

The structural component for a standard round was calculated to be 6.19 percent of the air blast (DoN, 2006). Given that this component of a gun blast was a small portion of the sound propagated into the water from a gun blast and far less than the sound from the gun muzzle itself, the transmission of sound from a gun blast through the ship's hull would have no effect on ESA-listed sea turtle species. In accordance with NEPA, sound transmitted through the ship hull would have no significant impact on sea turtles in territorial waters. Furthermore, sound transmitted through the ship hull would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Underwater Detonations and High Explosive Ordnance

Some of the training conducted under the No Action Alternative would involve underwater detonations and the use of other types of HE ordnance. Mine Countermeasures and Mine Neutralization exercises include underwater detonations that range in net explosive weight (NEW) from 0.00514-pound (lb) shots to 20-lb charges. These operations currently take place in the MINEX Boxes located in the Panama City OPAREA (Figure 2.1-1) and Corpus Christi OPAREA (Figure 2.1-3). The No Action Alternative also includes underwater detonations (up to 1.25-lb NEW) in the NSA Panama City Demolition Pond (Figure 2.1-6) and small arms training (anti-swimmer grenades, 0.5-lb NEW) in the Corpus Christi UNDET Box E3. The use of other HE ordnance under the No Action Alternative would be limited to dropping 52 HE bombs 192.2- to 415.8-lb NEW) per year in the Hotbox, which is located more than 12 nm offshore in the Pensacola OPAREA (Figure 2.1-1) (see Table 2.2-9 for a summary of explosions by training area).

BOMBEX, MINEX, and Small Arms Training

An explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions associated with MINEX (20-lb charges), BOMBEX, and small arms training (anti-swimmer grenades). Appendix J contains a technical report describing the scientific basis, methods, and assumptions of the explosive analysis. Table 3.8-5 provides a summary of the explosive analysis results for the No Action Alternative.

Loggerhead and leatherback turtles may be exposed at levels that could result in non-injurious effects, including behavioral disruption and temporary threshold shift. No sea turtle species are expected to be exposed at levels that could result in injurious physiological effects or mortality.

Exposure estimates could only be calculated for leatherback turtles, loggerhead turtles, and the hardshell turtles group (includes green, Kemp's ridley, hawksbill, extralimital olive ridley, and all unidentified hardshell turtles) because density data could not be calculated due to the limited available data for individual species of the hardshell turtles group. However, the likelihood of exposure to the individual species should be even lower than that estimated for the hardshell turtle group together. Implementation of mitigation measures would reduce the likelihood of exposure and potential effects.

TABLE 3.8-5
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR SEA TURTLES IN THE GOMEX RANGE COMPLEX—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles				
BOMBEX training	0	0	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Leatherback turtle				
BOMBEX training	4	4	0	0
MINEX training	NA	0	0	0
Small Arms training	0	0	0	0
Total Exposures	4	4	0	0
Loggerhead turtle				
BOMBEX training	3	3	0	0
MINEX training	NA	2	0	0
Small Arms training	0	0	0	0
Total Exposures	3	5	0	0

NA: MINEX is modeled as a single detonation event and therefore the behavioral disturbance criterion does not apply.

Endangered Species Act Conclusions

MINEX underwater detonations, small arms training with anti-swimmer granades, and BOMBEX HE ordnance use under the No Action Alternative may affect green, hawksbill, Kemp's ridley, loggerhead, leatherback, and olive ridley turtles, even though exposures are not anticipated for all species. However, the effects to extralimital and rare species (olive ridley turtle) are likely discountable due to the low occurrence of these species in the GOMEX Study Area.

National Environmental Policy Act and Executive Order 12114 Conclusions

In accordance with NEPA, although there may be impacts to individual sea turtles, there would be no significant impact to sea turtle populations from explosive ordnance use during training exercises within territorial waters. In accordance with Executive Order 12114, although there may be impacts to individual sea turtles, there would be no significant harm to sea turtle populations resulting from explosive ordnance use during training exercises in non-territorial waters.

Diver Training in the Demolition Pond

Underwater detonations using small charges for diver training is conducted in the Demolition Pond near St. Andrew Bay, Bay County, Florida. Sporadic nesting has been recorded for leatherback and green turtles in Bay County since 1990 (FFWCC-FWRI, 2008). Five leatherback nests were recorded in 2001 and two more were recorded in 2003. There have only been two green turtle nests recorded in Bay County; one each in 1999 and 2002. There are no records of sea turtles occurring in the Demolition Pond, and no age class of either green or leatherbacks is expected to occur there due to lack of suitable

habitat and intermittent access. Due to the extremely low nesting numbers and lack of inducement for turtles to enter the Demolition Pond, small underwater detonations in the Demolition Pond would have no effect on leatherback and green turtles.

There are no known nesting sites for Kemp's ridley, hawksbill, or olive ridley sea turtles that occur in the general vicinity of the Demolition Pond. Due to the relatively isolated nature and very small size of the pond itself (approximately 94 yd in diameter and 0-11 ft in depth), juvenile and adult Kemp's ridley, hawksbill, and olive ridley sea turtles are not expected to occur in the pond. Therefore, underwater detonations in the Demolition Pond would have no effect on Kemp's ridley, hawksbill, or olive ridley sea turtles.

The loggerhead nesting season in Bay County, Florida, occurs from May through September. Nests have been documented as early as May 21 and as late as September 5 (Meylan *et al.*, 1995). The majority of these nests are located on the barrier island beaches along the Gulf of Mexico (Mexico beach, Panama City beach, St. Andrew State Park, Shell Island, and Tyndall AFB). Between 1988 and 1992, 261 loggerhead nests were recorded in this area, representing 0.1 percent of total loggerhead nests in state of Florida (Meylan *et al.*, 1995). Similarly, 327 loggerhead nests were recorded between 2004 and 2007 (FFWCC-FWRI, 2008). No nests have been recorded within St. Andrew Bay; however this could be a result of low survey effort along those beaches. The mitigation measures presented in Chapter 5 would reduce the potential for exposures of adult nesting loggerheads. Hatchlings leaving the primary nesting areas in Bay County could potentially swim in to St. Andrew Bay, but this is unlikely as hatchlings generally orient themselves towards open water unless bright lights disorient them. Therefore, underwater detonations in the Demolition Pond associated with diver training may affect loggerhead turtles, but the effects would be discountable.

The sound pressure from underwater detonations in the Demolition Pond would have no effect on the adjacent portions of St. Andrew Bay. The Demolition Pond is very shallow and semi-enclosed. In very shallow water, surface- and bottom-boundary effects have more influence on propagation than in deeper water. At the point of detonation, the geometry of the short water column dictates that a charge must be close to one or both of these boundaries. Energy from detonations at the surface would dissipate through surface blowout and detonations closer to the bottom may have considerable energy absorbed by the seafloor. As pressure waves propagate laterally through the very shallow water column, the waves reflect off surface and bottom boundaries more often than they would over the same distance in deeper waters and thus, very shallow water boundaries exert their influence relatively more frequently over that distance. In the case of the Demolition Pond, pressure waves would also reflect off the shoreline, which encloses most of this training area. The Demolition Pond's opening to St. Andrew Bay is approximately 13.7 m wide at high tide (Figure 2.1-6). The connection is much smaller at low tide. The distance from the center of the Demolition Pond to St. Andrew Bay is roughly 53.3 m. Underwater detonations in the Demolition Pond would have no effect on sea turtles in the adjacent St. Andrew Bay.

In accordance with NEPA, underwater detonations in the Demolition Pond would have no significant impact on sea turtles in territorial waters under the No Action Alternative. Furthermore, underwater detonations in the Demolition Pond would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Military Expended Materials

Overview

A variety of military materials are expended during training exercises conducted in the GOMEX Study Area. The types and quantities of expended materials used and information regarding fate and transport of these materials within the marine environment are discussed in Section 3.2, Hazardous Materials and

Hazardous Waste. The analyses presented predict that the majority of the expended materials would rapidly sink to the sea floor, become encrusted by natural processes, and incorporated into the sea floor, with no significant accumulations in any particular area and no significant negative effects to water quality or marine benthic communities. Nonetheless, sea turtles could be exposed to some expended materials via contact and ingestion.

Sea turtles of all sizes and species are known to ingest a wide variety of marine debris, which might be mistaken for prey. Plastic bags and plastic sheeting are most commonly ingested by sea turtles but balloons, Styrofoam beads, monofilament fishing line, and tar are also known to be ingested (NRC, 1990; Lutz, 1990; Bjorndal *et al.*, 1994; Tomás *et al.*, 2002). Marine debris could pass through the digestive tract and be voided naturally without causing harm, or it could cause sublethal effects or lethal effects (Balazs, 1985). Sublethal effects may have a greater influence on populations than lethal effects through nutrient dilution. Nutrient dilution occurs when non-nutritive debris displaces nutritious food in the gut leading to decreased nutrient gain and ultimately slowing somatic growth or reducing reproductive output (McCauley and Bjorndal, 1999). Lutz (1990) found that hungry sea turtles will actively seek and consume marine debris if other food is not available. In most cases, this debris passed through the gut within a few days, but latex was found to take up to four months to clear the intestinal system. While ingestion of marine debris has been linked to sea turtle mortalities, sublethal effects are more common (NRC, 1990; Bjorndal *et al.*, 1994; McCauley and Bjorndal, 1999; Tomás *et al.*, 2002).

Ordnance Related Materials

Ordnance related materials include various sizes of NEPM and shrapnel from explosive rounds. These solid metal materials would quickly move through the water column and settle to the sea floor where they could be available for ingestion by benthic foraging sea turtles. Ingestion of expended ordnance is not expected to occur in the water column because ordnance quickly sinks.

The probability of sea turtles ingesting expended ordnance would depend on factors such as the size of the materials, the likelihood of the materials being mistaken for prey, and the level of benthic foraging that occurs in the impact area, which is a function of benthic habitat quality, prey availability, and species-specific foraging strategies. Some materials such as an intact non-explosive practice bomb would be too large to be ingested by a sea turtle, but other materials such as cannon shells, small caliber ammunition, and some shrapnel are small enough to be ingested. While the literature indicates that commonly ingested items such as drifting balloons or plastic bags might be mistaken as jellyfish or other pelagic prey, there are cases of pelagic foragers ingesting items, such as plastic caps, that do not resemble prey (Barreiros and Barcelos, 2001). It is possible that expended ordnance colonized by epibenthic fauna could be mistaken for prey or that expended ordnance could be incidentally ingested while foraging on natural prey items.

The amount of benthic foraging that occurs in areas where ordnance would be expended is unknown, but a majority of benthic foraging by green, hawksbill, Kemp's ridley, and loggerhead turtles is expected to occur in nearshore areas (Lutcavage *et al.*, 1997). Operations involving expended ordnance and shrapnel under the No Action Alternative occur in W-151A/B, W-151A/C, W-155A and W-155B associated with the Pensacola and Panama City OPAREAs. The majority of W-155B is seaward of the continental shelf break. The probability of a benthic foraging sea turtle to ingest ordnance appears to be low based on the fact that benthic foraging generally occurs in nearshore areas. Ingestion of ordnance under the No Action Alternative may affect green, hawksbill, Kemp's ridley, olive ridley, and loggerhead turtles. These effects may be discounted due to the unlikelihood of their occurrence.

Leatherbacks feed throughout the epipelagic and into the mesopelagic zones of the water column (Davenport,1988; Eckert *et al.*, 1989; Grant and Ferrell, 1993; Salmon *et al.*, 2004; James *et al.*, 2005a).

Prey is predominantly gelatinous zooplankton such as cnidarians (jellyfish and siphonophores) and tunicates (salps and pyrosomas) (NMFS and USFWS, 1992; Grant and Ferrell, 1993; Bjorndal, 1997; James and Herman, 2001; Salmon *et al.*, 2004). Leatherbacks would not ingest expended ordnance because they are not expected to feed in the benthic environment. Ingestion of ordnance under the No Action Alternative would have no effect on leatherback turtles. In accordance with NEPA, ordnance related materials would have no significant impact on sea turtles in territorial waters under the No Action Alternative. Furthermore, ordnance related materials would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Target Related Materials

Targets are used in training exercises throughout the GOMEX Study Area; a total of 44 targets per year are expended into the marine environment under the No Action Alternative. A variety of at-sea targets may be used in the OPAREA, ranging from high-tech remotely operated airborne and surface targets (*e.g.*, airborne drones and Seaborne Powered Targets) to low-tech floating at-sea targets (*e.g.*, inflatable targets, 55-gallon metal drums) and towed banners. Many of the targets are designed to be recovered for reuse and are not destroyed during training because ordnance is set to detonate before impacting the target. The only expendable airborne targets used in the OPAREA are Tactical Air-Launched Decoys, which are non-powered, constructed of extruded aluminum, weigh about 400 pounds, and are about 7 feet long. Expendable targets such as floating at-sea inflatable targets are recovered after use and properly disposed of onshore. Some targets such as 55-gallon metal drums cannot be recovered and sink to the sea floor after use. Unrecoverable floating materials generated by target use are expected to be minimal. Descriptions of the targets used in the OPAREA and information on fate and transport are provided in Section 3.2.

As discussed above for ordnance related materials, sea turtles that feed on or near the bottom may encounter an expended target while feeding; however, the size of the target would prohibit any listed species from ingesting it. Therefore, the use of targets under the No Action Alternative would have no effect on sea turtles. In accordance with NEPA, target related materials would have no significant impact on sea turtles in territorial waters under the No Action Alternative. Furthermore, target related materials would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Chaff Fibers, End Caps, and Pistons

The background information and general exposure analysis presented in Section 3.7.3 for marine mammals and chaff is also applicable to sea turtles and is not repeated here. Similar to marine mammals, sea turtles could be exposed to chaff through direct body contact, inhalation, and ingestion. Chaff is similar in form to fine human hair (USAF, 1997). Due to its flexible nature and softness, external contact with chaff would not be expected to adversely affect most wildlife (USAF, 1997) and the fibers would quickly wash off shortly after contact. Given the properties of chaff, skin irritation is not expected to be a problem (USAF, 1997).

The potential exists for sea turtles to inhale chaff fibers if they are at the surface while chaff is airborne. Arfsten *et al.* (2002), Hullar *et al.* (1999), and USAF (1997) reviewed the potential effects of chaff inhalation on humans, livestock, and animals and concluded that the fibers are too large to be inhaled into the lung. If inhaled, the fibers are predicted to be deposited in the nose, mouth, or trachea and are either swallowed or expelled; however, these reviews did not specifically consider sea turtles. In terrestrial environments, chaff fibers could break into smaller particles by various physical processes. If introduced back into the air, the small particles could be available for inhalation (USAF, 1997); however, this is not a concern in the marine environment because chaff fibers would not break up on the

water's surface or become airborne again. Any effect of chaff inhalation on sea turtles is considered insignificant given the low concentration of airborne fibers (1.8 fibers/ft^2 for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point) and the fact that sea turtles spend significant time submerged. Direct contact with chaff or inhalation of chaff would have no effect on sea turtles. In addition, any changes in water quality from chaff use would be negligible and would have no effect on sea turtles.

Based on the small size of chaff fibers, sea turtles would not confuse the fibers with prey items or purposefully feed on them. However, sea turtles could occasionally ingest low concentrations of chaff while feeding on prey items on the surface, in the water column, or on the bottom. While no studies have been conducted to evaluate the effects of chaff ingestion on sea turtles or other reptiles, the effects are expected to be negligible based the low concentrations that could reasonably be ingested, the small size of chaff fibers, and available data on the toxicity of chaff, aluminum, and silicon (as described in Section 3.7.3). A young sea turtle weighing 1 kg would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg (based on chaff consisting of 40 percent aluminum by weight and a 150 g chaff canister containing five million fibers). An adult loggerhead turtle weighing 113 kg or more would need to ingest more than nine million chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg. It is highly unlikely that a sea turtle would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff.

The potential also exists for sea turtles to ingest chaff end caps and pistons. However, the probability of sea turtles ingesting plastic end caps and pistons is low because these materials sink in saltwater (Spargo, 2007) and the environmental concentration would be low (approximately 7,528 pieces released per year or 1.4 pieces/nm^2/year). A majority of the end caps and pistons are expected to sink in offshore, deepwater areas and ultimately become incorporated into bottom sediments where minimal turtle foraging occurs. A small percentage of the end caps and pistons released are expected to land on *Sargassum* mats or be transported by currents to benthic foraging areas where the probability of ingestion would be higher. Since young pelagic turtles feed indiscriminately within *Sargassum* mats and are known to ingest anthropogenic debris (McCauley and Bjorndal, 1999), it is possible that sea turtles would be exposed to and ingest end caps and pistons. However, the overall probability of turtles ingesting an end cap or piston is low.

If ingested, it is likely the small (1.3-inch diameter, 0.13-inch thick) round end cap or piston would pass through the digestive tract of adult turtles without causing harm, as with other instances of debris ingestion (Balazs, 1985). Although ingestion of anthropogenic debris can result in serious injury or death, sea turtles are known to ingest small plastic items without noticeable negative consequence to health and viability (Barreiros and Barcelos, 2001; Mascarenhas *et al.*, 2004). Based on their smaller size, subadult and juvenile turtles (and even adults of some species) would be more susceptible to digestive tract blockage if they ingested these materials. Should a sea turtle encounter and ingest a discarded piston or end cap, the animal could experience effects ranging from sublethal effects such as nutritional dilution (McCauley and Bjorndal, 1999) to mortality (NRC, 1990; Bjorndal *et al.*, 1994; Tomás *et al.*, 2002). The likelihood of a sea turtle ingesting an end cap or piston appears to be extremely low based on the number of pieces released per year (7,528 pieces/year). Chaff use under the No Action Alternative may affect ESA-listed sea turtles, but the effects would be discountable and/or insignificant. In accordance with NEPA, chaff would have no significant impact on sea turtles in territorial waters under the No Action Alternative. Furthermore, chaff would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Self-Protection Flares

Self-protection flares consist of a magnesium/Teflon formulation that, when ignited and released from an aircraft, burn for a short period of time (less than 10 seconds) at very high temperatures. Flares release heat and light to disrupt tracking of Navy aircraft by enemy infrared tracking devices or weapons. Flares are designed to burn completely, thus reducing the amount of material that falls to the sea surface. Under normal operations, the only material that would enter the water would be a small, round plastic end cap (approximately 1.4 inch diameter). About 1,840 self-protection flares would be used during 368 sorties (five flares/sortie) in W-151A/B per year under the No Action Alternative.

An extensive literature review and controlled experiments conducted by the Air Force revealed that self-protection flare use poses little risk to the environment or animals (USAF, 1997). Nonetheless, sea turtles within the vicinity of W-151A/B could be exposed to light generated by the flares and flare plastic end caps. The light generated by flares would have no effect on sea turtles based on short burn time, relatively high altitudes where they are used, and the widely dispersed and infrequent use. Similar to chaff end caps and pistons, sea turtles could potentially ingest flare end caps. Based on their smaller size, subadult and juvenile turtles (and even adults of some species) would be more susceptible to digestive tract blockage if they ingested these materials. Should a sea turtle encounter and ingest a discarded end cap, the animal could experience effects ranging from sublethal effects such as nutritional dilution (McCauley and Bjorndal, 1999) to mortality (NRC, 1990; Bjorndal *et al.*, 1994; Tomás *et al.*, 2002). Ingestion of flare end caps under the No Action Alternative may affect sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, self-protection flares would have no significant impact on sea turtles in territorial waters under the No Action Alternative. Furthermore, self-protection flares would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Marine Markers

The MK-58 marine markers produce chemical flames and regions of surface smoke and are used as part of the training activities in the Demolition Pond and during BOMBEX in W-151A/C and W-155B. When the accompanying cartridge is broken, an area of smoke is released. The smoke dissipates in the air having little effect on the marine environment. It is unlikely that sea turtles would be exposed to any chemicals that produce either flames or smoke since these components are consumed in their entirety during the burning process. The marker burns similar to a flare, producing a flame until all burn components have been used. While the light generated from the marker is bright enough to be seen up to 3 miles away in ideal conditions, the resulting light would either be reflected off the water's surface or would enter the water and attenuate in brightness over depth. The point source of the light would be focused and be less intense than if an animal were to look to the surface and encounter the direct path of the sun. The MK-58 is composed of tin and contains two red phosphorus pyrotechnic candles and a seawater-activated battery. The MK-58 marine marker is 21.78 inches long and 5.03 inches in diameter, weighs 12.8 lb and produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes (The Ordnance Shop, 2007). The marker itself is not designed to be recovered and would eventually sink to the bottom and become encrusted and/or incorporated into the sediments. Under the No Action Alternative, approximately 34 marine markers would be used per year in the GOMEX Study Area . This includes two per year in the Demolition Pond.

Expended marine markers are a potential ingestion hazard for sea turtles. It is possible that a sea turtle may ingest a piece of the marker (either by biting it or ingesting a piece that has broken off) while the marker is floating or after it has sunk to the bottom. However, the probability of ingestion is extremely low based on the low number of marine markers expended per year (34) and the low concentration ($0.01/nm^2$/year). Marine marker ingestion under the No Action Alternative may affect sea turtles, but

the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, marine markers would have no significant impact on sea turtles in territorial waters under the No Action Alternative. Furthermore, marine markers would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, the No Action Alternative includes the use of Mine Warfare devices towed through the water by helicopters and ships. In addition, remotely operated vehicles are used during Mine Neutralization training. These devices are currently used in the Panama City and Corpus Christi MINEX Boxes, but they would no longer be used under Alternative 1 and 2. The effects of underwater detonations associated with the use of these devices are analyzed above in the underwater detonation and high explosive ordnance section. The effects of Mine Warfare devices towed by ships and remotely operated vehicles are expected to be the same as those described above for vessel movements. This section analyzes the effects of the MK-103, which is towed through the water by a helicopter.

Mine Warfare devices towed through the water by helicopters present a potential strike risk to sea turtles. Helicopter crew members monitor the water's surface during training to identify and avoid any objects that might damage the equipment. Based on the low flight altitudes and relatively slow air speeds, it is likely that crew members would be able to see turtles at or near the surface and avoid them. Sea turtles at or near the surface may see or hear the oncoming helicopter or feel the downdraft, which could initiate avoidance behavior. The water column disturbance and sound created by the towed device would likely elicit short-term behavioral responses similar to those discussed for vessel movements and aircraft overflights. While the potential exists for sea turtles to be struck by a towed device, there are no documented instances of this occurring in the Study Area.

Sargassum mats could occur in some areas where towed devices are used and some life stages of some species of sea turtles may be associated with these habitats. Mitigation measures specify that these exercises shall not be conducted within 250 yd of known or observed *Sargassum* mats. Air crews operating the helicopters would avoid visible *Sargassum* mats. Therefore, any disturbance to *Sargassum* would be limited to very small patches not visible to the air crew. Based on the use of mitigation measures, it is unlikely that a towed device would strike a sea turtle associated with a *Sargassum* mat.

The use of towed devices under the No Action Alternative may affect sea turtles, but the effects of collisions would be discountable because they are extremely unlikely to occur and the effects of disturbance would be insignificant. In accordance with NEPA, the use of towed devices in territorial waters would have no significant impact on sea turtles. In accordance with EO 12114, use of towed devices in non-territorial waters would not cause significant harm to sea turtles.

3.8.3.3 Alternative 1

Vessel Movements

The total number of vessel steaming days for the GOMEX Study Area would not change under Alternative 1. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 1. Vessel movements may affect sea turtles under Alternative 1. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on sea turtles. Furthermore, vessel movements in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Aircraft Overflights

Alternative 1 includes approximately 5,316 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 93 sorties per year (1.8%) compared to the No Action Alternative. The additional sorties would be associated with bombing exercises in W-151 and W-155 and would involve flights below 3,000 feet. Helicopter sorties would decrease from 38 to 18 per year under Alternative 1. The increase in fixed-wing sorties would increase the potential for behavioral disturbance from sound and shadow effects. Behavioral reactions to fixed-wing aircraft would be the same as discussed for the No Action Alternative. Aircraft overflights may affect sea turtles, but the effects are expected to be insignificant. In accordance with NEPA, aircraft overflights would have no significant impact on sea turtles in territorial waters. Furthermore, aircraft overflights would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Munitions Use/Non-explosive Practice Munitions

The amount of NEPM used would increase in the GOMEX Study Area under Alternative 1 (Tables 2.2-7 and 2.2-8). These changes would result in increased potential for sea turtle/NEPM strikes compared to the No Action Alternative. However, ordnance strike modeling predicts that no sea turtles would be exposed to direct NEPM strikes under Alternative 1 (see Appendix I). Additionally, Navy mitigation measures further reduce the probability of ordnance-related exposure. As discussed for the No Action Alternative, gunnery sound transmitted directly into the environment or through the ship hull would have no effect on sea turtles. The use of NEPM would have no effect on sea turtles under Alternative 1. In accordance with NEPA, NEPM would have no significant impact on sea turtles in territorial waters. Furthermore, NEPM would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Underwater Detonations and High Explosive Ordnance

Alternative 1 would include changes in underwater detonations and HE ordnance use in the GOMEX Study Area.

MINEX

Underwater detonations associated with Mine Warfare exercises in the Panama City and Corpus Christi UNDET Boxes would no longer occur under Alternative 1. As such, underwater detonations associated with Mine Warfare exercises would have no effect on sea turtles under Alternative 1.

Diver Training

Underwater detonations in the Demolition Pond would not change under Alternative 1. Therefore, the analysis for underwater detonations in the Demolition Pond under the No Action Alternative is applicable to Alternative 1.

BOMBEX and Small Arms Training

Alternative 1 would include an increase in the number of HE bombs dropped in the Hotbox from 52 to 155 per year. Therefore, the potential for sea turtles to be exposed to impacts associated with HE ordnance use would increase under Alternative 1. Small arms training would not change under Alternative 1. As discussed for the No Action Alternative, an explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions. Table 3.8-6 provides a summary of the explosive analysis results for Alternative 1.

Hardshell, loggerhead, and leatherback turtles may be exposed at levels that could result in non-injurious effects, including behavioral disruption and temporary threshold shift. Loggerhead and leatherback turtles may be exposed at levels that could result in injurious physiological effects,

including permanent threshold shift. No sea turtle species are expected to be exposed at levels that could result in mortality.

Exposure estimates could only be calculated for leatherback turtles, loggerhead turtles, and the hardshell turtles group (includes green, Kemp's ridley, hawksbill, extralimital olive ridley, and all unidentified hardshell turtles) because density data could not be calculated due to the limited available data for individual species of the hardshell turtles group. However, the likelihood of exposure to the individual species should be even lower than that estimated for the hardshell turtle group together. Implementation of mitigation measures would reduce the likelihood of exposure and potential effects.

TABLE 3.8-6
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR SEA TURTLES IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa^2-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles				
BOMBEX training	1	1	0	0
Small Arms training	0	0	0	0
Total Exposures	1	1	0	0
Leatherback turtle				
BOMBEX training	11	11	1	0
Small Arms training	0	0	0	0
Total Exposures	11	11	1	0
Loggerhead turtle				
BOMBEX training	7	8	1	0
Small Arms training	0	0	0	0
Total Exposures	7	8	1	0

Endangered Species Act Conclusions

Underwater detonations and explosive ordnance in Alternative 1 may affect green, hawksbill, Kemp's ridley, olive ridley, leatherback, and loggerhead turtles. However, the effects to extralimital and rare species (olive ridley turtle) are likely discountable due to the low occurrence of these species in the GOMEX Study Area.

National Environmental Policy Act and Executive Order 12114 Conclusions

In accordance with NEPA, although there may be impacts to individual sea turtles, underwater detonations and HE ordnance use in territorial waters would have no significant impact on sea turtle populations. Furthermore, although there may be impacts to individual sea turtles, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to sea turtle populations in accordance with Executive Order 12114.

Military Expended Materials

With the exception of NEPM and marine markers, the amount of military expended materials entering the marine environment would not change under Alternative 1 (Table 2.2-7). Alternative 1 includes expenditure of an additional 24,000 cannon shell rounds in the Hotbox. As discussed for the No Action Alternative, the probability of a benthic foraging sea turtle to ingest ordnance appears to be low based on the fact that benthic foraging generally occurs in nearshore areas. Ingestion of ordnance under Alternative 1 may affect green, hawksbill, Kemp's ridley, olive ridley, and loggerhead turtles. These effects may be discounted due to the unlikelihood of their occurrence. Leatherbacks would not ingest expended ordnance because they are not expected to feed in the benthic environment. Ingestion of ordnance under Alternative 1 would have no effect on leatherback turtles. In accordance with NEPA, ordnance related materials would have no significant impact on sea turtles in territorial waters under Alternative 1. Furthermore, ordnance-related materials would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 1 and would have no effect on sea turtles.

3.8.3.4 Alternative 2

Vessel Movements

The total number of vessel steaming days for the GOMEX Study Area would not change under Alternative 2. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 2. Vessel movements may affect sea turtles under Alternative 2. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on sea turtles. Furthermore, vessel movements in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Aircraft Overflights

Alternative 2 includes approximately 5,318 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 2 sorties per year compared to Alternative 1. Helicopter sorties would decrease from 38 to 18 per year under Alternative 2 (same as Alternative 1). Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. Aircraft overflights may affect sea turtles, but the effects are expected to be insignificant. In accordance with NEPA, aircraft overflights would have no significant impact on sea turtles in territorial waters. Furthermore, aircraft overflights would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Munitions Use/Non-explosive Practice Munitions

The amount of NEPM used would increase in the GOMEX Study Area under Alternative 2 (Tables 2.2-7 and 2.2-8). These changes would result in increased potential for sea turtle/NEPM strikes compared to the No Action Alternative. However, ordnance strike modeling predicts that no sea turtles would be exposed to direct NEPM strikes under Alternative 2 (see Appendix I). Additionally, Navy mitigation measures further reduce the probability of ordnance-related exposure. As discussed for the No Action Alternative, gunnery sound transmitted directly into the environment or through the ship hull would have no effect on sea turtles. The use of NEPM would have no effect on sea turtles under Alternative 2. In accordance with NEPA, NEPM would have no significant impact on sea turtles in territorial waters. Furthermore, NEPM would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Underwater Explosions and High Explosive Ordnance

Alternative 2 would include changes in HE ordnance use in the GOMEX Study Area.

MINEX

Underwater detonations associated with Mine Warfare exercises in the Panama City and Corpus Christi UNDET Boxes would no longer occur under Alternative 2, as was the case for Alternative 1. As such, underwater detonations associated with Mine Warfare exercises would have no effect on sea turtles under Alternative 2.

Diver Training

Underwater detonations in the Demolition Pond would not change under Alternative 2. Therefore, the analysis for underwater detonations in the Demolition Pond under the No Action Alternative and Alternative 1 is applicable to Alternative 2.

BOMBEX and Small Arms Training

Alternative 2 includes a substantial decrease in the number of HE bombs dropped (four per year) relative to both the No Action Alternative (52 per year) and Alternative 1 (155 per year). As a result, the potential for sea turtles to be exposed to HE ordnance would decrease substantially under Alternative 2 compared to the No Action Alternative and Alternative 1. Small arms training would not change under Alternative 2.

As discussed for the No Action Alternative and Alternative 1, an explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions. Table 3.8-7 provides a summary of the explosive analysis results for Alternative 2.

No sea turtle species are expected to be exposed at levels that could result in behavioral, non-injurious physiological, injurious physiological effects, or mortality.

TABLE 3.8-7
SUMMARY OF POTENTIAL EXPOSURES FROM EXPLOSIVE ORDNANCE USE (PER YEAR) FOR SEA TURTLES IN THE GOMEX RANGE COMPLEX—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB re: 1 μPa²-s (multiple detonations only)	Potential Exposures @ 182 dB re: 1 μPa²-s or 23 psi-ms	Potential Exposures @ 205 dB re: 1 μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Leatherback turtle				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0
Loggerhead turtle				
BOMBEX training	0	0	0	0
Small Arms training	0	0	0	0
Total Exposures	0	0	0	0

Exposure estimates could only be calculated for leatherback turtles, loggerhead turtles, and the hardshell turtles group (includes green, Kemp's ridley, hawksbill, extralimital olive ridley, and all unidentified hardshell turtles) because density data could not be calculated due to the limited available data for individual species of the hardshell turtles group. However, the likelihood of exposure to the individual species should be even lower than that estimated for the hardshell turtle group together. Implementation of mitigation measures would reduce the likelihood of exposure and potential effects.

Endangered Species Act Conclusions

Underwater detonations and explosive ordnance use in Alternative 2 may affect green, hawksbill, Kemp's ridley, olive ridley, leatherback, and loggerhead turtles. However, the effects to extralimital and rare species (olive ridley turtle) are likely discountable due to the low occurrence of these species in the GOMEX Study Area.

National Environmental Policy Act and Executive Order 12114 Conclusions

In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters would have no significant impact on sea turtles. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Military Expended Materials

With the exception of non-explosive practice bombs, the amount of military expended materials entering the marine environment under Alternative 2 would be the same as Alternative 1 (Table 2.2-7). Non-explosive practice bombs are too large to present an ingestion risk to sea turtles. Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. As discussed for the No Action Alternative, the probability of a benthic foraging sea turtle to ingest ordnance appears to be low based on the fact that benthic foraging generally occurs in nearshore areas. Ingestion of ordnance under Alternative 2 may affect green, hawksbill, Kemp's ridley, olive ridley, and loggerhead turtles. These effects may be discounted due to the unlikelihood of their occurrence. Leatherbacks would not ingest expended ordnance because they are not expected to feed in the benthic environment. Ingestion of ordnance under Alternative 2 would have no effect on leatherback turtles. In accordance with NEPA, ordnance related materials would have no significant impact on sea turtles in territorial waters under Alternative 2. Furthermore, ordnance-related materials would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 2 and would have no effect on sea turtles.

3.8.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to sea turtles.

3.8.5 Summary of Environmental Effects (NEPA and EO 12114)

3.8.5.1 Endangered Species Act

Table 3.8-8 provides a summary of the Navy's determination of effect for Alternative 2, the Preferred Alternative, for federally listed sea turtles that occur in the GOMEX Study Area. The analysis presented indicates that actions may affect ESA-listed sea turtles. Accordingly, the Navy consulted with NMFS under Section 7(a)(2) of the ESA regarding its determination of effect for federally-listed sea turtles. In addition, the Navy entered in Conference with NMFS under Section 7(a)(4) with regard to the proposed endangered listing of the Northwest Atlantic Distinct Population Segment of loggerhead sea turtles. The GOMEX Study Area does not contain designated critical habitat for any listed sea turtle species. Consequently, the Proposed Action would have no effect on critical habitat. NMFS concluded ESA Section 7 formal consultation with Navy for listed and proposed sea turtles (Appendix C).

TABLE 3.8-8
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED SEA TURTLES THAT OCCUR IN THE GOMEX STUDY AREA –PREFERRED ALTERNATIVE (ALTERNATIVE 2)

Stressor	Green Turtle	Hawksbill Turtle	Kemp's Ridley Turtle	Leatherback Turtle	Loggerhead Turtle[2]	Olive Ridley Turtle
VESSEL MOVEMENTS						
Vessel Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Vessel Collisions	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
AIRCRAFT OVERFLIGHTS[1]						
Aircraft Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
MUNITIONS USE/NON-EXPLOSIVE PRACTICE MUNITIONS (NEPM)						
NEPM Strikes	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
NEPM Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
UNDERWATER DETONATIONS/HIGH EXPLOSIVE (HE) USE						
High Explosive Use Bombs (BOMBEX Hotbox)	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Underwater Explosions Small Charges (Demolition Pond)	No Effect	No Effect	No Effect	No Effect	May Affect	No Effect
Grenades (UNDET Area E3)	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
MILITARY EXPENDED MATERIALS						
Ordnance Related Materials	May Affect	May Affect	May Affect	No Effect	May Affect	May Affect
Target Related Materials	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Chaff	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Shelf Protection Flares	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Marine Markers	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect

[1] *Any potential effects of aircraft transiting between OPAREAs/warning areas and air stations are not addressed in this EIS/OEIS.*

[2] *Effect determinations for loggerhead sea turtles applies to both the currently threatened population as well as the proposed endangered Northwest Atlantic Distinct Population Segment. The Navy has determined that activities in the GOMEX Range Complex will not likely jeopardize the continued existence of the Northwest Atlantic Distinct Population Segment of loggerhead turtles.*

3.8.5.2 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.8-9, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on sea turtles in territorial waters in accordance with NEPA. Furthermore, in accordance with Executive Order 12114 the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to sea turtles in non-territorial waters.

TABLE 3.8-9
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEA TURTLES IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions.	Same as U.S. Territory.
Aircraft Overflights	Potential for short-term behavioral responses to overflights.	Same as U.S. Territory.
Non-explosive Practice Munitions	No effect based on extremely low probability of direct strikes.	Same as U.S. Territory.
Underwater Detonation and High Explosive Ordnance	For MINEX training, some species may be exposed at levels that could result in non-injurious effects, including behavioral disruption and temporary threshold shift. No sea turtle species are expected to be exposed at levels that could result in injurious physiological effects or mortality. For diver training in the Demolition Pond, it is extremely unlikely that loggerhead hatchlings would be exposed. Nesting sea turtles would not be affected.	For BOMBEX and MINEX training, some species may be exposed at levels that could result in non-injurious effects, including behavioral disruption and temporary threshold shift. No sea turtle species are expected to be exposed at levels that could result in injurious physiological effects or mortality. No exposures predicted for small arms training.
Military Expended Materials	Potential for ingestion.	Same as U.S. Territory.
Towed Mine Warfare Devices	Low potential for towed device strikes.	Same as U.S. Territory.
Impact Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.

TABLE 3.8-9 (CONTINUED)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEA TURTLES IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Alternative 1		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action.	Same as U.S. Territory.
Non-Explosive Practice Munitions	No effect based on extremely low probability of direct strikes.	Same as U.S. Territory.
Underwater Detonation and High Explosive Ordnance	No exposures for MINEX training because these exercises would no longer be conducted. Same as No Action Alternative for diver training in the Demolition Pond.	No exposures for MINEX training because these exercises would no longer be conducted. Exposures would increase for BOMBEX training compared to No Action. Hardshell, loggerhead, and leatherback turtles may be exposed at levels that could result in non-injurious effects, including behavioral disruption and temporary threshold shift. Loggerhead and leatherback turtles may be exposed at levels that could result in injurious physiological effects, including permanent threshold shift. No sea turtle species are expected to be exposed at levels that could result in mortality. Same as No Action for small arms training.
Military Expended Materials	Slight increase compared to No Action.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable.	Not applicable.
Impact Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.

TABLE 3.8-9 (CONTINUED)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEA TURTLES IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Alternative 2		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action.	Same as U.S. Territory.
Non-Explosive Practice Munitions	No effect based on extremely low probability of direct strikes.	Same as U.S. Territory.
Underwater Detonation and High Explosive Ordnance	No exposures for MINEX training because these exercises would no longer be conducted. Same as No Action Alternative for diver training in the Demolition Pond.	No exposures for MINEX training because these exercises would no longer be conducted. Exposures would decrease for BOMBEX training compared to No Action based on reduction in HE BOMBEX. No sea turtle species are expected to be exposed at levels that could result in behavioral, non-injurious physiological, injurious physiological effects, or mortality. Same as No Action for small arms training.
Military Expended Materials	Slight increase compared to No Action.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable.	Not applicable.
Impact Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.

3.9 FISH AND ESSENTIAL FISH HABITAT

3.9.1 Introduction and Methods

3.9.1.1 Regulatory Framework

The primary laws that make up the regulatory framework for fish and essential fish habitat (EFH) are described in detail in Appendix K and include the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and the Endangered Species Act (ESA).

One of the most significant mandates in the MSFCMA is the EFH provision, which provides the means to conserve fish habitat. The MSFCMA requires that regional Fishery Management Councils (FMC) identify EFH for federally managed species (*i.e.*, species covered under federal fishery management plans [FMP]). The MSFCMA requires federal agencies to consult with NMFS on activities that may adversely affect EFH, or when NMFS independently learns of a federal activity that may adversely affect EFH. The MSFCMA defines an adverse effect as "any impact which reduces quality and/or quantity of EFH [and] may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species' fecundity), site-specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.810). As discussed in Section 3.9.2.2, EFH has been designated in the GOMEX Study Area (DoN, 2007a).

As discussed in Appendix K, the ESA established protection over and conservation of threatened and endangered species. Portions of the Study Area are within the current or historic ranges of the Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and smalltooth sawfish (*Pristis pectinata*), which are federally listed threatened and endangered, respectively. Therefore, the ESA requirements discussed in Appendix K are applicable to the analysis for the Gulf sturgeon and smalltooth sawfish. NMFS concluded ESA Section 7 formal consultation with Navy (Appendix C) for listed and proposed fish (Section 3.9.3.3)

3.9.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for fish and EFH is the same as the approach described for marine mammals in Section 3.7.1.2.

Study Area

The Study Area for fish and EFH addressed in this section includes those portions of the GOMEX Study Area that are located in the Gulf of Mexico (Figure 1.1-2), as well as the NSA Panama City Demolition Pond (Figure 2.1-6).

Data Sources

A comprehensive and systematic review of relevant literature and data has been conducted to complete this analysis for fish and EFH to ensure that best available information was used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, DoD operations reports, EISs, Range Complex Management Plans, and other technical reports published by government agencies, private businesses, or consulting firms. The scientific literature was also consulted during the search for geographic location data on the occurrence of marine resources within the Study Area. The primary sources of information used to describe the affected environment for fish and EFH were in the Navy's Marine Resources Assessment (MRA) report for Gulf of Mexico Operating Area (DoN, 2007a). The MRA report provides a compilation of the most recent data and information on the occurrence of marine resources in the Study Area. Descriptions of literature and data searches conducted during preparation of the MRA are described in detail in that report.

Factors Used to Assess Effects

This EIS/OEIS analyzes potential effects to fish and EFH in the context of the MSFCMA (federally managed species and EFH), ESA (species listed under the ESA only), NEPA, and EO 12114. The factors used to assess the significance of effects vary under these Acts. Pursuant to 50 CFR 600.910(a), an "adverse effect" on EFH is defined as any impact that reduces the quality and/or quantity of EFH. To help identify Navy activities falling within the adverse effect definition, the Navy has determined that temporary or minimal impacts are not considered to "adversely affect" EFH (OPNAVINST 5090.1B). 50 CFR 600.815(a)(2)(ii) and the EFH Final Rule (67 Fed. Reg. 2354) were used as guidance for this determination, as they highlight activities with impacts that are more than minimal and not temporary in nature, as opposed to those activities resulting in inconsequential changes to habitat. Temporary effects are those that are limited in duration and allow the particular environment to recover without measurable impact (NMFS, 2002). Minimal effects are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions (NMFS, 2002). Whether an impact is minimal will depend on a number of factors:

- The intensity of the impact at the specific site being affected.
- The spatial extent of the impact relative to the availability of the habitat type affected.
- The sensitivity/vulnerability of the habitat to the impact.
- The habitat functions that may be altered by the impact (*e.g.*, shelter from predators).
- The timing of the impact relative to when the species or life stage needs the habitat.

The factors outlined above were also considered in determining the significance of effects under NEPA and EO 12114. For purposes of ESA compliance, effects of the action were analyzed to make the Navy's determination of effect for listed species. The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998) and are provided in Section 3.7.1.2.

3.9.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to marine communities. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Final EIS/OEIS. As summarized in Table 3.9-1, potential stressors to fish and EFH include vessel movements (disturbance and collisions), aircraft overflights (disturbance), NEPM (strikes), underwater detonations and high explosive ordnance (explosions), military expended materials (ordnance-related materials, targets, chaff, self-protection flares, and marine markers), and towed Mine Warfare devices (strikes). The potential effects of these stressors on fish and EFH are analyzed in detail in Section 3.9.3.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as a result of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on fish and EFH. Accordingly, the effects of water and air quality changes on fish and EFH are not addressed further in this Final EIS/OEIS.

TABLE 3.9-1
SUMMARY OF POTENTIAL STRESSORS TO FISH AND ESSENTIAL FISH HABITAT

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Mine Warfare (MIW)							
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓		✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Surface Warfare (SUW)							
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	✓	✓	
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C, 155B		✓	✓	✓	✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓	✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Ship)	W-151 A/B; W-155A	✓		✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Panama City OPAREA	✓		✓		✓	

TABLE 3.9-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO FISH AND ESSENTIAL FISH HABITAT

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Corpus Christi UNDET Box E3	✓		✓	✓	✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓					
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓				
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓			✓	✓	
Air Warfare (AW)							
Air Intercept Control (AIC)	W-151; W-155		✓				
Amphibious Warfare (AMW)							
FIREX (Surface-to-Surface) with IMPASS (no HE ordnance)	W-151A/B; W-155A	✓		✓		✓	
Electronic Combat (EC)							
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓			✓	
Chaff Exercises (CHAFFEX)	Brownwood MOAs						
Flare Exercises (FLAREX)	W-155A/B		✓			✓	
Flare Exercises (FLAREX)	Brownwood MOAs						
Mission Area Training[44]							
Mission Area Flight Training	W-92; W-54		✓				

[44] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

TABLE 3.9-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO FISH AND ESSENTIAL FISH HABITAT

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Basic Flight Instruction	W-228; R-2908		✓				
Salvage Diver Training	NSA Panama City Demolition Pond				✓	✓	
Underwater Demolitions	NSA Panama City Demolition Pond				✓	✓	
Security Force Training	NSA Panama City Demolition Pond				✓	✓	
Diver Training	NSA Panama City Demolition Pond				✓	✓	

3.9.2 Affected Environment

3.9.2.1 Regional Overview

Approximately 752 species of fish, including the over 200 species of deep-sea fish, and over 650 species of benthic invertebrates (over 250 of which are crustaceans) have been recorded in the Gulf of Mexico. The distribution of fish and invertebrate species in the Study Area is influenced primarily by temperature, benthic habitat, and physiography (DoAF, 1997; Hoese and Moore, 1998). Water temperature is so important that it is one of the principal means of categorizing fish and invertebrate species. Based on their temperature preferences, species can be classified as either temperate (*i.e.*, species with water temperature preferences below 59°F) or subtropical-tropical (*i.e.*, species with water temperature preferences above 68°F).

Temperate species, dominated by members of the Sciaenidae family (croakers and drums), are common in the northern Gulf of Mexico and range from the Florida Panhandle (around Cedar Keys, Florida) westward to Texas, while subtropical-tropical species, predominately grunts and mojarras, inhabit waters from central Florida south to the Florida Keys and commonly associated with reef habitats (artificial and natural) (Chittenden and McEachran, 1976; Smith-Vaniz *et al.*, 1995; Hoese and Moore, 1998). Mixing of temperate and subtropical/tropical species is caused by seasonal temperature variations and current systems (*e.g.*, the Loop Current brings in larvae from the Caribbean Sea) (Pequegnat *et al.*, 1990; Smith-Vaniz *et al.*, 1995; DoAF, 1997). Most subtropical-tropical species overwinter in the central Gulf and only move northward in the spring and summer when water temperatures are the warmest (Robins, 1971; DoAF, 1997). Diversity among the temperate and

subtropical-tropical fish species in the Gulf is influenced by water depth, with the number of species increasing seaward from estuaries to the continental shelf break (Chittenden and Moore, 1977).

The type of habitat available geographically and the distance from suitable habitat greatly influence the fish diversity of a given area. In the northwestern Gulf, the limited availability of hard bottom substrate (<3% of the continental shelf), the limited habitat diversity (lack of coral reefs and mangroves), and the distance from the source populations in the Caribbean and southern Gulf, results in the predominance of temperate species (Dennis and Bright, 1988). The abundance of artificial habitats (especially oil and gas structures) available in the northwestern Gulf create usable habitat for the many fish species that do not normally inhabit the open, sandy bottom habitats dominating this region (Hernandez *et al.*, 2003). Hard bottom and artificial habitats in the Study Area are described in Section 3.6.2.

An additional means of classifying fish species is by their movement patterns. Species such as billfish (marlins and sailfish), swordfish, members of the mackerel family (tuna), and many shark species are considered highly migratory fish, as they are widely distributed geographically and occur from coastal waters seaward into the open ocean. Highly migratory species move vertically in the water column to feed, usually on a daily basis, and move great geographic distances for feeding or reproduction. In contrast to temperate and subtropical-tropical fish, highly migratory species are not dependent on available habitat (bottom substrate or coral reefs) or water temperatures, but instead associate with physiographic and hydrographic features such as ocean fronts, current boundaries, and complex bathymetry/physiography (the continental shelf break, canyons, or sea mounts) (NMFS, 2006a).

Fish larvae are distributed in the Gulf by surface currents and the Mississippi River Plume. The Loop Current, the major surface current in the Gulf of Mexico, concentrates fish larvae (both coastal and oceanic species) along its boundaries (Richards *et al.*, 1993). The Loop and Florida Currents often function as transport vectors for larval fish, particularly for subtropical-tropical reef fish species that are carried inshore or into the waters of the eastern Gulf or Atlantic Ocean (Limouzy-Paris *et al.*, 1997; Lee and Williams, 1999; Sponaugle *et al.*, 2003). Larval temperate fish, such as Gulf menhaden, anchovy, drum, mackerel, and flying fish, are entrained in the Mississippi River Plume, but densities of these species can be highly variable (Govoni *et al.*, 1989; Govoni and Grimes, 1992). Higher densities of these species occur in the winter when the plume is more defined (Govoni and Grimes, 1992). Currents and the Mississippi River outflow not only act as transport vectors for fish larvae in the Gulf but are also a source of abundant plankton prey for other fish lifestages (Grimes and Finucane, 1991).

3.9.2.2 Essential Fish Habitat and Federally Managed Species

Within the Gulf of Mexico, the Gulf of Mexico Fishery Management Council (GMFMC) has designated EFH under seven federal FMPs which include: the Reef Fish FMP, the Shrimp FMP, the Stone Crab FMP, the Spiny Lobster FMP, the Red Drum FMP, the Coastal Migratory Pelagics FMP, and the Coral and Coral Reef FMP. NMFS has also designated EFH within the Gulf for highly migratory species (tuna, billfish, sharks, and swordfish) managed under the Consolidated Atlantic Highly Migratory Species FMP (NMFS, 2006a). Table 3.9-2 provides a summary of EFH that has been designated in the GOMEX Study Area. All offshore OPAREAs contain designated EFH for five FMPs and some highly migratory species (Table 3.9-2). In addition, all estuarine systems of the Gulf of Mexico are designated as EFH for five FMPs (GMFMC, 2005). Therefore, the Demolition Pond, located in St. Andrew Bay, contains designated EFH (Table 3.9-2). Collectively, EFH has been designated in the Study Area for 66 species of finfish, three species of shrimp, two species of crab, and numerous species of coral.

The EFH that occurs within the Study Area and vicinity includes the following general categories:

- Benthic Habitat: These habitats, which include the continental shelf and slope of the Study Area, consist of the following substrates that have been designated as EFH: rock, gravel, sand, clay,

mud, silt, shell fragments, and hard bottom. These habitats are used by a variety species for spawning/nesting, development, dispersal, and feeding (GMFMC, 2005).

- Structured Habitats: Biogenic habitats provide shelter for a variety of species. Biogenic habitat includes sponge and mussel beds, hydroids, amphipod tubes, red algae, bryozoans, as well as vermeteid and coral reefs.
- Pelagic *Sargassum:* Pelagic *Sargassum* plays a unique role in the open ocean surface environment by providing an important habitat for numerous fish, especially the larval lifestage (*e.g.*, reef fish FMP).
- Marine Water Column: This habitat includes the vertical column of water from the surface to the sea floor. Depending on the species, the designated habitat may just refer to the surface waters, bottom waters, or the entire water column. This habitat is important for a wide variety of species and their lifestages.
- Estuarine Areas: Nearshore estuarine habitats (*e.g.*, salt marshes, oyster beds) are designated as EFH for many species.

Habitat Areas of Particular Concern (HAPC) are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation. Regional FMCs may designate a specific habitat area as an HAPC based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat, (2) the extent to which the habitat is sensitive to human-induced environmental degradation, (3) whether, and to what extent, development activities are, or will be, stressing the habitat type, and (4) rarity of the habitat type (NMFS, 2002). The HAPC designation does not confer additional protection or restrictions upon an area, but can help prioritize conservation efforts. HAPCs have been designated in the Gulf of Mexico for numerous species (DoN, 2007a). The Madison-Swanson Marine Reserve HAPC and bluefin tuna HAPC are located in the GOMEX Study Area (Figure 3.6-8). The Navy's *Marine Resources Assessment for the Gulf of Mexico* (DoN, 2007a) provides maps showing the locations of designated EFH within each OPAREA, as well as descriptions of managed species and EFH.

TABLE 3.9-2
REPRESENTATIVE SPECIES WITH ESSENTIAL FISH HABITAT THAT ARE EXPECTED TO OCCUR IN THE GOMEX STUDY AREA

Management Authority, Fishery Management Plan, and Managed Species	Designated Essential Fish Habitat				
	Corpus Christi	New Orleans	Pensacola	Panama City	Demo Pond
Gulf of Mexico Fishery Management Council					
Coastal Migratory Pelagic FMP[1]					
Cobia (*Rachycentron canadum*)	✓	✓	✓	✓	✓
King mackerel (*Scomberomorus cavalla*)	✓	✓	✓	✓	✓
Spanish mackerel (*Scomberomorus maculatus*	✓	✓	✓	✓	✓
Coral and Coral Reef FMP					
Class Hydrozoa (stinging and hydrocorals)	✓	✓	✓	✓	-
Class Anthozoa (sea fans, whips, precious corals, sea pens, and stony corals)	✓	✓	✓	✓	-
Red Drum FMP					
Red drum (*Sciaenops ocellatus*)	-	-	-	-	✓
Reef Fish FMP					
Almaco jack (*Seriola rivoliana*)	✓	✓	✓	✓	✓
Anchor tilefish (*Caulolatilus intermedius*)	✓	✓	✓	✓	✓
Banded rudderfish (*Seriola zonata*)	✓	✓	✓	✓	✓
Blackfin snapper (*Lutjanus buccanella*)	✓	✓	✓	✓	✓
Blackline tilefish (*Caulolatilus cyanops*)	✓	✓	✓	✓	✓
Black grouper (*Mycteroperca bonaci*)	✓	✓	✓	✓	✓
Blueline tilefish (*Caulolatilus microps*)	✓	✓	✓	✓	✓
Cubera snapper (*Lutjanus cyanopterus*)	✓	✓	✓	✓	✓
Dog snapper (*Lutjanus jocu*)	✓	✓	✓	✓	✓
Dwarf sand perch (*Diplectrum bivittatum*)	✓	✓	✓	✓	✓
Gag *(Mycteroperca microlepis)*	✓	✓	✓	✓	✓
Goldface tilefish (*Caulolatilus chrysops*)	✓	✓	✓	✓	✓
Goliath grouper (*Epinephelus itajara*)	✓	✓	✓	✓	✓
Gray snapper (*Lutjanus griseus*)	✓	✓	✓	✓	✓
Gray triggerfish (*Balistes capriscus*)	✓	✓	✓	✓	✓
Greater amberjack (*Seriola dumerili*)	✓	✓	✓	✓	✓
Hogfish (*Lachnolaimus maximus*)	✓	✓	✓	✓	✓
Lane snapper (*Lutjanus synagris*)	✓	✓	✓	✓	✓
Lesser amberjack (*Seriola fasciata*)	✓	✓	✓	✓	✓
Mahogany snapper (*Lutjanus mahogoni*)	✓	✓	✓	✓	✓
Marbled grouper (*Epinephelus inermis)*	✓	✓	✓	✓	✓
Misty grouper (*Epinephelus mystacinus*)	✓	✓	✓	✓	✓
Mutton snapper (*Lutjanus analis*)	✓	✓	✓	✓	✓
Nassau grouper (*Epinephelus striatus*)	✓	✓	✓	✓	✓
Queen snapper (*Etelis oculatus*)	✓	✓	✓	✓	✓
Red grouper (*Epinephelus morio*)	✓	✓	✓	✓	✓
Red hind (*Epinephelus guttatus*)	✓	✓	✓	✓	✓
Red snapper (*Lutjanus campechanus*)	✓	✓	✓	✓	✓
Rock hind (*Epinephelus adscensionis*)	✓	✓	✓	✓	✓

TABLE 3.9-2 (Continued)
REPRESENTATIVE SPECIES WITH ESSENTIAL FISH HABITAT THAT ARE EXPECTED TO OCCUR IN THE GOMEX STUDY AREA

Management Authority, Fishery Management Plan, and Managed Species	Designated Essential Fish Habitat				
	Corpus Christi	New Orleans	Pensacola	Panama City	Demo Pond
Sand perch (*Diplectrum formosum*)	✓	✓	✓	✓	✓
Scamp (*Mycteroperca phenax*)	✓	✓	✓	✓	✓
Schoolmaster (*Lutjanus apodus*)	✓	✓	✓	✓	✓
Silk snapper (*Lutjanus vivanus*)	✓	✓	✓	✓	✓
Snowy grouper (*Epinephelus niveatus*)	✓	✓	✓	✓	✓
Speckled hind (*Epinephelus drummondhayi*)	✓	✓	✓	✓	✓
Tilefish (*Lopholatilus chamaeleonticeps*)	✓	✓	✓	✓	✓
Vermilion snapper (*Rhomboplites aurorubens*)	✓	✓	✓	✓	✓
Warsaw grouper (*Epinephelus nigritus*)	✓	✓	✓	✓	✓
Wenchman (*Pristipomoides aquilonaris*)	✓	✓	✓	✓	✓
Yellowedge grouper (*Epinephelus flavolimbatus*)	✓	✓	✓	✓	✓
Yellowfin grouper (*Mycteroperca venenosa*)	✓	✓	✓	✓	✓
Yellowmouth grouper (*Mycteroperca interstitialis*)	✓	✓	✓	✓	✓
Yellowtail snapper (*Ocyurus chrysurus*)	✓	✓	✓	✓	✓
Shrimp FMP					
Brown shrimp (*Farfantepenaeus aztecus*)	✓	✓	✓	✓	✓
Pink shrimp (*Farfantepenaeus duorarum*)	✓	✓	✓	✓	✓
Royal red shrimp (*Pleoticus robustus*)	✓	✓	✓	✓	✓
Stone Crab FMP					
Florida stone crab (*Menippe mercenaria*)	✓	✓	✓	✓	-
Gulf stone crab (*Menippe adina*)	✓	✓	✓	✓	-
National Marine Fisheries Service					
Atlantic Billfish FMP					
Blue marlin (*Makaira nigricans*)	✓	✓	✓	✓	-
Sailfish (*Istiophorus platypterus*)	✓	✓	✓	✓	-
White marlin (*Tetrapturus albidus*)	✓	✓	✓	✓	-
Atlantic Tunas, Swordfish, and Sharks FMP					
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	✓	-	✓	-	-
Blacknose shark (*Carcharhinus acronotus*)	-	-	✓	-	-
Blacktip shark (*Carcharhinus limbatus*)	✓	✓	✓	✓	-
Bluefin tuna (*Thunnus thynnus*)	✓	✓	✓	✓	
Bonnethead shark (*Sphyrna tiburo*)	✓	-	✓	-	-
Bull shark (*Carcharhinus leucas*)	✓	-	✓	✓	-
Finetooth shark (*Carcharhinus isodon*)	✓	-	✓	✓	-
Lemon shark (*Negaprion brevirostris*)	✓	-	-	-	-
Longfin mako shark (*Isurus paucus*)	-	✓	✓	✓	-
Sandbar shark (*Carcharhinus plumbeus*)	-	-	-	✓	-
Scalloped hammerhead shark (*Sphyrna lewini*)	-	-	✓	-	-
Silky shark (*Carcharhinus falciformis*)	-	-	✓	✓	-
Skipjack tuna (*Katsuwonus pelamis*)	✓	✓	✓	✓	-
Swordfish (*Xiphias gladius*)	✓	✓	✓	✓	-
Tiger shark (*Galeocerdo cuvier*)	-	-	✓	✓	-
Yellowfin tuna (*Thunnus albacares*)	✓	✓	✓	✓	-

Sources: DoN, 2007a; GMFMC, 2005.
✓ = essential fish habitat designated in training area
- = essential fish habitat not designated in training area.
[1]Jointly managed by the Gulf of Mexico Fishery Management Council (lead) and South Atlantic Fishery Management Council.

3.9.2.3 Fisheries Management Zones

NMFS uses fisheries management zones as tools to conserve both fish stocks and fish habitat. Fisheries management zones are areas that are closed, at least partially, to fishing activity. NMFS has the jurisdiction to restrict or even prohibit the use of one or more types of fishing gear in some areas to protect habitats, fish stocks, or species assemblages and/or to promote the recovery of threatened and endangered species, such as marine mammals and sea turtles. These area closures can be either seasonal or year-round. Fisheries management zones within the Study Area include:

- **Reef Fish Stressed Area (Figure 3.6-8, area 1) –** This area borders all five Gulf States and is located in the nearshore coastal waters of the Gulf of Mexico. It covers 27,700 nm^2, and was designated in 1990 to rebuild declining reef fish stocks in the stressed inshore areas (NOAA and DoI 2005a). Portions of the Reef Fish Stressed Area are located in the nearshore waters of the Panama City, Pensacola, and Corpus Christi OPAREAs. The use of fish traps, roller trawls, and powerheads on spear guns is prohibited within the area.
- **Reef Fish Longline/Buoy Gear Restricted Area (Figure 3.6-8, area 11) –** In 1990 the Reef Fish Longline and Buoy Gear Restricted Area was established to protect reef fishes, and in particular red snapper, by prohibiting the use of longline and buoy fishing gear. The area coincides with portions of the Panama City, Pensacola, and Corpus Christi OPAREAs, and includes waters on the continental shelf shoreward of the 91 m isobath, except along parts of the Gulf coast of Florida where the Restricted Area is located shoreward of the 37 m isobath.
- **DeSoto Canyon Closed Area (Figure 3.6-8, area 21) –** Established in November 2000, the DeSoto Canyon Closed Area consists of two rectangular areas covering nearly 24,800 nm^2 (GMFMC, 2000). Portions of the northwestern block are located in the Panama City and Pensacola OPAREAs, and the entire Hotbox is located with this closed area. The southeastern block is located outside of the Study Area. The DeSoto Canyon Closed Area was created for the purpose of reducing the number of undersized swordfish, billfish, and other species incidentally caught with pelagic longline gear. As such, longlining is prohibited year-round. The managed area consists of the water column up to the surface, but does not include bottom features (GMFMC, 2000). This closure is considered crucial to the sustainability of the swordfish fishery because this area includes a swordfish nursery ground where the longline fishery has historically caught and discarded a large number of juvenile swordfish. DeSoto Canyon is an erosional valley that cuts through the broad continental shelf in the northern part of the Gulf of Mexico (Figure 3.1-1). An upwelling of deep nutrient-rich water occurs here, resulting in relatively high primary productivity. This means that more food is available through the food web. The end result is a greater abundance of animals in this region (NOAA, 2008). The DeSoto Canyon area is recognized for its sport fishing for pelagic species such as swordfish, marlin, tuna, dolphin fish, and wahoo.
- **Madison-Swanson Marine Reserve – (Figure 3.6-8, area 22) -** This HAPC was designated to protect a spawning site of gag grouper, which spawn in large aggregations, during which time they are particularly vulnerable to fishing. The low relief Madison-Swanson Spawning Site is located south of Panama City, Florida in W-151B. In June 2000, NMFS closed the Marine Reserve to all fishing for a period of four years to evaluate the effects of fishing on gag grouper spawning aggregations, and to help rebuild the population (NOAA and DoI, 2005b). Recently,

NMFS extended these closures through 2010. Both closures serve as large-scale experiments designed to ascertain whether extreme fishing pressure on the spawning stocks of gag grouper has brought the fishery to the brink of collapse.

3.9.2.4 Recreational Fishing Hotspots

Recreational fishing is addressed in detail in Section 3.17. Recreational fishing hotspots tend to support dense aggregations of sport fish and are discussed in this section to help provide qualitative information about species distribution and abundance, particularly in areas such as the Hotbox where HE ordnance is used.

In portions of the Gulf of Mexico, offshore recreational fishing activity is concentrated around oil/gas structures; for example, 70 percent of all recreational trips within Louisiana's Exclusive Economic Zone were to these structures (Stanley and Wilson, 1989). These sites are often used by anglers to target snapper, grouper, red drum, spotted seatrout, croaker, king mackerel, cobia, and amberjack. On average, recreational anglers typically travel no more than about 30 nm from shore to oil and gas structures but distances as great as 60 nm have been traveled (Stanley and Wilson 1989; MMS 2005). The highest concentrations of oil/gas structures are found outside the Study Area, off the coasts of Mississippi and Louisiana (Figure 3.6-7). Some structures are located in the western portion of the Pensacola OPAREA, the New Orleans OPAREA, and the Corpus Christi OPAREA. No structures are located in the Panama City OPAREA, the Hotbox (Figure 3.6-3), or the Corpus Christi MINEX Boxes (3.6-4).

3.9.2.5 Endangered Species Act-Listed Species

Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

General Description—The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is classified under the family Acipenseridae and is characterized as having rows of armored plates along the sides and back, called scutes. The Gulf sturgeon is a demersal species (dwelling at or near the bottom) that has a vacuum like mouth, a long snout, and whiskers commonly called barbells, which are used for feeding. Gulf sturgeon typically range in color from a light neutral color to dark brown and have a white under belly. Gulf sturgeon can grow to 2.4 m long and weigh 90.7 kg (Huff, 1975).

Status and Management—USFWS and NMFS listed Gulf sturgeon as a threatened species under the ESA in 1991 (USFWS and NMFS, 1991). NMFS and USFWS share jurisdiction of the Gulf sturgeon depending on habitat. The USFWS has jurisdiction in freshwater habitats, while NMFS has jurisdiction of Gulf sturgeon in the marine environment. However, both agencies share authority in estuarine environments. On September 22, 1995, NMFS and USFWS jointly released a recovery plan for Gulf sturgeon (Gulf Sturgeon Recovery/Management Task Team, 1995).

Gulf sturgeon designated critical habitat is composed of 14 geographic areas, or units (Figure 3.9-1). In total, the units collectively encompasses approximately 2,783 km and over 6,042 km^2 of estuarine and marine habitat (USFWS and NMFS, 2003).

As required by the ESA, critical habitat determinations are designated by defining the physical and biological features, known as primary constituent elements, which are essential to the conservation of the species (USFWS and NMFS, 2003). There are seven primary constituent elements defined for Gulf sturgeon:

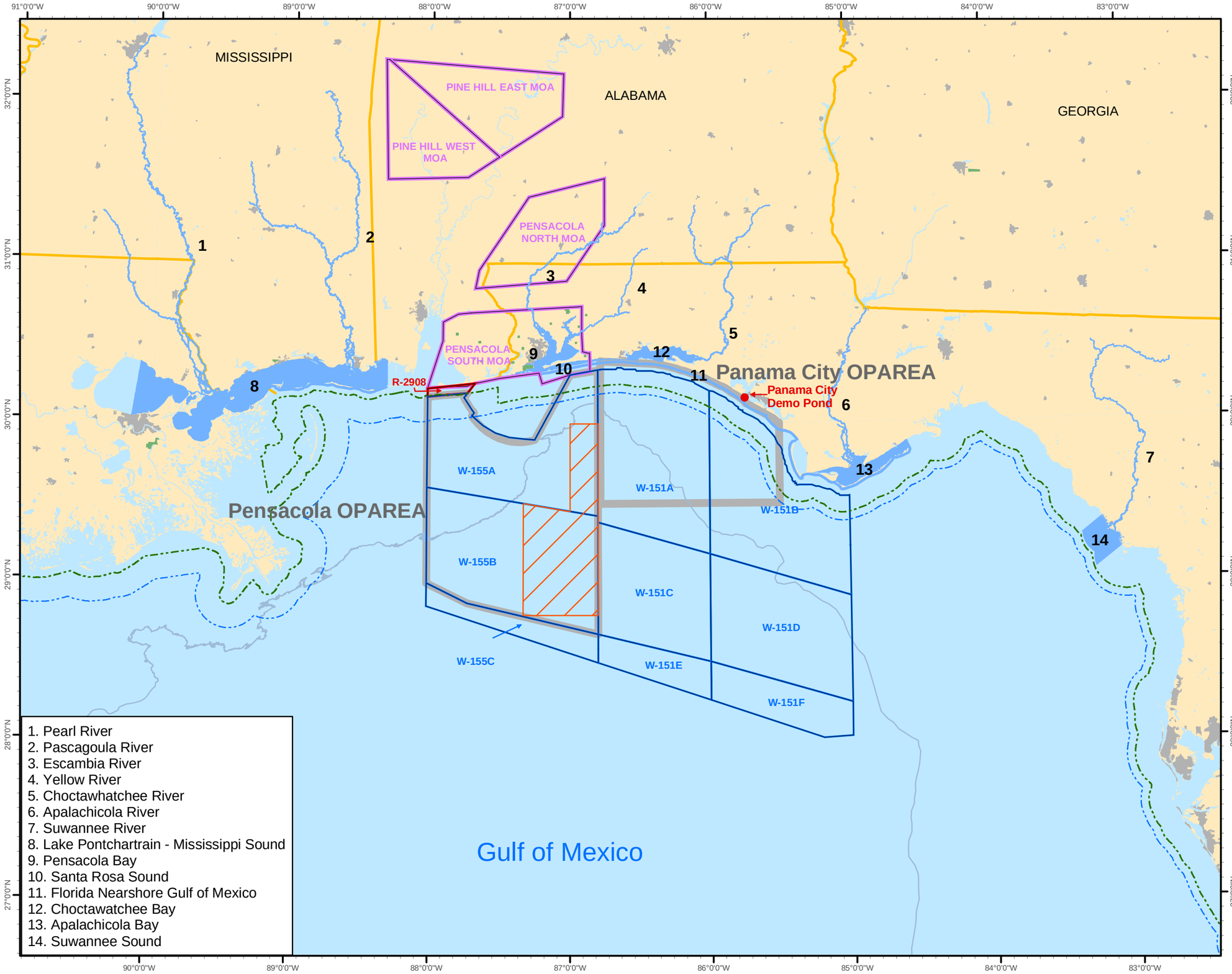
- Abundant food items within riverine habitats for larval and juvenile life stages, and within estuarine and marine habitats for adult and subadult life stages.
- Riverine spawning sites with suitable substrate.

- Riverine aggregation areas (resting, holding, or staging areas).
- Proper stream flow regime for all life stages.
- Adequate water quality for all life stages.
- Adequate sediment quality for all life stages.
- Safe and unobstructed migratory pathways for passage within and between riverine, estuarine, and marine habitats.

Within the GOMEX Study Area, only the Panama City OPAREA is located within Gulf sturgeon critical habitat Unit 11 (Figure 3.9-1). Unit 11 encompasses Florida nearshore Gulf of Mexico waters within Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf Counties in Florida. Unit 11 is important because it provides migration habitat for Gulf sturgeon on route from Gulf of Mexico winter/feeding grounds to their spring/summer natal rivers (Yellow, Choctawhatchee, and Apalachicola). Gulf sturgeon remain within 1.6 km of the coastline between Pensacola Bay and Apalachicola Bay in depths of less than 6 m during the winter months (Fox *et al.*, 2002; USFWS 2004, 2006).

Habitat—Various habitats are important to Gulf sturgeon depending on life stage and the species' spatial and temporal distribution patterns. The Gulf sturgeon is an anadromous fish; adults spawn in freshwater and migrate to feed and grow in estuarine/marine habitats. Gulf sturgeon larvae and young-of-the-year are found in freshwater rivers, usually associated with sandbars or sand shoals. Adult Gulf sturgeon migration patterns depend on various factors including sex, maturity, and water temperature. Primarily, habitats are determined by season (summer vs. winter) and water temperature. Typically, most subadult and adult Gulf sturgeon spend the fall and winter seasons (October/November through March/April) in estuarine areas, bays, and/or in the Gulf of Mexico and spend the spring and summer seasons (April/May through September/October) in local rivers (Foster and Clugston, 1997; Parauka *et al.*, 2001; Fox *et al.*, 2002; Hightower *et al.*, 2002). Having spent at least six months fasting, natal river mouths are presumed to be important foraging habitats for subadult and adult Gulf sturgeon that migrate from rivers to marine environments (Harris, 2003).

In the marine environment, both subadult and adult Gulf sturgeon are usually found near sandy shoreline habitats in shallow waters (<8 m) with low salinity levels (<6.3 parts per thousand [ppt]) (Fox and Hightower, 1998; USFWS, 2004, 2006). Fox *et al.*, (2002) found that most tagged fish were located near nonvegetated areas in shallow shoals ranging in depth from 1.5 to 2.1 m, in deep holes near passes (Craft *et al.*, 2001), or offshore in the Gulf of Mexico in shallow waters (<8 m) ranging from inshore waters to about 2 km offshore (Fox *et al.*, 2002). In addition, it was recently found that when Gulf sturgeon were in the marine environment, they preferred nonvegetated, fine to medium-grain sand habitats, such as sandbars, intertidal and subtidal energy zones (USFWS, 2004, 2006). It is probable that these predominantly sandy areas support a variety of prey items including estuarine crustaceans,



Designated Critical Habitat for the Gulf Sturgeon within the GOMEX Study Area

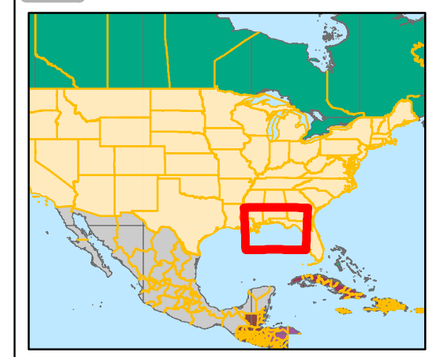
Figure 3.9-1

Legend

- Shelf Break
- State Seaward Extent
  TX & FL 9 nm; AL, MS & LA 3 nm
- 12 nm Territorial Limit
- Critical Habitat of Sturgeon

Special Use Airspace

- Military Operating Areas (MOA)
- Restricted Airspace (R-)
- Warning Areas (W)
- Eastern GOMEX BOMBEX HotBox
- Operating Areas (OPAREA)



N

1:2,566,879

Nautical Miles
0 12.5 25 50 75

Kilometers
0 25 50 100 150

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Sources: National Geospatial Intelligence Agency (NGA) Database;Special Use Airspace Document AP/1A; COMLANTFLT 3120.26E Document.

Estuarine/marine critical habitat for the Gulf sturgeon (NMFS, 2003).

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small bivalvemollusks, ghost shrimp, small crabs, various polychaete worms, and lancelets (Huff, 1975; Gulf Sturgeon Recovery/Management Task Team, 1995; Harris 2003; Brooks and Sulak, 2004; Brooks and Sulak, 2005; Harris *et al.*, 2005).

Distribution—Historically, Gulf sturgeon were found from Louisiana to Charlotte Harbor, Florida. Today, Gulf sturgeon are found from Lake Pontchartrain and the Pearl River system in Louisiana east to the Suwannee River in Florida. In addition, although extremely rare, a few random occurrences have been recorded from the Rio Grande River between Texas and Mexico and a few records exist for Florida Bay (Wooley and Crateau, 1985; Reynolds, 1993). Gulf sturgeon are found in most major freshwater tributaries of the northeastern Gulf of Mexico, from the Mississippi River to Florida's Suwannee River (Wooley and Crateau, 1985). Gulf sturgeon are found in the Escambia, Yellow, Blackwater, Choctawhatchee, Apalachicola, Ochlockonee, and Suwannee rivers (Reynolds, 1993).

Based on tagging data from December 2003-April 2004, Gulf sturgeon were primarily found along northwest Florida beaches during the winter months. Two Gulf sturgeon, in particular, were tracked just southeast of the mouth of St. Andrew Bay along the coastline (USFWS, 2004). Relocation data from December 2005-April 2006 indicate Gulf sturgeon movements northeast of the mouth of St. Andrew Bay. Relocated fish were found in water depths ranging from 12 to 40 feet and from 0.5 to 2 miles offshore (USFWS, 2006). Researchers suspected that the relocated fish were associated with fine sand and shell hash substrates because the bottom types provided habitat for major Gulf sturgeon prey items such as lancelets, polychaetes, and amphipods (USFWS, 2006).

GOMEX Study Area Gulf Sturgeon Occurrence—Gulf sturgeon are found from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi to the Suwannee River in Florida. Recent tagging information demonstrates that Gulf sturgeon are found mostly in the marine environment and primarily along the northeastern beaches of the Gulf of Mexico in waters ranging in depth from 12 to 40 feet and from 0.5 to 2 miles offshore. Available information indicates that remaining viable Gulf sturgeon populations are found in most major freshwater tributaries of the northeastern Gulf of Mexico, from the Mississippi River to Florida's Escambia, Yellow, Blackwater, Choctawhatchee, Apalachicola, Ochlockonee, and Suwannee rivers during the spring and summer months (March or April through October or November) and are found in the marine environment (estuaries, bays, and in the Gulf of Mexico) during the fall and winter (Zehfuss *et al.*, 1999; USFWS, 1999; USFWS, 2004; Berg, 2004; Reynolds, 1993).

In addition, USFWS biologists have identified an important Gulf sturgeon wintering area westward from Pensacola, Florida to Mobile Point, Alabama, with most of the activity occurring near Perdido Pass, Alabama. Additionally, recreational fishermen fishing off piers at St. Andrews State Park and the Dan Russell Pier in the Gulf of Mexico have reported Gulf sturgeon traversing along the coastline during the winter (Parauka, Pers. Comm., 2008).

Although tagging information suggests that Gulf sturgeon are mostly found within 3.7 nm of the coastline during the fall and winter, Gulf sturgeon have been observed as far as 9 nm from shore near the Suwannee River (USFWS and NMFS, 2003). Tagging data indicate that during the fall and winter, some fish remain within St. Andrew Bay while other animals traverse from the bay to the coastal waters of the Gulf of Mexico (Parauka, Pers. Comm., 2008). Therefore, during the fall and winter season, it is possible that Gulf sturgeon may occur along the northern boundaries of the Panama City and Pensacola OPAREAs. However, occurrence in the OPAREAs is unlikely since the OPAREAs are located offshore of the preferred seasonal habitats of Gulf sturgeon (shallow [<10 m] coastal waters) (Fox *et al.*, 2002; USFWS, 2004, 2006). In addition, the closest Gulf sturgeon populations to the Study Area (*i.e.*, Choctawhatchee, Escambia, and Yellow rivers) are of low abundance.

During fall and winter, Gulf sturgeon may occur in the vicinity of the Demolition Pond. However, tagging data indicates that most fish are found in the marine environment and no tagging studies have shown that Gulf sturgeon seek shallow, semi-enclosed areas such as the Demolition Pond. Studies have shown that Gulf sturgeon feed on the benthic prey found in the sandy sediments associated with coastal beaches (Harris, 2003; Brooks and Sulak, 2004, 2005; Harris *et al.*, 2005). Still, it is possible that some fish may remain within the St. Andrew Bay and other animals traverse from the bay to the Gulf of Mexico on a regular basis. Thus, Gulf sturgeon may occur in the vicinity of the Demolition Pond during fall and winter.

GOMEX Study Area Gulf Sturgeon Density—No data were available to calculate Gulf sturgeon density in the GOMEX Study Area.

Smalltooth Sawfish (*Pristis pectinata*)

General Description—Smalltooth sawfish (*Pristis pectinata*) is a widely distributed member of the family Pristidae. This tropical marine and estuarine elasmobranch (cartilaginous skeleton; sharks, skates, rays) was named for its long, flat snout (~25% of body length) edged with 24 to 34 sharp teeth. Dorsally, the body is brownish or bluish gray in color and has mostly white underside (Simpfendorfer, 2005). Adult smalltooth sawfish are usually about 5.5 m long, maximum size is 7.6 m, and maximum weight is around 907 kg (Simpfendorfer, 2002; Simpfendorfer, 2005; Passarelli and Curtis, 2003).

Status and Management—Smalltooth sawfish were once common in the Gulf of Mexico and along the east coast of the United States. Today, the population is severely depleted and restricted mostly to southern Florida (Simpfendorfer, 2002; Poulakis and Seitz, 2004; Simpfendorfer, 2005; Simpfendorfer and Wiley, 2005a,b; Passarelli and Curtis, 2003). The U.S. smalltooth sawfish population was listed as endangered under the ESA on April 1, 2003 (NMFS, 2003). The smalltooth sawfish population in U.S. waters is considered isolated from other populations, making it a Distinct Population Segment (DPS) (NMFS, 2003). NMFS proposed critical habitat for the smalltooth sawfish on November 20, 2008 (73 FR 70290), but none of the proposed critical habitat is within the GOMEX Study Area. Presently, the Smalltooth Sawfish Recovery Team is drafting a smalltooth sawfish recovery plan (NMFS, 2006b).

Habitat—Important smalltooth sawfish habitats include shorelines and benthic vegetation, with salinity, depth, and temperature requirements. The smalltooth sawfish commonly inhabits shallow subtropical-tropical estuarine and marine waters, but may also be found in freshwater river habitats (Simpfendorfer, 2002; Schultz, 2004). The species is considered demersal and prefers to remain close to the bottom in deep holes consisting of sand or muddy sand substrates. Smalltooth sawfish may be associated with a variety of habitats including shallow inshore areas, mangroves, and seagrasses. Smalltooth sawfish has been reported to utilize various bottom habitats from mud, limestone hard bottom, to coral reefs (Poulakis and Seitz, 2004; Schultz, 2004). Moreover, this species has also been associated with sea fans (hard bottom communities), artificial reefs, and oil rigs (Poulakis and Seitz, 2004).

Sawfish could be found in waters with wide ranging salinity levels (3.2 to 28 ppt), dissolved oxygen levels ranging from 3.18 to 8.14 mg/L, and water temperatures from 19.7° to 31.5°C with most animals observed at higher temperatures (29° and 31°C) (Simpfendorfer, 2001; Matheson *et al.*, 2006). Simpfendorfer and Wiley (2005a,b) found that the majority (59.7%) of smalltooth sawfish encounters occurred within 1,000 m of shore, with most within 200 m.

Distribution—In the western North Atlantic Ocean, smalltooth sawfish were once found from New York (seasonally) to Brazil, throughout the Gulf of Mexico (*e.g.*, Texas, Mexico), and were abundant year-round in Florida waters (Schultz, 2004). Currently, the only remaining viable population in U.S. waters exists off Florida, with the center of distribution being the Everglades National Park, including

Florida Bay (NMFS, 2003). Recent smalltooth sawfish records are limited to Texas, Alabama, Georgia, Florida, Bermuda, and Cuba (Wiley and Simpfendorfer, 2007).

Throughout the United States, there have been a total of 898 reported and verified sawfish encounters since 1998, most from recreational fishermen (Wiley and Simpfendorfer, 2007). Most of the smalltooth sawfish encounters have occurred in Florida with the majority of reports from the Caloosahatchee River to Florida Bay. Based on the smalltooth sawfish encounter distribution data, the highest encounter density areas were in the Ten Thousand Islands, the central Everglades coast, the mouth of the Caloosahatchee River, Florida Bay, Marquesas Keys, and northwest Florida, respectively (Wiley and Simpfendorfer, 2007).

Seasonal distribution is unknown since populations are mostly depleted and available data are opportunistic. Nonetheless, although recreational fishermen reported catching smalltooth sawfish throughout the year in Florida Bay and Florida Keys, the majority reported catching animals between March and August (Poulakis and Seitz, 2004). Wiley and Simpfendorfer (2007) reported that the highest numbers of encounters occurred in March and June and lowest numbers occurred during September through January.

GOMEX Study Area Smalltooth Sawfish Occurrence—The smalltooth sawfish population and range is mostly restricted to Florida waters, generally south of 26.2°N (Wiley and Simpfendorfer, 2007). Within the State of Florida, there has been only one smalltooth sawfish reported and verified encounter within the vicinity of the Pensacola OPAREA. Although there have been six reported smalltooth incidental catches by commercial shrimp trawls operating off the west coast of Florida in the Gulf of Mexico (three in state waters and three in federal waters), all three were reported south and outside of the Panama City OPAREA (NMFS, 2006b). No smalltooth sawfish encounters have ever been reported and verified in federal waters off northwestern Florida and within either the Pensacola or the Panama City OPAREAs by either commercial fishermen or recreational divers. However, current information suggests that high habitat suitability areas for this species are located in northwestern Florida nearshore waters (Simpfendorfer, 2006). Smalltooth sawfish may occur in or near the Demolition Pond. There have been three smalltooth sawfish encounters that have been reported and verified since 1998 west of the mouth of St. Andrew Bay in May, September, and October (Wiley and Simpfendorfer, 2007).

GOMEX Study Area Smalltooth Sawfish Density—No data were available to calculate the smalltooth sawfish density in the GOMEX Study Area.

3.9.3 Environmental Consequences

3.9.3.1 No Action Alternative

Vessel Movements

Effects on Essential Fish Habitat

Vessel movements would have no effect on benthic or artificial habitats because Navy vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats. Vessel movements would result in short-term, localized disturbances to water column and *Sargassum* habitats. Impacts to *Sargassum* habitats would be avoided and minimized by mitigation measures (Chapter 5). Impacts to EFH would be temporary and minimal. Vessel movements would not reduce the quality and/or quantity of EFH in the Study Area.

Disturbance to Fish

Studies documenting behavioral responses of fish to vessels show that fish may exhibit avoidance responses to engine sound, sonar, depth finders, and fish finders (Jorgensen *et al.*, 2004; Acoustic

Ecology Institute, 2007). Avoidance reactions are quite variable depending on the type of fish, its life history stage, behavior, time of day, and, the sound propagation characteristics of the water (Schwarz, 1985). Misund (1997) found that fish ahead of a ship, that showed avoidance reactions, did so at ranges of 160 to 490 ft. When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance and/or downward compression of the school.

The low frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman and Hawkins, 1973). Avoidance ended within 10 seconds after the vessel departed. Twenty five percent of the fish groups habituated to the sound of the large vessel and 75 percent of the responsive fish groups habituated to the sound of small boats.

Vessel movements under the No Action Alternative would expose fish to general disturbance, which could result in short-term behavioral and/or physiological responses (*e.g.*, swimming away and increased heart rate). Such responses would not be expected to compromise the general health or condition of individual fish.

Collisions with Fish

The probability of collisions between vessels and adult or juvenile fish, which could result in injury or mortality, would be extremely low because these life stages are highly mobile and Navy vessel density in the Study Area is low. Ichthyoplankton (fish eggs and larvae) in the upper portions of the water column could be displaced, injured, or killed by vessel and propeller movements. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to vessel movements would be low relative to total ichthyoplankton biomass. Mitigation measures (see Chapter 5), which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of injury or mortality. In accordance with NEPA, vessel movements in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, vessel movements in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Aircraft Overflights

Effects on Essential Fish Habitat

Under the No Action Alternative a total of 5,223 fixed-wing aircraft and 38 helicopter sorties are expected to occur each year over the Gulf of Mexico. As discussed in Section 3.7.3.3, aircraft overflights in the Study Area would produce intermittent airborne noise and some of this sound energy would be transmitted into the water. Based on the analysis presented in Section 3.7.3.3, aircraft overflights could increase ambient sound levels in the water column and possibly in shallow water benthic habitats. However, most fixed-wing overflights occur at 3,000 to 30,000 ft and low-altitude flights are infrequent. Furthermore, any increased sound levels in the water column would be short-term (a few seconds as the aircraft passes) and localized (a narrow cone under the aircraft). The downdraft from low altitude helicopter overflights could also result in short-term, localized disturbance to the water surface. Impacts from aircraft overflights to EFH would be temporary and minimal. Aircraft overflights would not reduce the quality and/or quantity of EFH in the Study Area.

Effects on Fish

Some species of fish could respond to noise associated with low-altitude aircraft overflights or to the surface disturbance created by downdrafts from helicopters. However, studies indicate that hearing specializations in marine fish are quite rare and that most marine fish are considered hearing generalists (Popper, 2008; Popper, 2003; Amoser and Ladich, 2005). Generalists are limited to detection of the particle motion component of low frequency sounds at relatively high sound intensities (Amoser and

Ladich, 2005). As such, it is possible that many species of fish would not hear or respond to noise associated with most aircraft overflights. If fish were to respond to aircraft overflights, only short-term behavioral and/or physiological reactions (*e.g.*, swimming away and increased heart rate) would be expected. Such responses would not compromise the general health or condition of individual fish. In accordance with NEPA, aircraft overflights over territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Non-Explosive Practice Munitions

Effects on Essential Fish Habitat

Current Navy operations in the GOMEX Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, naval gunshells, naval medium caliber cannon ammunition, and small arms ammunition. NEPM use in the Gulf of Mexico is limited to W-151 A/B/C and the Harbor Security Group Machine Gun Area (Panama City OPAREA); W-155 A/B (Pensacola OPAREA); and MINEX Box E3 (Corpus Christi OPAREA). NEPM is not used in the New Orleans OPAREA (see Table 2.2-8 for a summary of ordnance use by training area).

Disturbances to water column habitats from NEPM strikes would be short-term and localized. Navy mitigation measures require avoidance of *Sargassum*; therefore impacts to these habitats would be minimal. The potential for NEPM strikes to adversely affect benthic EFH and the associated magnitude of effects depend on several factors, including the size and speed of the ordnance, water depth, the number of rounds delivered, the frequency of training, and the presence/absence of sensitive benthic communities. As described in Section 3.6.2.2, both soft bottom and hard bottom communities occur in the portions of the Study Area where NEPM use occurs. While a broad area of soft and hard bottom benthic habitat could be exposed to direct ordnance strikes, the training exercises are intermittent and widely dispersed, which decreases the likelihood that a given area would be subjected to repeated exposure. Most ordnance firing occurs in areas well offshore in waters over 30 m deep. NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, NEPM strikes would cause little or no physical damage to soft bottom benthic habitat and any damage would be localized.

Live hard bottom habitats would be vulnerable to damage from NEPM strikes. This is particularly true for areas that support coral because coral is fragile and could be easily broken by contact with larger objects such as non-explosive practice bombs. While large coral reefs are not known to occur in the Study Area, some hard bottom areas could support patches of coral. Repopulation and recovery of damaged hard bottom habitats would be relatively slow (*e.g.*, years to a decade or more) compared to soft bottom areas (*e.g.*, less than one year) (NRC, 2002).

Large, heavy items such as non-explosive practice bombs and naval gun shells (Table 3.9-3) could cause damage if they struck sensitive hard bottom habitat. Small caliber ammunition has little potential to disturb the bottom because these materials are relatively small and light, and their velocity would decrease through the water column. A total of 180 non-explosive practice bombs would be dropped per year in W-151A/C and W-155B under the No Action Alternative. Assuming an even distribution within these areas, the relative concentration of non-explosive practice bombs would be 0.026/nm^2/year. Actual concentrations would vary based on specific training scenarios, but would nonetheless be extremely low. A total of 1,240 non-explosive naval gun shells (5 in and 76 mm) would be fired per year under the No Action Alternative in W-151A/B and W-155A.

The maximum area of benthic habitat affected by non-explosive practice bomb and naval gun shell strikes would be approximately 2,780 ft^2 (0.00008 nm^2) per year or 27,800 ft^2 (0.0008 nm^2) over a ten-

year period for the No Action Alternative, assuming that the area affected by a single NEPM would be two times its footprint (Table 3.9-4).

TABLE 3.9-3
SIZE OF NON-EXPLOSIVE PRACTICE BOMBS AND NAVAL GUN SHELLS USED AT SEA IN THE GOMEX STUDY AREA

NEPM Type	Weight (pounds)	Length (inches)	Diameter (inches)	Footprint (ft^2)[(2)]
BDU-45	500	66	11	5.0
MK-76	25	25	4	0.7
MK-83(I)[(1)]	1,000	119	14	11.6
MK-84(I)[(1)]	2,000	129	18	16.1
5 in	70	26	5	0.9
76 mm	14	14	3	0.3

[(1)]Alternative 2 only.
[(2)]Length x diameter.

TABLE 3.9-4
ESTIMATES OF MARINE BENTHIC HABITAT THAT WOULD BE AFFECTED BY NON-EXPLOSIVE PRACTICE BOMBS AND NAVAL GUN SHELLS IN THE GOMEX STUDY AREA

NEPM Type	No Action Alternative		Alternative 1		Alternative 2	
	#/Yr	Area Affected/Yr (ft^2)[(1)]	#/Yr	Area Affected/Yr (ft^2)[(1)]	#/Yr	Area Affected/Yr (ft^2)[(1)]
Non-Explosive Practice Bombs – W-151A/C and W-155A/B[(2)]						
BDU-45	40	400	40	400	148	1480
MK-76	140	196	140	196	140	196
MK-83(I)	0	0	0	0	44	1,021
MK-84(I)	0	0	0	0	3	97
Subtotal =	**180**	**596**	**180**	**596**	**335**	**2,793**
Non-Explosive Practice Naval Gun Shells – W-151A/B and W-155A						
5 in	1,200	2,160	1,200	2,160	1,200	2,160
76 mm	40	24	40	24	40	24
Subtotal =	**1,240**	**2,184**	**1,240**	**2,184**	**1,240**	**2,184**
Total =		**2,780**		**2,780**		**4,977**

[(1)]Assumed that area of marine benthic habitat affected per year = footprint x 2 x #/yr.
[(2)]W-155A is for Alternative 2 only.

Given the dispersed nature of the training activities, often patchy distribution of community types, and relatively limited bottom mapping data, it is not possible to accurately determine the number of non-explosive practice bombs and naval gun shells that would strike soft bottom habitats versus more sensitive areas such as live hard bottom or artificial habitats. As shown in Figure 3.6-3, portions of W-151 and W-155 are known to support live hard bottom and artificial habitats based on available data. However, most of W-151 and W-155 is expected to consist of soft bottom habitat. While non-explosive practice bombs and naval gun shells have the potential to strike and damage live hard bottom and artificial habitats, including areas that support coral, it is likely that most would strike areas of soft bottom habitat based on the abundance of this habitat type. As noted above, the maximum area of benthic habitat affected per year by non-explosive practice bombs and naval gun shells would be about

2,780 ft^2. This represents a very small percentage of the total area within W-151 and W-155 (0.000001%). The probability of a non-explosive practice bomb striking live hard bottom or artificial habitats is low given the number of bombs dropped and spatial distribution of the exercises and resources. If a non-explosive practice bomb were to strike live hard bottom or an artificial habitat, long-term damage could result, but the area affected would be small (*i.e.*, less than 2,780 ft^2 per year). As such, non-explosive practice bomb and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities or artificial habitats, but the effects would be localized and no long-term changes to community structure or function would be expected.

Non-explosive practice bomb and naval gun shell strikes could result in long-term, minor effects to benthic EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to benthic EFH would be minimal based on the relatively small area affected by non-explosive practice bombs. Given the small area affected, NEPM use under the No Action Alternative would not reduce the quality and/or quantity of EFH in the Study Area.

Effects on Fish

NEPM and associated shrapnel have the potential to directly strike fish as it travels through the water column. NEPM could also generate physical shock entering the water, but would not explode. Shock waves could cause behavioral reactions or physical injury. Fish at the surface would be most susceptible to injury from strikes because NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Navy mitigation measures, which include avoidance of large *Sargassum* mats where some fish tend to concentrate, further reduce the probability of NEPM-related injury or mortality. As discussed in Section 3.7.3 and 3.8.3, statistical modeling conducted for the Study Area indicates that the probability of NEPM striking marine mammals and sea turtles is extremely low. Statistical modeling could not be conducted to estimate the probability of NEPM/fish strikes because fish density data are not available. A possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of NEPM delivery, but population-level effects would not occur.

Weapons firing could have acoustic effects from: 1) sound generated by firing the gun (muzzle blast), 2) vibration from the blast propagating through the ship's hull, and 3) sonic-booms generated by the shell flying through the air.

Firing a deck gun produces a shock wave in air that propagates away from the muzzle in all directions, including toward the air/water surface. Direct measurements of shock wave pressures transferred through the air/water interface from the muzzle blast of a 5-inch gun are well below levels known to be harmful at shallow depths (Yagla and Stiegler, 2003). Sound produced during gunfire may disturb fish in the vicinity of the ship. Because the sound is brief, no extended disruption of fish behavior is expected.

Gun fire sends energy through the ship structure, into the water, and away from the ship. This effect was also investigated in conjunction with the measurement of 5-inch gun blasts described above (Yagla and Stiegler, 2003). The energy transmitted through the ship to the water for a typical round was found to be about 6 percent of that from the air blast impinging on the water. Therefore, sound transmitted from the gun, through the hull into the water should have negligible impact on marine life.

The sound generated by a shell in its flight at supersonic speeds above the water is transmitted into the water in much the same way as a muzzle blast (Pater, 1981). The region of underwater sound influence from a single traveling shell is relatively small, diminishes quickly as the shell gains altitude, and is of short duration. The penetration of sound through the air\water interface is relatively limited (Miller, 1991; Yagla and Stiegler, 2003). Studies reviewed in DoN (2007b) indicate only a small number of

submerged species would be exposed to the pressure waves from sonic booms from 5-inch shells fired during routine training exercises. The potential exists for energy from multiple sonic booms to accumulate over time from multiple, possibly rapid firings of a gun. However, it is highly unlikely that the energy from more than two or three shells would be additive because sound energy would only enter the water in a small area directly below the shells' path.

In accordance with NEPA, NEPM use in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, NEPM use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Overview

As summarized below and in Tables 2.2-4 and 2.2-9, some of the training conducted under the No Action Alternative would involve underwater detonations and the use of HE ordnance:

- The No Action Alternative includes Mine Countermeasures and Mine Neutralization exercises with underwater detonations that range in net explosive weight (NEW) from 0.00514-lb shots to 20-lb charges. These operations currently take place in the MINEX Boxes located in the Panama City OPAREA (Figure 2.1-1) and Corpus Christi OPAREA (Figure 2.1-3). Some charges would be detonated directly on the bottom and the others would be detonated in the water column.
- The No Action Alternative includes the use of 20 anti-swimmer grenades (0.5-lb NEW) per year in MINEX Box E3 within the Corpus Christi OPAREA. These grenades detonate about 10 feet under the water's surface within four to five seconds of being deployed. The training area where these grenades are used is about 7 to 12 nm offshore in 72 to 85 feet of water.
- The No Action Alternative includes underwater detonations in the NSA Panama City Demolition Pond (Figure 2.1-6). The Demolition Pond is located in a small (5,800 m^2) bayou of St. Andrew Bay with a maximum depth of 11 feet. Up to 5-lb NEW charges are authorized in the Demolition Pond, but maximum charge included in the No Action Alternative is 1.25-lb NEW.
- The No Action Alternative includes dropping 52 HE bombs (192.2- and 415.8-lb NEW) per year in the Hotbox, which is located more than 12 nm offshore in the Pensacola OPAREA (Figure 2.1-1). Explosions associated with HE bombs occur at or near the water's surface (about 3.3 feet below the surface) in the Hotbox where depths range from about 320 to 4,000 feet.

Potential effects to fish and EFH from underwater explosions include: habitat disturbance; disturbance, injury, or death from the shock (pressure) wave; acoustic effects; and indirect effects including those on prey species and other components of the food web.

Habitat Disturbance and Essential Fish Habitat

The underwater detonation of explosives can result in physical alteration of fish habitats (Wright and Hopky, 1998). As discussed above in Section 3.9.2, EFH has been designated for various federally managed species in training areas where underwater detonations and HE ordnance use occurs. All underwater detonations and HE ordnance use would result in disturbance to water column habitats. However, water column disturbances would be short-term and localized, and associated effects to EFH would be considered temporary and minimal. Therefore, water column disturbances associated with underwater detonations and HE ordnance use would not result in adverse effects to EFH as defined under the MSFCMA.

A primary concern is the potential for explosions to affect live hard bottom, coral reefs, artificial reefs, shipwrecks, and oil/gas structures, because these resources provide shelter and habitat for a wide variety of marine life and dense aggregations of fish (Cahoon *et al.*, 1990, Thompson *et al.*, 1999). Mine

Neutralization exercises conducted under the No Action Alternative in the Panama City and Corpus Christi MINEX Boxes would include underwater detonations set on or near the sea floor, as well as in the water column. Areas where these exercises take place generally lack live hard bottom and artificial habitats (Figure 3.6-3 and 3.6-4). Furthermore, the Navy does not set underwater explosive charges associated with Mine Neutralization exercises within 1,000 m of known live/hard bottom, artificial reefs, and shipwrecks or within 700 yards of *Sargassum* mats (see Section 5.6 for detailed description of Navy mitigation measures for underwater detonations). Therefore, only unconsolidated, soft bottom and water column habitats should be exposed to impacts from underwater detonations associated with Mine Neutralization exercises.

Cratering of soft bottom habitats would result from Mine Neutralization charges set on or near the bottom. For a specific size of explosive charge, crater depths and widths would vary depending on depth of the charge and sediment type, but crater dimensions generally decrease as bottom depth increases. A 20-lb NEW charge detonated on the bottom can create depressions in the substrate up to 4 to 5 feet in diameter (12.6 to 19.6 ft^2) and 1 foot deep (DoN, 2000). Crater effects are usually temporary in sand and mud bottoms. Short-term increases in turbidity, resuspension of bottom sediments, and localized mortality of benthic organisms and plankton would be expected. Repopulation of displaced sediments should be relatively rapid (less than one year) compared to hard bottom areas (years to decades or more) (NRC, 2002). The effects to EFH from Mine Neutralization underwater detonations would be considered minimal based on the relatively small area affected. The effects would also be considered temporary based on the relatively rapid recovery (less than one year) of soft bottom habitats and associated benthic communities. Therefore, benthic habitat disturbances from Mine Neutralization underwater detonations would not result in adverse effects to EFH as defined under the MSFCMA.

Underwater detonations would also result in disturbances to bottom substrate in the Demolition Pond, which are expected to consist of sand, silt, and clay. The area affected would vary based on the NEW and location of the charge in relationship to the bottom. While the explosive charges used in the Demolition Pond have relatively low NEWs, the shallow depth of the pond increases the likelihood that benthic habitat would be adversely affected. Based on the small size of the pond and the frequent use (90 days per year), it is possible that some bottom areas would be repeatedly disturbed by underwater detonations and that benthic habitat would not fully recovery after an explosion. Therefore, underwater detonations could result in long-term impairment of Demolition Pond's benthic community. Habitat quality could be degraded and reductions in species richness and abundance could occur. However, the effects would be localized and limited to the pond or a portion of the pond. Given the small size of the Demolition Pond and the abundance of similar soft bottom habitats in the immediate area, the effects of underwater detonations would be considered minimal. Therefore, benthic habitat disturbances from training in the Demolition Pond would not result in adverse effects to EFH as defined under the MSFCMA.

Explosions from anti-swimmer grenades in the Corpus Christi MINEX Box E-3 would occur about 10 feet below the surface. These explosions have little potential to adversely affect benthic or artificial habitats based on the low NEW (0.5 lbs) and water depths. Based on information presented in Section 3.6.2 (Figure 3.6-4), coral reefs, live/hard bottom habitats, and artificial habitats do not occur in MINEX Box E-3. In addition, *Sargassum* is not expected to occur in this relatively nearshore area (Figure 3.6-1). Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by the explosion would be about 3 feet, which would not extend to the bottom based on the minimum water depth of the training area (72 feet) and a detonation depth of 10 feet. Anti-swimmer grenade explosions would have minimal effects on soft bottom benthic habitats and no effect on artificial habitats. Therefore, anti-swimmer grenade use would not result in adverse effects to EFH as defined under the MSFCMA.

Explosions from HE bombs in the Hotbox would occur about 3.3 feet below the surface in waters ranging from about 320 to 4,000 feet deep. Mapped live hard bottom communities in the Hotbox are limited to the northwestern corner and along the western boundary (Figure 3.6-3). The hard bottom in the northwestern corner is part of an area known as 29 Edge/27 Edge and covers about 20 nm^2 within the 1,459 nm^2 Hotbox (1.4%). At least two shipwrecks (Gandy Dancer in 690 feet of water and an unknown wreck in 2,625 feet of water) and one artificial reef (Woodburn Reef, consisting of steel truck cabs in 2,165 feet of water) are located in the Hotbox (Figure 3.6-3). At least one point supporting deep sea corals has been identified in the Hotbox, but oil/gas structures are not present (Figure 3.6-3).

Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by MK-82 and MK-83 HE bomb explosions would be about 23 and 30 feet, respectively. The gas bubbles would not extend to the bottom based on the minimum water depth of the Hotbox (320 feet) and a detonation depth of 3.3 feet below the surface. HE bomb explosions in the Hotbox are not expected to result in disturbance to benthic or artificial habitats because detonations would occur near the surface in deep waters. Furthermore, occurrence of known live hard bottom and artificial habitats is very limited in this area and Navy mitigation measures specify that HE bombs are not targeted to impact within 5,100 yards of known coral/live hard bottom. Effects of explosions on *Sargassum* habitats would be minimal because Navy mitigation measures specify that HE bombs are not targeted to impact within 5,100 yards of observed *Sargassum* mats. Therefore, HE bomb use would not result in adverse effects to EFH as defined under the MSFCMA.

In summary, underwater detonations and HE ordnance use under the No Action Alternative would result in short-term and localized disturbances to water column habitats. Underwater detonations associated with Mine Neutralization training would disturb soft bottom benthic habitats, but the effects would be minimal and temporary. Underwater detonations in the Demolition Pond would result in long-term disturbance to soft bottom benthic habitat, but the effects would be considered minimal based on the small area affected. Underwater detonations and HE ordnance use are not expected to have adverse effects on live hard bottom, corals, coral reefs, or artificial habitats that can support dense aggregations of fish. Navy mitigation measures further reduce the potential for these resources and *Sargassum* habitats to be affected by explosions. Underwater detonations and HE ordnance use would not result in a measurable decrease in the quantity or quality of EFH in the Study Area and would have no adverse effects to EFH as defined under the MSFCMA. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters under the No Action Alternative would not result in significant impacts to fish habitat. In accordance with EO 12114, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish habitat.

Pressure Effects and Acoustic Effects

An underwater explosion generates a shock wave that produces a sudden, intense change in local pressure as it passes through the water (DoN, 1998, 2001). Pressure waves extend to a greater distance than other forms of energy produced by the explosion (*i.e.*, heat and light) and are therefore the most likely source of negative effects to marine life from underwater explosions (Craig, 2001; SIO, 2005; DoN, 2006).

The shock wave from an underwater explosion is lethal to fish at close range, causing massive organ and tissue damage and internal bleeding (Keevin and Hempen, 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Wright, 1982; Keevin and Hempen, 1997). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast

suffer the greatest impact (Yelverton *et al.*, 1975; Wiley *et al.*, 1981; O'Keefe and Young, 1984a,b; Edds-Walton and Finneran, 2006).

Species with gas-filled organs have higher mortality than those without them (Goertner *et al.*, 1994; CSA, 2004). The swim bladder, the gas-filled organ used by many pelagic fish to control buoyancy, is the primary site of damage from explosives (Yelverton *et al.*, 1975; Wright, 1982). Gas-filled fish swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves. Swim bladders are a characteristic of bony fishes and are not present in sharks and rays. However, hemorrhaging of the liver in sharks exposed to the shock waves from explosives could have deleterious effects on the buoyancy function provided by the livers of these species (Edds-Walton and Finneran, 2006). Delayed lethality could result from the accumulation of sub-lethal injuries (DoN, 2001).

Two aspects of the shock wave appear most responsible for injury and death to fish: the received peak pressure and the time required for the pressure to rise and decay (Dzwilewski and Fenton, 2003). Higher peak pressure and abrupt rise and decay times are more likely to cause acute pathological effects (Wright and Hopky, 1998). Rapidly oscillating pressure waves might rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin and Hempen, 1997). They can also generate bubbles in blood and other tissues, possibly causing embolism damage (Ketten, 1998). Oscillating pressure waves might also burst gas-containing organs.

Studies that have documented fish killed during planned underwater explosions indicate that most fish that die do so within one to four hours, and almost all die within a day (Hubbs and Rechnizer, 1952; Yelverton *et al.*, 1975). Fitch and Young (1948) found that the type of fish killed changed when blasting was repeated at the same marine location within 24 hours of previous blasting. They observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts. However, fishes collected during these types of studies have mostly been recovered floating on the waters surface. Gitschlag *et al.* (2000) collected both floating fish and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. They found that as few as 3 percent of the specimens killed during a blast might float to the surface. Other impediments to accurately characterizing the magnitude of fish mortality included currents and winds that transported floating fishes out of the sampling area and predation by seabirds or other fishes.

There have been few studies of the impact of underwater explosions on early life stages of fishes (eggs, larvae, juveniles). Fitch and Young (1948) reported the demise of larval anchovies exposed to underwater blasts off California, and Nix and Chapman (1985) reported mortality of anchovy and smelt larvae following the detonation of buried charges. Similar to adult fishes, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fishes (Settle *et al.*, 2002). Shock wave trauma to internal organs of larval pinfish and spot from shock waves was documented by Govoni *et al.* (2003). These were laboratory studies, however, and have not been verified in the field.

Fish not killed or driven from a location by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright, 1982). Fish which ascend too quickly, a typical response to fear or to avoid negative stimuli, might experience an increase in the volume of gas-filled organs due to the reduction in ambient pressure. The resulting inflation might render the fish unable to immediately return to its normal habitat depth because the expanded organs make the buoyancy of the fish too great to overcome by swimming downward. Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation.

The variety of environmental parameters and biological features that can modify the impact of underwater explosions complicates the effort to predict lethal effect ranges in the field (Wright, 1982; Keevin and Hempen, 1997). Predictive models have, however, been developed over the past three decades (Wiley *et al.*, 1981; Goertner, 1982; Young, 1991). These are based on measurements of the pressure produced by underwater explosions at increasing distance from the detonation point (O'Keefe and Young, 1984a,b; Wright and Hopky, 1998; Dzwilewski and Fenton, 2003). Different types of explosive materials are normalized in effect range models by establishing an equivalent weight of TNT known as NEW.

Young (1991) provides equations that allow estimation of the potential effect on fish possessing swim bladders using a damage prediction method developed by Goertner (1982). Young's parameters include the size of the fish and its location relative to the explosive source, but are independent of environmental conditions (*e.g.*, depth of fish and explosive shot frequency). An example of such model predictions is shown in Table 3.9-5, which lists estimated explosive-effects ranges using Young's (1991) method for fish possessing swim bladders exposed to explosions that would occur under the No Action Alternative and Alternatives 1 and 2 (Note: Mine Neutralization activities will be discontinued under Alternatives 1 and 2) . The 10 percent mortality range is the distance beyond which 90 percent of the fish present would be expected to survive. It is difficult to predict the range of more subtle effects causing injury but not mortality (CSA, 2004).

As noted in Table 3.9-5, the effects range estimates do not take into account the very shallow and semi-enclosed nature of the Demolition Pond. In very shallow water, surface- and bottom-boundary effects have more influence on propagation than in deeper water. At the point of detonation, the geometry of the short water column dictates that a charge must be close to one or both of these boundaries. More likely surface blowout can dissipate energy and diminish bubble formation with its attendant oscillation effects, while detonations closer to the bottom may have considerable energy absorbed by the bottom as well. Further, as pressure waves propagate laterally through the very shallow water column, they reflect off surface and bottom boundaries more often over a given distance than in deeper waters and thus, very shallow water boundaries exert their influence relatively more frequently over that distance. In the case of the Demolition Pond, pressure waves would also reflect off the shoreline, which encloses most of this training area. The Demolition Pond's opening to St. Andrew Bay is approximately 45 feet wide at high tide (Figure 2.1-6). The connection is much smaller at low tide. The distance from the center of the Demolition Pond to St. Andrew Bay is roughly 175 feet. Based on the factors discussed above and the effects ranges presented in Table 3.9-5, it is likely that any lethal effects from underwater detonations would be limited to the Demolition Pond and would not extend into St. Andrew Bay.

Fish located outside the lethal effects range of an underwater explosion could also experience adverse effects from the blast's acoustical signature. Sound is the only form of energy that propagates well underwater and is used by many aquatic animals for imaging, navigations, and communication. Fish have evolved two main sensory organs for detecting sound: the inner ear, located in the skull, and the lateral line system along the flanks and on the head (Ladich and Popper, 2004). The perception of sound pressure is restricted to fish species with gas-filled swim bladders. Due to the higher compressibility of gas than water, the swim bladder responds effectively to sound pressure fluctuations. In some species of fish, a series of modified vertebra connect the inner ear to the swim bladder acting as a transducer that converts sound pressure waves into particle motion which stimulates the otoliths. Species with no swim bladder (for example, mackerel, tuna, sharks) or a much-reduced one (many benthic species, including flatfish) tend to have relatively low auditory sensitivity.

TABLE 3.9-5
ESTIMATED EXPLOSIVE EFFECTS RANGES FOR FISH WITH SWIM BLADDERS

Training Operation and Type of Ordnance	NEW (lb)	Depth of Explosion (ft)	10% Mortality Range (ft)		
			1-oz Fish	1-lb Fish	30-lb Fish
Mine Neutralization (Panama City and Corpus Christi MINEX Boxes)					
5-lb NEW UNDET Charge[1]	5	30	452	315	202
10-lb NEW UNDET Charge[1]	10	30	549	383	246
20-lb NEW UNDET Charge[1]	20	30	666	464	299
EOD Tech/Security Force/Diver Training (Demolition Pond Training)					
1.2-lb NEW UNDET Charge	1.2	5[2]	204[3]	142[3]	92[3]
Anti-Swimmer Training (Corpus Christi MINEX Box E-3)					
Anti-Swimmer Grenade	0.5	10	186	130	83
Bombing Exercise (Hotbox)					
MK-82[4]	192.2	3.3	772	539	346
MK-83	415.8	3.3	959	668	430
MK-84[5]	945	3.3	1,206	841	541

[1] No Action Alternative only.
[2] Actual depth may range from 5 to 11 feet.
[3] Estimates do not account for the very shallow and semi-enclosed nature of the Demolition Pond. Actual ranges are expected to be substantially be smaller.
[4] No Action Alternative and Alternative 1 only.
[5] Alternative 1 only.

Broadly, fish can be categorized as either hearing specialists or hearing generalists. Fish in the hearing specialist category have a broad frequency range with a low auditory threshold due to a mechanical connection between an air filled cavity, such as a swim bladder, and the inner ear. Specialists detect both the particle motion and pressure components of sound and can hear at levels above 1 kHz. Generalists are limited to detection of the particle motion component of low frequency sounds at relatively high sound intensities (Amoser and Ladich, 2005). Although hearing capability data only exists for 100 of the 27,000 fish species (Hastings and Popper, 2005), it is thought that most species of fish detect sounds from 0.05 to 1.0 kHz (NRC, 2003). Studies indicate that hearing specializations in marine species are quite rare and that most marine fish are considered hearing generalists (Popper, 2003, 2008; Amoser and Ladich, 2005). Studies have shown different hearing abilities for species within the same family (Amoser and Ladich, 2005). It has also been shown that susceptibility to the effects of anthropogenic sound can be influenced by developmental and genetic differences in the same species of fish (Popper *et al.*, 2007). Therefore, generalizations about fish hearing abilities must be made with caution.

The potential acoustic effects of underwater explosions may be considered in four categories:

- Masking – interference with the ability to hear biologically important sounds.
- Stress – physiological responses including elevated heart rate and release of hormones.
- Behavior – disruption of natural activities like swimming, schooling, feeding, breeding, and migration.
- Hearing – permanent hearing loss from high intensity/long duration sounds or temporary hearing loss from less intense sounds.

If an individual fish were repeatedly exposed to sounds from underwater explosions, the acoustic effects outlined above could lead to long-term consequences such as reduced survival, growth, or reproductive capacity. However, the time scale of individual explosions is very limited, and training exercises involving explosions are dispersed in space and time. Consequently, repeated exposure of individual fish to sounds from underwater explosions is not likely and most acoustic effects are expected to be short-term and localized. As discussed above, fish mortality caused by pressure waves is the primary issue of concern associated with underwater detonations and HE ordnance use.

The number of fish affected by an underwater explosion would depend on the population density in the vicinity of the blast, as well as factors discussed above such as NEW, depth of the explosion, and fish size. For example, if an explosion occurred in the middle of a dense school of striped mullet, bay anchovy, or other schooling fish, a large number of fish could be killed. This would not, however, represent significant mortality in terms of the total population of such fish in the Study Area. Furthermore, the probability of this occurring is low based on the patchy distribution of dense schooling fish. Fish density in a given area is inherently dynamic and varies seasonally, daily, and over shorter time frames. Consequently, fish density data are not available for the Study Area and the number of fish affected by underwater detonations and HE ordnance cannot be accurately quantified.

Fish density is influenced by numerous environmental conditions including habitat and productivity. The Hotbox is also located over portions of DeSoto Canyon (Figure 3.1-1) and within the DeSoto Canyon Closed Area (3.6-8). As discussed in Section 3.9.2, DeSoto Canyon has relatively high primary productivity and supports a relatively high abundance of pelagic fish species. The DeSoto Canyon Closed Area includes a swordfish nursery ground. The deep waters of the Hotbox (320 to 4,000 feet) reduce the likelihood that demersal fish would be exposed to harmful pressure waves from HE bomb explosions. As discussed above in the analysis of habitat disturbance, know occurrences of live hard bottom habitats are limited in the training areas where explosions would take place. In addition, artificial habitats that support dense aggregations of fish are generally absent. These factors coupled with Navy mitigation measures, which include avoidance of known or observed live hard bottom, shipwrecks, and *Sargassum* mats, reduce the possibility that large numbers of fish would be affected. Navy mitigation measures specifying that HE bombs shall not be targeted to impact within 5,100 yards of observed *Sargassum* mats or known coral/live hard bottom would reduce, but not eliminate, the potential for pelagic fish to be exposed to harmful pressure waves from HE bomb explosions in the Hotbox.

To summarize, a limited number of fish would be killed in the immediate proximity of underwater explosions. Additional fish would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of lethal or injurious effects, there could be short-term effects such as masking, stress, behavioral changes, and hearing threshold shifts. However, given the relatively small area that would be affected, and the abundance and distribution of the species concerned, population-level effects would not be expected. When exercises are completed, the fish stock should repopulate the area. The regional abundance and diversity of fish are unlikely to measurably decrease. While these conclusions are primarily based on qualitative judgments, they are supported by the best scientific information currently available. Quantitative predictions of population-level effects are simply beyond the capacity of contemporary ocean science. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters under the No Action Alternative would not result in significant impacts to fish populations. In accordance with EO 12114, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish populations.

Indirect Effects

In addition to directly affecting fish and fish habitat, underwater explosions could affect other species in the food web including plankton and other prey species. The effects of underwater explosions would differ depending upon the type of prey species in the area of the blast. As previously indicated, fish with swim bladders are more susceptible to blast injuries than fish without swim bladders. Invertebrate species, however, like squid, do not possess air-filled cavities, and therefore are less prone to blast effects (Voss, 1965), although impulsive sound has been implicated in mortality of deep water species (Guerra *et al.*, 2004).

In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, squid might exhibit a strong startle reaction to detonations that might include swimming to the surface, jetting away from the source, and releasing ink (McCauley *et al.*, 2000). This startle and flight response is the most common secondary defense among animals (Hanlon and Messenger, 1996). The sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fish and squid if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. No lasting effect on prey availability or the pelagic food web would be expected. Indirect effects of underwater detonations and HE ordnance use under the No Action Alternative would not result in a decrease in the quantity or quality of EFH in the Study Area and would have no adverse effects to EFH as defined under the MSFCMA. In accordance with NEPA, indirect effects of underwater detonations and HE ordnance use in territorial waters under the No Action Alternative would not result in significant impacts to fish populations or habitat. In accordance with EO 12114, indirect effects of underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish populations or habitat.

Military Expended Materials

Overview

The Navy uses a variety of military expended materials during training exercises conducted in the GOMEX Study Area. The types and quantities of expended materials used and information regarding fate and transport of these materials within the marine environment are discussed in Section 3.2. The analyses presented in Sections 3.2, 3.3, and 3.6 predict that the majority of the expended materials would rapidly sink to the sea floor, become encrusted by natural processes, and incorporated into the sea floor, with no significant accumulations in any particular area and no significant negative effects to water quality or marine benthic communities. Based on the analyses presented in Sections 3.2, 3.3, and 3.6, impacts associated with military expended materials to EFH would be temporary and/or minimal. Military expended materials under the No Action Alternative would not reduce the quality and/or quantity of EFH in the Study Area. Therefore, the remainder of this section focuses on the effects of military expended materials on fish.

Fish could be exposed to some expended materials via contact and ingestion. Benthic-foraging fish are more likely to encounter and ingest military expended materials than species that forage in the water column. Fish ingest non-food items incidentally to normal feeding, but also commonly expel non-food items before swallowing them. The effects of military expended material ingestion on fish are largely unknown, but would likely vary depending on species and size of the individual, as well as the type and quantity of material ingested.

Ordnance-related Materials

Ordnance-related materials include various sizes of NEPM and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). Operations involving expended ordnance and shrapnel under the No Action

Alternative would occur in W-151A/B/C, W-155A/B, and the Harbor Security Group Machine Gun Area. The solid metal materials would quickly move through the water column and settle to the sea floor where they could be available for ingestion by benthic-foraging fish. Some materials such as an intact non-explosive practice bomb would be too large to be ingested, but other materials such as small caliber ammunition and shrapnel are small enough to be ingested. These materials could pass through the digestive tract without causing harm, but could also lodge in the digestive system and interfere with food consumption and digestion. Some ordnance-related materials contain lead, copper and other metals, which could be toxic to fish when ingested. While ingestion of ordnance related materials could result in sublethal or lethal effects, the likelihood of ingestion is low based on the dispersed nature of the materials. Furthermore, a fish might expel the item before swallowing it. Based on these factors, the number of fish potentially affected by ingestion of ordnance-related materials would be low and population-level effects would not occur.

Some ordnance-related materials are the same as those often used in artificial reef construction (*e.g.*, concrete and metal associated with non-explosive practice bombs) and would be colonized by benthic organisms that prefer hard substrate. This colonization could result in localized increases in species richness and abundance, but no significant changes in community structure or function would be anticipated based on the limited amount and dispersed nature of the materials.

Target-related Materials

Most targets are recovered after use and reused or properly disposed of onshore. Some targets such as 55-gallon metal drums cannot be recovered and sink to the sea floor after use. Unrecoverable floating materials (*e.g.*, shredded cardboard, vinyl, or other synthetic materials) generated by target use are expected to be minimal. Descriptions of targets used in the Study Area and information on fate and transport are provided in Section 3.2. Benthic foraging fish may encounter an expended target on the bottom, but the size of the target would prohibit fish from ingesting it.

Chaff Fibers, End Caps, and Pistons

The background information and general exposure analysis presented in Section 3.7 for marine mammals and chaff is also applicable to fish and is not repeated here. Similar to marine mammals, fish could be exposed to chaff through direct body contact and ingestion. Fish are not expected to respond to direct contact with chaff. In addition, any changes in water quality from chaff use would be negligible and would not be expected to affect fish.

Based on the small size of chaff fibers, fish would likely not confuse the fibers with prey items or purposefully feed on them. However, fish could occasionally ingest low concentrations of chaff incidentally while feeding on prey items on the surface, in the water column, or on the bottom. The effects of chaff fiber ingestion on fish are expected to be negligible based on the low concentration that could reasonably be ingested, the small size of the chaff fibers, and available data on the toxicity of chaff and aluminum (see Section 3.7).

The potential also exists for fish to ingest chaff end caps and pistons as they sink through the water column or after they have settled to the bottom. If ingested, it is possible the small, (1.3-inch diameter, 0.13-inch thick) round, plastic end cap or piston would pass through the digestive tract of larger fish without causing harm and that a large quantity would need to be ingested to cause harm. Based on the low environmental concentration (1.4 pieces/nm^2/year), it is unlikely that a larger number of fish would ingest an end cap or piston, much less a harmful quantity. Furthermore, a fish might expel the item before swallowing it. Based on these factors, the number of fish potentially affected by ingestion of chaff end cap or pistons would be low and population-level effects would not occur.

Self-protection Flares

The potential exists for fish to ingest self-protection flare end caps as they sink through the water column or after they have settled to the bottom. Similar to chaff end caps and pistons, the environmental concentration would be low (0.4 pieces/nm^2/year). The number of fish potentially affected by ingestion of self-protection flare end caps would be low. Therefore, population-level effects would not occur.

Marine Markers

The MK-25 and MK-58 marine markers produce chemical flames and regions of surface smoke and are used in various training exercises to mark a surface position to simulate divers, ships, and points of contact on the surface of the ocean. The marker is not designed to be recovered after use and would eventually sink to the bottom after burning out. Fish in the immediate vicinity could be startled by the light generated by a burning marine marker on the sea surface. However, the effects would be short-term and localized. The tin and aluminum marine mark canisters are cylindrical. The M-25 is 18.5 in long by 2.9 in diameter and the MK-58 is 21.8 in long by 5 in diameter. While marine markers do not present an ingestion risk based on their size, a slight chance exists for a fish to encounter a canister while foraging on the bottom and to become lodged in the canister. Adverse effects from marine markers are not anticipated based on the small number used under the No Action Alternative (34 per year).

In summary, fish could be exposed to a variety of military expended materials under the No Action Alternative, but the analysis presented above indicates that the effects on fish and EFH would be negligible to minor. Military expended materials under the No Action Alternative would not result in adverse effects to fish populations or EFH as defined under the MSFCMA. In accordance with NEPA, military expended materials in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, military expended materials in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Towed Mine Warfare Devices

Effects on Essential Fish Habitat

As described in Chapter 2 and Appendix D, the No Action Alternative includes the use of Mine Warfare devices towed through the water by helicopters and ships. These devices are currently used in the Panama City and Corpus Christi MINEX Areas, but they would no longer be used under Alternative 1 and 2.

The use of towed Mine Warfare devices would result in short-term and localized disturbances to the water column, but benthic habitats would not be affected because the devices are not towed on the bottom. *Sargassum* mats may occur in the training areas. While towed Mine Warfare devices could result in short-term and localized disturbances to *Sargassum* habitats, Navy mitigation measures specify that the crew monitor for *Sargassum* rafts prior to and during the exercise. Visible *Sargassum* would be avoided to prevent fouling of the towed devices. Air crews operating the helicopters are expected to be able to see and avoid most *Sargassum* mats based on the relatively low flight altitude and low airspeeds. Therefore, any disturbance to *Sargassum* would be limited to very small patches that are not visible to the air crew. Impacts to EFH would be temporary and minimal. Use of towed Mine Warfare devices would not reduce the quality and/or quantity of EFH in the Study Area.

Effects on Fish

The probability of collisions between towed Mine Warfare devices and adult or juvenile fish, which could result in injury or mortality, would be extremely low because these life stages are highly mobile. Ichthyoplankton (fish eggs and larvae) in the upper portions of the water column could be displaced, injured, or killed by towed Mine Warfare devices. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to towed Mine Warfare devices would be low relative to total ichthyoplankton biomass.

In accordance with NEPA, towed Mine Warfare device use in territorial waters would have no significant impact on fish populations or habitat under the No Action Alternative. In accordance with EO 12114, towed Mine Warfare device use in non-territorial waters under the No Action Alternative would not cause significant harm to fish populations or habitat.

Gulf Sturgeon

Based on information presented in Sections 3.9.3, the Gulf sturgeon is not expected to occur in the Corpus Christi or New Orleans OPAREAs or in the deeper waters (>40 ft) of the Pensacola and Panama City OPAREAs. Therefore, proposed training in these areas would have no effect on the Gulf sturgeon.

The Gulf sturgeon may occur seasonally (fall and winter) in the coastal waters of the Panama City OPAREA and coastal waters adjacent to the Pensacola OPAREA (within 2 nm of the coastline). Operations that would take place in these areas would be limited to fixed-wing aircraft overflights and vessel movements. All fixed-wing aircraft overflights would be above 3,000 feet and would have no effect on the Gulf sturgeon. Helicopter overflights would take place offshore; outside the area of expected occurrence for Gulf sturgeon. Gulf sturgeon would not be exposed to vessel collisions because they are demersal. As discussed above for other fish, vessel movements under the No Action Alternative could expose Gulf sturgeon to general disturbance, which could result in short-term behavioral and/or physiological responses (*e.g.*, swimming away and increased heart rate). Such responses would not be expected to compromise the general health or condition of individual fish. Vessel disturbance may affect the Gulf sturgeon, but the effects would be insignificant.

The Gulf sturgeon may also occur in St. Andrew Bay in the vicinity of the Demolition Pond during fall and winter. Potential stressors associated with training activities in the Demolition Pond include underwater detonations and military expended materials. The potential for Gulf sturgeon to be exposed to these stressors would be limited to the fall and winter when they are known to occur in the general area. Therefore, training conducted during the spring and summer would have no effect on the Gulf sturgeon.

As discussed above in the analysis of underwater detonations for other species of fish, the Demolition Pond is a semi-enclosed, very shallow water environment with limited connection to St. Andrew Bay. The maximum explosive charge that would be detonated under the No Action Alternative would be relatively small (1.25-lb NEW). It is likely that any lethal effects from underwater detonations would be limited to the Demolition Pond and would not extend into St. Andrew Bay. As discussed in Section 3.9.2, occurrence of a Gulf sturgeon in the Demolition Pond is unlikely. Therefore, the probability of a Gulf sturgeon being exposed to a lethal blast from an underwater detonation is extremely low and the effects may be discounted.

While most of the sound energy associated from an underwater detonation is expected to be confined based on the semi-enclosed nature of the Demolition Pond, it is possible that a blast's acoustical signature could extend into St. Andrew Bay. If a Gulf sturgeon were in the immediate vicinity of the Demolition Pond it could briefly be exposed to elevated sound levels and could exhibit a short-term stress or behavioral response to the sound (Wright, 1982). Such responses would not be expected to compromise the general health of individuals and any effects would be very short-term and

insignificant. Furthermore, the likelihood of a Gulf sturgeon being exposed to elevated sound levels is low based on its infrequent, seasonal occurrence in the area. Underwater detonations conducted in the Demolition Pond under the No Action Alternative may affect the Gulf sturgeon, but the effects would be considered discountable or insignificant.

Expended materials associated with items used during training would enter the Demolition Pond. Most of these materials are expected to sink and could present an ingestion risk to the Gulf sturgeon. However, mitigation measures for the Demolition Pond require that military expended materials be collected and removed immediately following all exercises, when feasible. The probability of a Gulf sturgeon ingesting military expended materials is extremely low based on implementation of mitigation measures and the unlikely occurrence of this species in the Demolition Pond. Military expended materials under the No Action Alternative may affect the Gulf sturgeon, but the effects would be considered discountable.

Gulf sturgeon critical habitat within the Study Area is limited to Unit 11, which is located in the nearshore waters (<3 nm) of the Panama City OPAREA. Operations occurring in Gulf sturgeon critical habitat would be limited to vessel movements. Other than short-term and localized disturbances to the water column, vessel movements would have no effect on critical habitat. Indirect effects such as degradation due to changes in water quality, sediment quality, or benthic fauna are not expected to occur. Likewise, the No Action Alternative would not result in indirect effects to other critical habitat units outside the Study Area based on distance from the training activities. The No Action Alternative would not adversely modify Gulf sturgeon critical habitat.

Smalltooth Sawfish

Based on information presented in Sections 3.9.3, the smalltooth sawfish is not expected to occur in the Corpus Christi or New Orleans OPAREAs or in the deeper waters (>40 ft) of the Pensacola and Panama City OPAREAs. Therefore, proposed training in these areas would have no effect on the smalltooth sawfish.

The smalltooth sawfish may rarely occur in the coastal waters of the Panama City OPAREA and coastal waters adjacent to the Pensacola OPAREA (within 2 nm of the coastline). Operations that would take place in these areas would be limited to a fixed-wing ircraft overflights and vessel movements. All fixed-wing aircraft overflights would be above 3,000 feet and would have no effect on the smalltooth sawfish. Helicopter overflights would take place offshore; outside the area of expected occurrence for smalltooth sawfish. Smalltooth sawfish would not be exposed to vessel collisions because they are demersal. As discussed above for other fish, vessel movements under the No Action Alternative could expose smalltooth sawfish to general disturbance, which could result in short-term behavioral and/or physiological responses (*e.g.*, swimming away and increased heart rate). Such responses would not be expected to compromise the general health or condition of individual fish. Vessel disturbance may affect the smalltooth sawfish, but the effects would be insignificant.

The smalltooth sawfish may also occur in St. Andrew Bay in the vicinity of the Demolition Pond. While suitable habitat exists in this area, only three smalltooth sawfish encounters have been reported and verified since 1998 west of the mouth of St. Andrew Bay (Wiley and Simpfendorfer, 2007). Potential stressors associated with training activities in the Demolition Pond include underwater detonations and military expended materials.

As discussed above in the analysis of underwater detonations for other species of fish and the Gulf sturgeon, it is likely that any lethal effects from underwater detonations would be limited to the Demolition Pond and would not extend into St. Andrew Bay. Like other elasmobranchs, smalltooth sawfish lack a swim bladder. Goertner *et al.* (1994) and others have found that fish without swim

bladders are less susceptible to the lethal effects of underwater detonations than those with swim bladders. Therefore, the estimated effects ranges for smalltooth sawfish are expected to be less than the values presented for fish with swim bladders in Table 3.9-5. The probability of a smalltooth sawfish being exposed to lethal blast from an underwater detonation is extremely low based on the infrequent occurrence of the smalltooth sawfish in the vicinity of the Demolition Pond and the small area that would be affected by underwater detonations. The effects are considered discountable because they are extremely unlikely to occur.

While most of the sound energy associated from an underwater detonation is expected to be confined based on the semi-enclosed nature of the Demolition Pond, it is possible that a blast's acoustical signature could extend into St. Andrew Bay. If a smalltooth sawfish were in the immediate vicinity of the Demolition Pond it could briefly be exposed to elevated sound levels and could exhibit a short-term stress or behavioral response to the sound. Such responses would not be expected to compromise the general health of individuals and any effects would be very short-term and insignificant. Furthermore, the likelihood of a smalltooth sawfish being exposed to elevated sound levels is low based on its infrequent occurrence in the area. Underwater detonations conducted in the Demolition Pond under the No Action Alternative may affect the smalltooth sawfish, but the effects would be considered discountable or insignificant. NMFS proposed critical habitat for the smalltooth sawfish on November 20, 2008, but none of the proposed critical habitat is within the GOMEX Study Area..

Expended materials associated with items used during training would enter the Demolition Pond. Most of these materials are expected to sink and could present an ingestion risk to the smalltooth. However, mitigation measures for the Demolition Pond require that military expended materials be collected and removed immediately following all exercises, when feasible. The probability of a smalltooth sawfish ingesting military expended materials is extremely low based on implementation of mitigation measures and the unlikely occurrence of this species in the Demolition Pond. Military expended materials under the No Action Alternative may affect the smalltooth sawfish, but the effects would be considered discountable.

3.9.3.2 Alternative 1

Vessel Movements

The total number of vessel steaming days for the Study Area would not change under Alternative 1. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 1. Impacts to EFH from vessel movements under Alternative 1 would be temporary and minimal. Vessel movements would not reduce the quality and/or quantity of EFH in the Study Area. Vessel movements under Alternative 1 would not result in adverse effects to fish populations or EFH as defined under the MSFCMA. In accordance with NEPA, vessel movements in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, vessel movements in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Aircraft Overflights

Alternative 1 includes approximately 5,316 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 93 sorties per year (1.8%) compared to the No Action Alternative. The additional sorties would be associated with bombing exercises in W-151 and W-155 and would involve flights below 3,000 feet. Helicopter sorties would decrease from 38 to 18 per year under Alternative 1. Fish responses to aircraft overflights are expected to be limited to short-term behavioral and/or physiological reactions (*e.g.*, swimming away and increased heart rate). Such responses would not compromise the general health or condition of individual fish. Impacts to EFH from aircraft overflights under

Alternative 1 would be temporary and minimal. Aircraft overflights would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, aircraft overflights over territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Non-explosive Practice Munitions

The number of 20 mm cannon rounds fired in W-151A/B and W-155A would increase from 0 to 24,000 per year under Alternative 1 (Tables 2.2-7 and 2.2-8). This change would result in increased potential for NEPM to strike fish, benthic communities, and artificial habitats compared to baseline conditions, but the rounds would be widely dispersed within W-151A/B and W-155A, which include over 7,300 nm^2. As discussed for the No Action Alternative, a possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of NEPM delivery, but population-level effects would not occur. As discussed for the No Action Alternative, small caliber ammunition, such as a 20 mm round, has little potential to disturb the bottom because these materials are relatively small and light and their velocity would decrease through the water column. A 20 mm projectile weighs about 3.6 ounces and its footprint is about 0.01 ft^2. The total footprint of 24,000 rounds per year would be about 283 ft^2, but this total footprint would be spread over a very large area because training activities are widely dispersed. For these reasons, impacts to benthic EFH from 20 mm round strikes would be minimal.

The number of non-explosive practice bombs and naval gun shells, which are the largest type of NEPM, would not change under Alternative 1. Therefore, the analysis presented for non-explosive practice bombs and naval gun shells under the No Action Alternative is applicable to Alternative 1. As discussed for the No Action Alternative, NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, NEPM strikes would cause little or no physical damage to soft bottom benthic habitat and any damage would be localized. Non-explosive practice bomb and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities and artificial habitats, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to benthic EFH would be minimal based on the relatively small area affected by non-explosive practice bombs, missiles, and naval gun shells. Given the small area affected, NEPM use under Alternative 1 would not reduce the quality and/or quantity of EFH in the Study Area.In accordance with NEPA, NEPM use in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, NEPM use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Alternative 1 would include changes in underwater detonations and HE ordnance use in the GOMEX Study Area. Underwater detonations associated with Mine Warfare exercises in the Panama City and Corpus Christi MINEX Boxes would no longer occur under Alternative 1. As such, benthic habitat disturbances and fish injury and mortality described for these activities under the No Action Alternative would no longer occur.

The use of anti-swimmer grenades (0.5-lb NEW) would not change under Alternative 1. Therefore, the No Action Alternative analysis for anti-swimmer grenades is applicable to Alternative 1.

As summarized in Section 2.2.4.1, Alternative 1 includes changes in operations at the Demolition Pond. Some annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW, the number of 1.25-lb NEW charges would not change, and the

number of training days would not change. Therefore, the effects of Alternative 1 at the Demolition Pond are expected to be the same as the No Action Alternative.

Alternative 1 would include an increase in the number of HE bombs dropped in the Hotbox from 52 to 155 per year. The MK-84, which has a NEW of 945 lbs, would also be dropped under Alternative 1 (three per year). The frequency of water column disturbances and the area disturbed would increase, but the effects would continue to be short-term and localized. As discussed above for the No Action Alternative, explosions associated with HE bombs occur at or near the water's surface in the Hotbox where depths range from 320 feet to 4,000 feet. Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by MK-82, MK-83, and MK-84 HE bomb explosions would be about 23, 30, and 39 feet, respectively. The gas bubbles would not extend to the bottom based on the minimum water depth of the Hotbox (320 feet) and a detonation depth of 3.3 feet below the surface. Therefore, HE bomb explosions in the Hotbox are not expected to result in disturbance to benthic or artificial habitats because detonations would occur near the surface in deep waters. Furthermore, occurrence of known live hard bottom and artificial habitats is very limited in this area and Navy mitigation measures specify that HE bombs are not targeted to impact within 5,100 yards of known coral/live hard bottom. Effects of explosions on *Sargassum* habitats would be minimal because Navy mitigation measures specify that HE bombs are not targeted to impact within 5,100 yards of observed *Sargassum* mats. Therefore, HE bomb use would not result in adverse effects to EFH as defined under the MSFCMA.

As discussed for the No Action Alternative, it is not possible to quantify the number of fish that would be adversely affected by underwater explosions. The number of bombs dropped per year for Alternative 1 would increase by almost 200 percent compared to the No Action Alternative. Therefore, a corresponding increase in the number of fish injured or killed by HE bomb explosions would be expected. The fact that the MK-84 has a higher NEW and larger effects range, would also contribute to an increase in the number of fish affected. While this increase would be offset to some degree by eliminating the Mine Warfare underwater detonations, the total number of fish injured or killed under Alternative 1 is expected to be substantially higher than the No Action Alternative. Navy mitigation measures specifying that HE bombs shall not be targeted to impact within 5,100 yards of observed *Sargassum* mats or known coral/live hard bottom would reduce, but not eliminate, the potential for pelagic fish to be exposed to harmful pressure waves from HE bomb explosions in the Hotbox. The deep waters of the Hotbox (320 to 4,000 feet) also reduce the likelihood that demersal fish would be exposed to harmful pressure waves from HE bomb explosions.

A limited number of fish would be killed in the immediate proximity of underwater explosions. Additional fish would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of lethal or injurious effects, there could be short-term effects such as masking, stress, behavioral changes, and hearing threshold shifts. However, given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no major fish mortality or population-level effects would be expected. When exercises are completed, the fish stock should repopulate the area. The regional abundance and diversity of fish are unlikely to measurably decrease. Impacts to EFH from underwater detonations and HE ordnance use under Alternative 1 would be minimal. Underwater detonations and HE ordnance use would not reduce the quality and/or quantity of EFH in the Study Area.In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters under Alternative 1 would not result in significant impacts to fish populations. In accordance with EO 12114, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish populations.

Military Expended Materials

The amount of military expended materials entering the marine environment would increase slightly under Alternative 1 (NEPM and marine markers only, Table 2.2-7). These changes would result in increased exposure of fish and EFH to military expended materials. However, exposure would not be measurably different than the No Action Alternative. As discussed above for the No Action Alternative and based on the analyses presented in Sections 3.2, 3.3, and 3.6, impacts associated with military expended materials to EFH would be temporary and/or minimal. Military expended materials under Alternative 1 would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, military expended materials in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, military expended materials in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 1. Therefore, the effects described for the No Action Alternative would no longer occur.

Gulf Sturgeon

As summarized in Section 2.2.4.1, Alternative 1 includes minor changes in operations at the Demolition Pond. Some annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW, the number of 1.25-lb NEW charges would not change, and the number of training days would not change. Therefore, the effects of Alternative 1 at the Demolition Pond are expected to be the same as the No Action Alternative. Alternative 1 does not include changes in operations in other areas where the Gulf sturgeon may occur or in Gulf sturgeon critical habitat. Alternative 1 may affect the Gulf sturgeon, but the effects would be considered discountable or insignificant. Alternative 1 would not adversely modify Gulf sturgeon critical habitat.

Smalltooth Sawfish

As summarized in Section 2.2.4.1, Alternative 1 includes changes in operations at the Demolition Pond. Some annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW, the number of 1.25-lb NEW charges would not change, and the number of training days would not change. Therefore, the effects of Alternative 1 at the Demolition Pond are expected to be the same as the No Action Alternative. Alternative 1 does not include changes in operations in other areas where the smalltooth sawfish is expected to occur. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 1. Alternative 1 may affect the smalltooth sawfish, but the effects would be considered discountable or insignificant. NMFS proposed critical habitat for the smalltooth sawfish on November 20, 2008, but none of the proposed critical habitat is within the GOMEX Study Area.

3.9.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

The total number of vessel steaming days for the GOMEX Study Area would not change under Alternative 2. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 2. Impacts to EFH from vessel movements under Alternative 1 would be temporary and minimal. Vessel movements would not reduce the quality and/or quantity of EFH in the Study Area.In accordance with NEPA, vessel movements in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, vessel movements in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Aircraft Overflights

Alternative 2 includes approximately 5,318 fixed-wing aircraft sorties per year over the Gulf of Mexico; a negligible increase of 2 sorties per year (0.04%) compared to Alternative 1. Helicopter sorties would decrease from 38 to 18 per year under Alternative 2 (same as Alternative 1). Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. Impacts to EFH from aircraft overflights under Alternative 2 would be temporary and minimal. Aircraft overflights would not reduce the quality and/or quantity of EFH in the Study Area In accordance with NEPA, aircraft overflights over territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Non-explosive Practice Munitions

Compared to the No Action Alternative, the number of 20 mm cannon rounds fired in W-151A/B and W-155A would increase from 0 to 24,000 per year (Table 2.2-8). This change would result in increased potential for NEPM to strike fish, benthic communities, and artificial habitats compared to baseline conditions, but the rounds would be widely dispersed within W-151A/B and W-155A, which include over 7,300 nm^2. As discussed for the No Action Alternative, a possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of NEPM delivery, but population-level effects would not occur. As discussed for the No Action Alternative, small caliber ammunition, such as a 20 mm round, has little potential to disturb the bottom because these materials are relatively small and light and their velocity would decrease through the water column. A 20 mm projectile weighs about 3.6 ounces and its footprint is about 0.01 ft^2. The total footprint of 24,000 rounds per year would be about 283 ft^2, but this total footprint would be spread over a very large area because training activities are widely dispersed. For these reasons, impacts to benthic EFH from 20 mm round strikes would be minimal.

The number of non-explosive practice bombs dropped in W-151A/C and W-155B would increase from 180 to 335 per year (Table 3.9-4) under Alternative 2. Some of these non-explosive practice bombs would also be dropped in W-155A for this alternative. The number of non-explosive naval gun shells would be the same as the No Action Alternative. The potential effects to EFH would be similar to those described for the No Action Alternative and Alternative 1, but the total area affected by non-explosive practice bombs and naval gun shells would increase. The relative non-explosive practice bomb concentration would increase from 026/nm^2/year in W-151A/C and W-155B under the No Action Alternative to 0.036/nm^2/year under Alternative 2. Using the assumptions discussed for the No Action Alternative, the maximum area of benthic habitat affected by non-explosive practice bomb and naval gun shell strikes would increase from 2,780 ft^2 (0.00008 nm^2) per year to 4,977 ft^2 (0.0001 nm^2) per year (Table 3.9-4). The probability of a non-explosive practice bomb or naval gun shell striking live hard bottom or artificial habitats would be low given the number of used and the spatial distribution of the exercises and resources. If a non-explosive practice bomb or naval gun shell were to strike live hard bottom or an artificial habitat, long-term damage could result, but the area affected would be small (*i.e.*, less than 4,977 ft^2 per year). As such, non-explosive practice bomb and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities and artificial habitats, but the effects would be localized and no long-term changes to community structure or function would be expected.Impacts to benthic EFH would be minimal based on the relatively small area affected by non-explosive practice bombs and naval gun shells. Given the small area affected, NEPM use under Alternative 2 would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, NEPM use in territorial waters under Alternative 2 would have no significant impact on

fish populations or habitat. Furthermore, NEPM use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Mine Warfare underwater detonations would no longer occur in the GOMEX Study Area under Alternative 2, as was the case for Alternative 1. Demolition Pond training and use of anti-swimmer grenades for Alternative 2 would also be the same as Alternative 1. However, Alternative 2 includes a substantial decrease in the number of HE bombs dropped (4 per year) relative to both the No Action Alternative (52 per year) and Alternative 1 (155 per year). As a result, the potential for fish and EFH to be exposed to HE ordnance would decrease substantially under Alternative 2 compared to the No Action Alternative and Alternative 1.

While serious injury and/or mortality to individual fish would be expected if they were present in the immediate vicinity of an explosion, explosions under Alternative 2 would not result in significant impacts to fish populations based on the low number of fish that would be affected. Disturbances to EFH in the Gulf of Mexico would be limited to the water column and would be short-term and localized. Disturbances to EFH in the Demolition Pond (benthic habitat) would be long-term, but the effects would be minimal because they would be limited to the pond or a portion of the pond. Impacts to EFH from underwater detonations and HE ordnance use under Alternative 2 would be minimal. Underwater detonations and HE ordnance use would not reduce the quality and/or quantity of EFH in the Study Area.In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Military Expended Materials

The amount of military expended materials entering the marine environment would increase slightly under Alternative 2 (NEPM and marine markers only, Table 2.2-7). These changes would result in increased exposure of fish and EFH to military expended materials. However, exposure would not be measurably different than the No Action Alternative. As discussed above for the No Action Alternative and based on the analyses presented in Sections 3.2, 3.3, and 3.6, impacts associated with military expended materials to EFH would be temporary and/or minimal. Military expended materials under Alternative 2 would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, military expended materials in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, military expended materials in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 2. Therefore, the effects described for the No Action Alternative would no longer occur.

Gulf Sturgeon

As summarized in Section 2.2.4.1, Alternative 2 includes changes in operations at the Demolition Pond. Some annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW, the number of 1.25-lb NEW charges would not change, and the number of training days would not change. Therefore, the effects of Alternative 1 at the Demolition Pond are expected to be the same as the No Action Alternative. Alternative 2 does not include changes in operations in other areas where the Gulf sturgeon may occur or in Gulf sturgeon critical habitat.

Alternative 2 may affect the Gulf sturgeon, but the effects would be considered discountable or insignificant. Alternative 2 would not adversely modify Gulf sturgeon critical habitat.

Smalltooth Sawfish

As summarized in Section 2.2.4.1, Alternative 2 includes changes in operations at the Demolition Pond. Some annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW, the number of 1.25-lb NEW charges would not change, and the number of training days would not change. Therefore, the effects of Alternative 2 at the Demolition Pond are expected to be the same as the No Action Alternative. Alternative 2 does not include changes in operations in other areas where the smalltooth sawfish is expected to occur. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 2. Alternative 2 may affect the smalltooth sawfish, but the effects would be considered discountable or insignificant. NMFS proposed critical habitat for the smalltooth sawfish on November 20, 2008, but none of the proposed critical habitat is within the GOMEX Study Area.

3.9.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to fish populations or EFH.

3.9.5 Summary of Environmental Effects (NEPA and EO 12114)

Endangered Species Act

Table 3.9-6 provides a summary of the Navy's determination of effect for Alternative 2 (the Preferred Alternative) and federally listed fish that potentially occur in or near the Study Area. Alternative 2 may affect the Gulf sturgeon and would not adversely modify Gulf sturgeon critical habitat. Alternative 2 may affect the smalltooth sawfish. NMFS proposed critical habitat for the smalltooth sawfish on November 20, 2008, but none of the proposed critical habitat is within the GOMEX Study Area. NMFS concluded ESA Section 7 formal consultation with Navy for listed and proposed fish (Appendix C).

Magnuson-Stevens Fishery Conservation and Management Act – Essential Fish Habitat

As summarized in Table 3.9-7, the No Action Alternative, Alternative 1, and Alternative 2 would not adversely affect EFH. Any impacts would be temporary and/or minimal. The No Action Alternative, Alternative 1, or Alternative 2 would not reduce the quality and/or quantity of EFH in the Study Area. Therefore, EFH consultation with NMFS is not required.

TABLE 3.9-6
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED FISH POTENTIALLY OCCURRING IN THE GOMEX STUDY AREA – ALTERNATIVE 2

Stressor	Gulf Sturgeon	Gulf Sturgeon Critical Habitat	Smalltooth Sawfish
Vessel Movements			
Vessel Disturbance	May Affect	No Effect	May Affect
Vessel Collisions	No Effect	No Effect	No Effect
Aircraft Overflights			
Aircraft Disturbance	No Effect	No Effect	No Effect
Non-explosive Practice Munitions			
Non-explosive Practice Munitions Strikes/Disturbance	No Effect	No Effect	No Effect
Underwater Detonations and High Explosive Ordnance			
Underwater Detonations Small Charges (Demolition Pond)	May Effect	No Effect	May Affect
High Explosive Ordnance Bombs (Hotbox))	No Effect	No Effect	No Effect
Small Arms Training Anti-swimmer Grenades (UNDET Area E3)	No Effect	No Effect	No Effect
Military Expended Materials			
Ordnance Related Materials	May Affect	No Effect	May Affect
Target Related Materials	No Effect	No Effect	No Effect
Chaff	May Affect	May Affect	May Affect
Self-protection Flares	May Affect	No Effect	May Affect
Marine Markers	May Affect	No Effect	May Affect
Towed Mine Warfare Devices			
Towed Device Strikes	Not Applicable	Not Applicable	Not Applicable

National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.9-7, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on fish populations or habitat in territorial waters in accordance with NEPA. Furthermore, in accordance with EO 12114 the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to fish populations or habitat in non-territorial waters.

TABLE 3.9-7
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE GOMEX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and MSFCMA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 and MSFCMA (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	**EFH –** Vessel movements would result in short-term, localized disturbances to water column and *Sargassum* habitats. Impacts to *Sargassum* habitats would be avoided and minimized by mitigation measures. Vessel movements would not disturb the sea floor and would have no impact on benthic habitats. Impacts to EFH would be temporary and minimal. **Fish/Managed Species –** Vessel movements could elicit behavioral and/or physiological responses in fish, but the effects would be temporary and localized. The probability of vessel collisions with adult and juvenile fish would be low. Injury and mortality to fish eggs and larvae would occur, but the effects would be localized. No population-level impacts would occur.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Aircraft Overflights	**EFH –** Aircraft overflights would result in short-term and localized increases in ambient sound levels in the water column and possibly in shallow water benthic habitats. Impacts to EFH would be temporary and minimal. **Fish/Managed Species –** Aircraft overflights could elicit behavioral and/or physiological responses in some species of fish, but the effects would be temporary and localized. No population-level impacts would occur.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Towed Mine Warfare Devices	**EFH -** Towed MIW devices would result in short-term, localized disturbances to water column and Sargassum habitats. Impacts to Sargassum habitats would be minimized by avoidance. Towed MIW devices would not disturb the sea floor and would have no impact on benthic habitats. Impacts to EFH would be temporary and minimal. **Fish/Managed Species** – Towed MIW devices could elicit behavioral and/or physiological responses in fish, but the effects would be temporary and localized. The probability of collisions with adult and juvenile fish would be low. Injury and mortality to fish eggs and larvae would occur, but the effects would be localized. No population-level impacts would occur.	**EFH – Same as territorial waters.** **Fish/Managed Species – Same as territorial waters.**

TABLE 3.9-7 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE GOMEX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and MSFCMA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 and MSFCMA (Non-Territorial Waters, >12 nm)
Non-explosive Practice Munitions	**EFH** – Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters. **Fish/Managed Species** - Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters.	**EFH** - Disturbances to water column habitats from NEPM strikes would be temporary and minimal. Impacts to *Sargassum* habitat would be minimal because Navy mitigation measures require avoidance of *Sargassum* mats. Impacts to soft bottom benthic EFH would be temporary and minimal. The total area of benthic habitat affected by non-explosive practice bombs and naval gun shells would be small (about 2,780 ft^2 per year) and only a percentage of the total area affected (less than 2,780 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bombs and naval gun shells could result in long-term, minor effects to benthic EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to benthic EFH would be minimal based on the relatively small area affected. **Fish/Managed Species** - A remote possibility exists that some individual fish at or near the surface may be directly impacted if they are in the target area and at the point of physical impact at the time of NEPM delivery. Navy mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, reduce the probability of NEPM-related injury or mortality. A limited number of fish might be injured or killed, but NEPM strikes would not result in population-level effects.

TABLE 3.9-7 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE GOMEX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and MSFCMA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 and MSFCMA (Non-Territorial Waters, >12 nm)
Underwater Detonations and High Explosive Ordnance	**EFH –** Underwater explosions in territorial waters would be limited to MINEX UNDETs, UNDETs in the Demolition Pond, and anti-swimmer grenades, which would result in short-term and localized disturbances to the water column. MINEX and Demolition Pond UNDETS would also cause localized disturbances to soft bottom benthic habitats. Impacts to EFH would be temporary and minimal. **Fish/Managed Species –** A limited number of fish would be killed in the proximity of underwater explosions. Additional fish would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of lethal or injurious effects, there could be short-term effects such as masking, stress, behavioral changes, and hearing threshold shifts. However, given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no population-level effects would be expected.	**EFH –** Underwater explosions in non-territorial waters would be limited to BOMBEX, which occur at or near the water's surface in relatively deep waters. Water column disturbances would be short-term and localized, and associated effects to water column EFH would be temporary and minimal. Impacts to *Sargassum* habitat would also be minimal because Navy mitigation measures require avoidance of *Sargassum* mats. Calculations indicate that the maximum radius of the gas bubble produced by these explosions would not extend to the sea floor. Therefore, explosions during these exercises are not expected to result in physical disturbance to benthic habitats. Impacts to EFH would be temporary and minimal. **Fish/Managed Species –** Effects would be similar to those described for territorial waters, but additional fish would be affected because explosions associated with BOMBEX occur in non-territorial waters. Given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no population-level effects would be expected.
Military Expended Materials	**EFH –** The majority of the expended materials would rapidly sink to the sea floor, become encrusted by natural processes, and incorporated into the sea floor, with no significant accumulations in any particular area and no significant negative effects to water quality or marine benthic communities. Impacts associated with military expended to EFH would be minimal. **Fish/Managed Species –** Some MEM could be ingested by some species of fish and could cause sublethal or lethal effects. However, the number of fish affected would be small and no population-level effects would occur.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Impact Conclusion	**MSFCMA –** Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. **NEPA -** No significant impact to fish populations or habitat.	**MSFCMA –** Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. **Executive Order 12114 -** No significant harm to fish populations or habitat.
Alternative 1		
Vessel Movements	**EFH –** Same as No Action. **Fish/Managed Species –** Same as No Action.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Aircraft Overflights	**EFH -** Slight increase compared to No Action. **Fish/Managed Species -** Slight increase compared to No Action.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Towed Mine Warfare Devices	Not applicable. Towed Mine Warfare devices would not be used under Alternative 1.	Not applicable. Towed Mine Warfare devices would not be used under Alternative 1.

TABLE 3.9-7 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE GOMEX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and MSFCMA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 and MSFCMA (Non-Territorial Waters, >12 nm)**
Non-explosive Practice Munitions	**EFH –** Same as No Action. **Fish/Managed Species –** Same as No Action.	**EFH –** Similar to No Action with increase in 20 mm rounds. The total area of benthic habitat affected by non-explosive practice bombs and naval gun shells would be the same as No Action. **Fish/Managed Species –** Similar to No Action with increased potential for NEPM/fish strikes from increased 20 mm round use.
Underwater Detonations and High Explosive Ordnance	**EFH –** MINEX UNDETs and associated impacts to the water column and soft bottom benthic habits would be eliminated. Impacts associated with Demolition Pond and anti-swimmer grenades would be the same as No Action. **Fish/Managed Species –** Decrease compared to No Action based on elimination of MINEX UNDETs.	**EFH -** Similar to No Action, with increase in HE BOMBEX. **Fish/Managed Species -** Similar to No Action, with increase in HE BOMBEX.
Military Expended Materials	**EFH -** Similar to No Action, with slight increase in materials. **Fish/Managed Species -** Similar to No Action, with slight increase in materials.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Impact Conclusion	**MSFCMA –** Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. **NEPA -** No significant impact to fish populations or habitat.	**MSFCMA –** Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. **Executive Order 12114 -** No significant harm to fish populations or habitat.
Alternative 2		
Vessel Movements	**EFH –** Same as No Action. **Fish/Managed Species –** Same as No Action.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Aircraft Overflights	**EFH -** Slight increase compared to No Action. **Fish/Managed Species -** Slight increase compared to No Action.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Towed Mine Warfare Devices	Not applicable. Towed Mine Warfare devices would not be used under Alternative 1.	Not applicable. Towed Mine Warfare devices would not be used under Alternative 1.
Non-explosive Practice Munitions	**EFH –** Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters. **Fish/Managed Species -** Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters.	**EFH –** Similar to No Action with increase in non-explosive practice bombs. The total area of benthic habitat affected by non-explosive practice bombs and naval gun shells would be small (about 4,977 ft^2 per year) and only a percentage of the total area affected (less than 4,977 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bombs and naval gun shells could result in long-term, minor effects to benthic EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to benthic EFH would be minimal based on the relatively small area affected. **Fish/Managed Species –** Similar to No Action with increased potential for NEPM/fish strikes from increased 20 mm round use.
Underwater Detonations	**EFH –** MINEX UNDETs and associated	**EFH –** Decrease in HE BOMBEX from 52 to 4

TABLE 3.9-7 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE GOMEX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and MSFCMA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 and MSFCMA (Non-Territorial Waters, >12 nm)**
and High Explosive Ordnance	impacts to the water column and soft bottom benthic habits would be eliminated. Impacts associated with Demolition Pond and anti-swimmer grenades would be the same as No Action. **Fish/Managed Species –** Decrease compared to No Action based on elimination of MINEX UNDETs.	per year would result in a substantial decrease in water column disturbance compared to No Action. **Fish/Managed Species –** Decrease in HE BOMBEX from 52 to 4 per year would result in a substantial decrease in associated effects to fish compared to No Action.
Military Expended Materials	**EFH -** Similar to No Action, with increase in materials. **Fish/Managed Species -** Similar to No Action, with increase in materials.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Impact Conclusion	**MSFCMA –** Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. **NEPA -** No significant impact to fish populations or habitat.	**MSFCMA –** Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. **Executive Order 12114 -** No significant harm to fish populations or habitat.

3.10 SEABIRDS AND MIGRATORY BIRDS

3.10.1 Introduction and Methods

3.10.1.1 Regulatory Framework

This section focuses on seabirds in the open waters of the Gulf of Mexico and migratory birds that could migrate through the area seasonally. The analysis for birds occurring at Dixie and Yankee Targets (McMullen County Range) and SEARAY Target (Noxubee County Range) is provided in Section 3.11 - Terrestrial and Freshwater Biological Resources. Seabirds are birds whose normal habitat and food source is the sea, whether they utilize coastal waters (the nearshore), offshore waters (the continental shelf), or pelagic waters (the open sea) (Harrison, 1983). Migratory birds are any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. The seabirds addressed in this Final EIS/OEIS are migratory birds.

The regulatory framework for seabirds and migratory birds is described in detail in Appendix K. The Migratory Bird Treaty Act (MBTA) of 1918 is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. Incidental take of migratory birds during Department of Defense military readiness activities is addressed by a regulation promulgated by the Secretary of the Interior and published in the Federal Register on February 28, 2007 (50 CFR Part 21). This regulation authorizes incidental take of migratory birds during military readiness activities, including training and testing in the GOMEX Range Complex. This regulation also requires the Armed Forces to confer and cooperate with the U.S. Fish and Wildlife Service on development and implementation of conservation measures to minimize or mitigate adverse effects of a military readiness activity if it determines that such activity may have a significant adverse effect on a population of a migratory bird species. Additional details are provided in Appendix K.

One federally listed seabird species (brown pelican, *Pelecanus occidentalis*) occurs within the GOMEX Study Area. Therefore, the ESA requirements discussed in Appendix K are applicable to the analysis of the brown pelican. The Navy has completed informal ESA Section 7 consultation with USFWS regarding its determination of effect for Alternative 2 and the brown pelican. In a letter dated 9 March 2009 (Appendix C), USFWS concurred with the Navy's determination that Alternative 2 may affect, but is not likely to adversely affect the listed brown pelican. (Note to readers: On November 17, 2009, USFWS published a Final Rule in the Federal Register announcing the removal of the brown pelican from the Federal List of Endangered and Threatened Wildlife (74 FR 59443 59472). The effective date of the Final Rule was December 17, 2009. The information and analysis presented in this Final EIS/OEIS for the brown pelican has not been edited to reflect the Final Rule.)

3.10.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for seabirds and migratory birds is the same as the approach described for marine mammals in Section 3.7.1.2.

Study Area

The Study Area for seabirds and migratory birds addressed in this section includes those portions of the GOMEX Study Area located in the Gulf of Mexico (Figure 1.1-2), including the NSA Panama City Demolition Pond. Birds occurring at the inland ranges (McMullen County Range and Noxubee County Range) are addressed separately in Section 3.11.

Data Sources

A comprehensive and systematic review of relevant literature and data has been conducted to complete this analysis for seabirds and migratory birds and to ensure that best available data were used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in this assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, EISs, Range Complex Management Plans, and other technical reports published by government agencies, private businesses, or consulting firms. The scientific literature was also consulted during the search for geographic location data on the occurrence of marine resources within the Study Area.

Factors Used to Assess the Significance of Effects

This EIS/OEIS analyzes potential effects to seabirds and migratory birds in the context of the MBTA, ESA (listed species only), NEPA, and EO 12114. The factors used to assess the significance of effects vary under these Acts. Factors considered under the MBTA, NEPA, and EO 12114 include the extent to which an alternative could diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem over a reasonable period of time. For purposes of ESA compliance, effects of the action were analyzed to make the Navy's determination of effect for listed species. The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998) and are provided in Section 3.7.1.2.

3.10.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to seabirds and migratory birds. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Final EIS/OEIS. As summarized in Table 3.10-1, potential stressors to seabirds and migratory birds include vessel movements (disturbance and collisions), aircraft overflights (disturbance and strikes), non-explosive practice munitions (NEPM) (disturbance and strikes), underwater detonations and high explosive (HE) ordnance, military expended materials (targets, chaff, self-protection flares, and marine markers), and towed Mine Warfare devices. The potential effects of these stressors on seabirds and migratory birds are analyzed in detail in Section 3.10.3.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as part of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on seabirds and migratory birds. Accordingly, the effects of water and air quality changes on seabirds and migratory birds are not addressed further in this Final EIS/OEIS.

TABLE 3.10-1
SUMMARY OF POTENTIAL STRESSORS TO SEABIRDS AND MIGRATORY BIRDS

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Mine Warfare (MIW)							
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓		✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓			✓	✓	✓
Surface Warfare (SUW)							
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	✓	✓	
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B		✓	✓	✓	✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓	✓		✓	

TABLE 3.10-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEABIRDS AND MIGRATORY BIRDS

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓		✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Boat)	Panama City OPAREA	✓		✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Boat)	Corpus Christi UNDET Box E3	✓		✓	✓	✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓					
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓				
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓			✓	✓	
Air Warfare (AW)							
Air Intercept Control (AIC)	W-151; W-155		✓				
Amphibious Warfare (AMW)							
FIREX (Surface-to-Surface) with IMPASS (no HE ordnance)	W-151A/B; W-155A	✓		✓		✓	
Electronic Combat (EC)							
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓			✓	

TABLE 3.10-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEABIRDS AND MIGRATORY BIRDS

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials	Towed Mine Warfare Devices
Chaff Exercises (CHAFFEX)	Brownwood MOAs		✓			✓	
Flare Exercises (FLAREX)	W-155A/B		✓			✓	
Flare Exercises (FLAREX)	Brownwood MOAs		✓			✓	
Mission Area Training[45]							
Mission Area Flight Training	W-92; W-54 Brownwood MOAs		✓				
Basic Flight Instruction	W-228; R-2908		✓				
Salvage Diver Training	NSA Panama City Demolition Pond				✓	✓	
Underwater Demolitions	NSA Panama City Demolition Pond				✓	✓	
Security Force Training	NSA Panama City Demolition Pond				✓	✓	
Diver Training	NSA Panama City Demolition Pond				✓	✓	

[45] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

3.10.2 Affected Environment

3.10.2.1 Major Migratory Bird Flyways

Overview

The terms "migration route" and "flyway" are to some extent theoretical concepts, while the latter has, in addition, come to have an administrative meaning (USFWS, 2003). Migration routes may be defined as the lanes of individual travel from any particular breeding ground to the winter quarters of the birds that use them. Flyways, on the other hand, may well be conceived as those broader areas in which related migration routes are associated or blended into a definite geographic region. The routes followed by migratory birds are numerous, and while some of them are simple and easily traced, others are extremely complicated. Differences in distance traveled, time of starting, speed of flight, geographical position, latitude of the breeding and wintering grounds, and other factors all contribute to great diversity. No two species follow exactly the same path from beginning to end; geographical groups of species with an almost continental distribution may travel different routes.

Numerous species of waterbirds and landbirds could cross the GOMEX Study Area during biannual (spring and fall) migrations. While some birds migrate in daylight, the vast majority migrate at night (Kerlinger, 1995; Lincoln *et al.*, 1998). The altitudes at which migrating birds fly can vary greatly based on the type of bird, where they are flying (over water or over land), and other factors such as weather (Kerlinger, 1995). As seen by radar, some nocturnal migrants (probably shorebirds) fly over the ocean at 15,000 or even 20,000 feet (Lincoln *et al.*, 1998). Some species such as sea ducks and loons may be commonly seen flying just above the water' surface, but the same species can also be spotted flying so high that they are barely visible through binoculars (Kerlinger, 1995; Lincoln *et al.*, 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 and 1,000 feet. Radar studies have demonstrated that 95 percent of the migratory movements occur at less than 10,000 feet, the bulk of the movements occurring under 3,000 feet (Lincoln *et al.*, 1998).

There are four major North American flyways: the Atlantic, Mississippi, Central, and Pacific. Except along the coasts, flyway boundaries are not always sharply defined. There is overlapping in both the northern breeding grounds and southern wintering grounds. Migratory birds that move through the GOMEX Study Area are generally associated with the Mississippi Flyway and the Central Flyway.

Mississippi Flyway

The Mississippi Flyway runs through the peninsula of southern Ontario to western Lake Erie, then southwestwardly across Ohio and Indiana to the Mississippi River where it rather closely follows the river to its mouth. The western boundary does not have such precise definition as the eastern boundary, and for this reason in eastern Nebraska and western Missouri and Arkansas, the Mississippi Flyway merges imperceptibly into the Central Flyway. The longest migration route of any in the Western Hemisphere lies in this flyway. The northern terminus is on the Arctic coast of Alaska and its southern end is in Patagonia. During the spring migration some of the shorebirds traverse the full length of this great artery and several species that breed north to Yukon and Alaska must twice each year cover the larger part of it. For more than 3,000 miles, from the mouth of the Mackenzie to the delta of the Mississippi, this route is uninterrupted by mountains. Well timbered and watered, the entire region affords ideal conditions for the support of hosts of migrating birds. The two rivers that mark it, the Mackenzie emptying on the Arctic coast and the Mississippi in the Gulf of Mexico, have a general north-and-south direction, another factor in determining the importance of this route, which is used by large numbers of ducks, geese, shorebirds, blackbirds, sparrows, warblers, and thrushes (Lincoln *et al.*, 1998; Sibley, 2003).

The majority of North American land birds seeking winter homes in the tropics come south through the Mississippi Flyway take the short cut across the Gulf of Mexico in preference to the longer land or island journey by way of Texas or the Antilles (Sibley, 2003).

Central Flyway

In the United States, the Central Flyway merges toward the east with the Mississippi Flyway and is bounded in that direction by the Missouri River. In the south on this side, the flyway trends through western Missouri, Arkansas, and Louisiana, and then follows the Gulf coast of Mexico southward. On the northwest Arctic coast, where this great flyway has its beginning, the same territory involved that also sends hosts of migrants down the Mississippi Flyway, but farther south, in Canada, the western boundary follows closely the eastern base of the Rocky Mountains (Lincoln *et al.*, 1998).

3.10.2.2 Seabirds in the GOMEX Study Area

Seabird distribution and abundance varies considerably by species, with some species primarily occurring in nearshore habitats and others primarily occurring in offshore pelagic habitats. The area from the beach to about 10 nm offshore provides foraging areas for breeding terns, gulls, skimmers, and pelicans; a migration corridor and winter habitat for terns, gulls, skimmers, pelicans, loons, cormorants, and gannets; and supports non-breeding and transient pelagic seabirds. Offshore pelagic waters support non-breeding and transient pelagic seabirds, loons, gannets, and several tern species (Davis *et al.*, 2000; Hunter *et al.*, 2006). Pelagic seabirds are generally widely distributed, but tend to congregate in areas of higher productivity and prey availability. These areas may be correlated with phytoplankton distributions, pelagic *Sargassum* aggregations, artificial structures, fish aggregating devices, and other surface occurrences of high productivity, as discussed in Section 3.6 - Marine Communities. Figure 3.6-1 shows historically reported locations of *Sargassum* mats. Table 3.10-2 provides a representative list of pelagic seabirds that could potentially occur in the GOMEX Study Area.

TABLE 3.10-2
REPRESENTATIVE LIST OF PELAGIC SEABIRDS POTENTIALLY OCCURRING IN THE GOMEX STUDY AREA

Family	Scientific Name	Common Name	ESA Status
Fregatidae	*Fregata magnificens*	Magnificent frigatebird	-
Hydrobatidae	*Oceanites oceanicus*	Wilson's storm-petrel	-
	Oceanodroma castro	Band-rumped storm-petrel	-
	Oceanodroma leucorhoa	Leach's storm-petrel	-
Laridae	*Anous stolidus*	Brown noddy	-
	Chlidonias niger	Black tern	-
	Larus argentatus	Herring gull	-
	Larus atricilla	Laughing gull	-
	Larus philadelphia	Bonaparte's gull	-
	Stercorarius parasiticus	Parasitic jaeger	-
	Stercorarius longicaudus	Long-tailed jaeger	-
	Stercorarius pomarinus	Pomarine jaeger	-
	Sterna anaethetus	Bridled tern	-
	Sterna antillarum	Least tern	-(1)
	Sterna fuscata	Sooty tern	-
	Sterna hirundo	Common tern	-
	Sterna maxima	Royal tern	-
	Sterna paradisaea	Arctic tern	-
	Sterna sandvicensis	Sandwich tern	-

TABLE 3.10-2 (Continued)
REPRESENTATIVE LIST OF PELAGIC SEABIRDS POTENTIALLY OCCURRING IN THE GOMEX STUDY AREA

Family	Scientific Name	Common Name	ESA Status
Pelecanidae	*Pelecanus occidentalis*	Brown pelican	Endangered[(2)]
Phaethontidae	*Phaethon aethereus*	Red-billed tropicbird	-
	Phaethon lepturus	White-tailed tropicbird	-
Procellariidae	*Calonectris diomedea*	Cory's shearwater	-
	Puffinus gravis	Greater shearwater	-
	Puffinus griseus	Sooty shearwater	-
	Puffinus lherminieri	Audubon's shearwater	-
	Puffinus puffinus	Manx shearwater	-
Sulidae	*Morus bassanus*	Northern gannet	-
	Sula dactylatra	Masked booby	-

Sources: Davis *et al*., 2000; Ribic *et al*., 1997.

[(1)]Interior populations of least terns are federally listed as endangered. Birds that occur in open waters of the Gulf of Mexico in the Study Area are not federally listed.

[(2)]The brown pelican is currently listed as endangered throughout its range except for along the Atlantic Coast of the United States and in Florida and Alabama. On February 20, 2008, the USFWS published a Proposed Rule to remove the brown pelican from the Federal List of Endangered and Threatened Wildlife due to recovery.

The brown pelican is listed under the ESA and could potentially occur in the GOMEX Study Area. Additional information about this species is provided below. Critical habitat for listed birds has not been designated under the ESA within the Study Area. While not listed under the ESA, others species potentially occurring in the Study Area are of management concern based on relatively low or declining populations, including the masked booby, sooty shearwater, and northern gannet (Hunter *et al*., 2006).

3.10.2.3 Endangered Species Act-listed Birds

Brown Pelican

General Description - The brown pelican, a member of the Pelicanidae family, is a large dark gray-brown water bird with white about the head and neck. Adults weigh about 8 to 10 pounds and have a wingspan of 6.5 to 7.5 feet. Brown pelicans are social and gregarious, with males and females and juveniles and adults congregating together in large flocks for most of the year. Primarily fish-eaters, brown pelicans fly over the water at heights of up to 60 to 70 feet and dive steeply into the water to capture prey (USFWS, 2008a). Feeding typically occurs during daylight hours. These birds are usually inactive at night and use nocturnal roosts located on land (Croll *et al*., 1986; Briggs *et al*., 1983)

Status and Management - The brown pelican was originally listed under authority of the Endangered Species Conservation Act of 1969 and was subsequently listed as endangered under the ESA of 1973. On February 4, 1985, the USFWS published a Final Rule that removed endangered status for brown pelicans on the Atlantic and Gulf Coasts of the United States, except for Texas, Louisiana, and Mississippi (50 FR 4938-4945). The brown pelican is listed currently as an endangered distinct population segment throughout its range except for along the Atlantic Coast of the United States and in Florida and Alabama. This distinct population segment has a wide distribution, including the Gulf Coast of the United States from Mississippi to Texas, California, Mexico, the Caribbean, Central America, and South America. On February 20, 2008, the USFWS published a Proposed Rule to remove the brown pelican from the Federal List of Endangered and Threatened Wildlife due to recovery. If this

proposal is finalized, the brown pelican will remain protected under the provisions of the MBTA. Critical habitat has not been designated for the brown pelican (USFWS, 2008b).

Historically, declines in brown pelican populations were attributable to hunting, slaughtering by commercial fisherman who believed pelicans decimated their industry, and reproductive failure caused by dichloro-diphenyl-trichloroethane (DDT) contamination. By the 1960s, brown pelicans had nearly disappeared along the Gulf Coast. The species has made a strong comeback as a result of the 1972 ban on the use of DDT and other conservation efforts such as the Louisiana Department of Wildlife and Fisheries' reintroduction program (USFWS, 2008a). Remaining threats to this species include injury from fishing gear, other conflicts with fishing activities (including overfishing), intrusions on nesting areas during breeding seasons, loss of habitat due to hurricanes, collisions, and oil spills (USFWS, 2007).

The global brown pelican population is estimated at 650,000 birds, which includes an estimate of 400,000 birds in Peru (USFWS, 2008a). The number of nesting brown pelicans on the Gulf Coast has increased dramatically since extirpation in Louisiana and near-extirpation in Texas in the 1960s. The estimated historic population sizes for Texas were in the range of 1,500 to 4,000 nesting pairs, but only two nests were recorded in 1968. Texas had 3,895 active nests by 2003. In Louisiana, the historic population sizes were in the range of 10,000 to 15,000 nesting pairs, but total reproductive failure was reported by the 1960s. Between 1968 and 1980 the Louisiana Department of Wildlife and Fisheries conducted a successful program to reintroduce brown pelicans to Louisiana using Florida colonies as a source of birds. The estimated total number of successful nests increased since the initiation of reintroduction to 16,405 in 2001. Severe storms caused a decrease in successful nests in Louisiana during 2003 (13,044 nests), but the population appeared to recover from these impacts and a peak of 16,501 nests were recorded in 2004. Negative effects on production in Louisiana were also observed following the severe hurricane and tropical storm season of 2005. Surveys conducted in Louisiana during 2006 detected 5,425 nests west of the Mississippi River and 2,205 nests east of the river. Population estimates are not available for Mississippi. While brown pelicans are commonly seen roosting and feeding along the Gulf Coast and on coastal islands of Mississippi, there are no known records of brown pelicans nesting in Mississippi (USFWS, 2007).

Habitat – The brown pelican is found in coastal marine and estuarine habitats. They sometimes occur on inland lakes in areas such as Florida and are rarely seen far offshore. They nest in large colonies on the ground or in trees or shrubs. Islands are often used for nesting. Brown pelicans primarily forage in shallow waters within 4 to 5 nm of shore. They may rarely forage up to 40 miles offshore (USFWS, 2008a; Shields, 2002; NatureServe, 2008; Clapp *et al.*, 1982).

Distribution – The brown pelican is found along the Atlantic, Pacific, and Gulf Coasts of North and South America. On the Gulf Coast, this species is found in Florida, Alabama, Mississippi, Louisiana, Texas, and Mexico.

GOMEX Study Area ESA-listed Brown Pelican Occurrence – While brown pelicans in Mississippi, Louisiana, and Texas are currently listed as endangered (proposed for delisting); this species was delisted in Florida and Alabama in 1985. Therefore, ESA-listed brown pelicans are not expected to occur in portions of the GOMEX Study Area located off the coasts of Florida and Alabama (Panama City OPAREA, Pensacola OPAREA, and associated Special Use Airspace) or at the NSA Panama City (Florida) Demolition Pond. Occurrence of ESA-listed brown pelicans in the New Orleans OPAREA, W-92, and W-54 would be considered rare because these areas are located more than 12 nm offshore and brown pelicans primarily use nearshore habitats. ESA-listed brown pelicans are expected to occur in nearshore portions of the GOMEX Study Area off the coast of Texas, including those portions of the

Corpus Christi OPAREA located closest to shore. However, occurrence in W-228 and portions of the Corpus Christi OPAREA that are more than 12 nm offshore would be considered rare.

3.10.3 Environmental Consequences

3.10.3.1 No Action Alternative

Vessel Movements

Many of the ongoing and proposed operations within the GOMEX Study Area involve maneuvers by various types of Navy vessels. Birds could be exposed to moving vessels throughout the Study Area, but direct encounters would be few based on the infrequency of operations and the low density of vessels within the Study Area at any given time. The Navy would log about 180 total vessel steaming days in the Study Area during a typical year under the No Action Alternative (Table 2.2-7).

Birds respond to moving vessels in various ways. Some birds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses (Hamilton, 1958; Hyrenbach, 2001; Hyrenbach, 2006); while other species such as frigatebirds and sooty terns seem to avoid vessels (Borberg *et al.*, 2005; Hyrenbach, 2006). Vessel movements could elicit short-term behavioral or physiological responses (*e.g.*, alert response, startle response, fleeing the immediate area, temporary increase in heart rate). However, the general health of individual birds would not be compromised (see additional discussion of these responses below under aircraft overflights). Direct collisions with vessels or interactions with a vessel's rigging (fishing gear, wires, poles, masts, *etc*.) can result in bird injury or mortality. The possibility of encounters could increase at night, especially during inclement weather. Birds can become disoriented at night in the presence of artificial light (Bruderer *et al.*, 1999; Black, 2005) and lighting on vessels may attract some seabirds (Hunter *et al.*, 2006), increasing the potential for harmful encounters. Harmful seabird/vessel interactions are commonly associated with commercial fishing vessels because birds are attracted to concentrated food sources around these vessels (Melvin *et al.*, 2001; Dietrich and Melvin, 2004).

Based on the low Navy vessel density and often patchy distribution of seabirds (Schneider and Duffy, 1985; Haney, 1986; Fauchald *et al.*, 2002), the probability of bird/vessel collisions is extremely low. Navy training activities attempt to simulate war-like conditions; therefore, in an attempt to remain visually disguised, vessels do not typically use large deck lights or strobes. This reduces the potential attraction of nocturnal foraging seabirds. Furthermore, the concentrated food sources that attract seabirds to commercial fishing vessels are not present around Navy vessels. Navy mitigation measures (see Chapter 5), which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of vessel disturbance and collisions. If a bird were to collide with a vessel, injury or mortality could occur. Vessel movements under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on birds. Furthermore, vessel movements in non-territorial waters would not cause significant harm to birds in accordance with EO 12114. Effects of the No Action Alternative on the federally listed brown pelican are analyzed below.

Aircraft Overflights

Aircraft Disturbance

Various types of fixed-wing aircraft and helicopters are used in training exercises throughout the Study Area (see Chapter 2 and Appendix D). Approximately 5,223 fixed-wing aircraft sorties would occur per year over the Gulf of Mexico under the No Action Alternative. Most of these sorties would occur in W-228 (3,865 sorties per year) and W-151 and W-155 (850 sorties per year). About 328 sorties per year

would occur in W-92 and W-54, while 180 sorties per year would take place in R-2908. Flight altitudes for all fixed-wing sorties would be above 3,000 feet above ground level (AGL) with the exception of 74 sorties associated with air-to-surface Bombing Exercises, which occur in W-151A/C and W-155A/B. Typical flight altitudes during air-to-surface Bombing Exercises are from 500 to 5,000 feet AGL. Most fixed-wing aircraft flight hours (greater than 90%) occur greater than 12 nm offshore. The No Action Alternative also includes 38 helicopter sorties per year in W-151, W155 and the Corpus Christi OPAREA. Most of the helicopter sorties would be associated with Airborne Mine Countermeasures training and would occur at altitudes as low as 75 to 100 feet.

Seabirds and other migratory birds could be exposed to airborne noise associated with subsonic and supersonic fixed-wing aircraft overflights and helicopter operations (see Section 3.5 – Noise Environment for a description of the existing noise environment and Appendix H for an overview of airborne acoustics). Birds could be exposed to elevated noise levels while foraging or migrating in open water environments within the Gulf of Mexico.

Numerous studies have documented that birds and other wild animals respond to human-made noise including aircraft overflights, weapons firing, and explosions (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). The manner in which birds respond to noise depends on several factors including life-history characteristics of the species, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. Researchers have documented a range of bird behavioral responses to noise including no response, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). While difficult to measure in the field, some of these behavioral responses are likely accompanied by physiological responses, such as increased heart rate, or stress. Chronic stress can compromise the general health of birds, but stress is not necessarily indicative of negative consequences to individual birds or to populations (Larkin, 1996; National Park Service, 1994). For example, the reported behavioral and physiological responses of birds to noise exposure are within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. Unless repeatedly exposed to loud noises or simultaneously exposed to synergistic stressors, it is possible that individuals would return to homeostasis almost immediately after exposure and the individual's overall metabolism and energy budgets would not be affected. Studies have also shown that birds can become habituated to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). Little is known about physiological responses of birds that have habituated to noise.

Seabird exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the transitory and dispersed nature of the overflights; repeated exposure of individual birds over a short period of time (hours or days) is extremely unlikely. Furthermore, the sound exposure levels would be relatively low because the aircraft rarely fly below 3,000 feet. It is quite possible that seabirds at or near the sea surface would not respond to overflight noise based on the relatively high flight altitudes. Most documented responses of birds have been to low-level aircraft overflights occurring below 3,000 feet (National Park Service, 1994). Unlike the situation at a busy commercial airport or military landing field, repeated exposure of individual birds or groups of birds is unlikely based on the dispersed nature of the overflights. If birds were to respond to an overflight, the responses would be limited to short-term behavioral or physiological reactions (*e.g.*, alert response, startle response, temporary increase in heart rate) and the general health of individual birds would not be compromised.

In general, birds are more likely to respond to helicopter overflights because they fly at lower altitudes than fixed-wing aircraft. In addition, some studies have suggested that birds respond more to

disturbance from helicopters than from that of fixed-wing aircraft (Larkin, 1996; Plumpton, 2006). However, the potential for seabird exposure to helicopter overflights is low based on the low number of sorties (20 per year). Noise from low-altitude helicopter overflights would be expected to elicit short-term behavioral or physiological responses (*e.g.*, alert response, startle response, temporary increase in heart rate) in exposed birds. Repeated exposure of individual birds or groups of birds is unlikely based on the low number of sorties and dispersed nature of the overflights. The general health of individual birds would not be compromised.

In summary, aircraft noise under the No Action Alternative could elicit short-term behavioral or physiological responses in exposed birds, but minimal exposure is expected based on the high flight altitudes of most fixed-wing aircraft and the low number of helicopter sorties. Aircraft noise under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft noise over territorial waters would have no significant impact on birds. Furthermore, aircraft noise over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Aircraft Strikes

Wildlife/aircraft strikes are a major concern for the Navy because they can cause harm to aircrews, damage to equipment, and injury or mortality to wildlife. From 2002 through 2004 an annual average of 596 known wildlife/aircraft strike events occurred Navy-wide and most of these events involved birds (Navy Safety Center, 2004). While all wildlife/aircraft strikes are considered serious and dangerous events, the number of animals injured or killed annually is small considering the number of Navy-wide aircraft operations. While bird strikes can occur anywhere aircraft are operated, Navy data indicate they occur most often over land or close to shore. The potential for bird strikes to occur in offshore areas is relatively low because operations are widely dispersed at relatively high altitudes (above 3,000 feet for fixed-wing aircraft) and bird densities are generally low. For example, from 2002 through 2004 only five known bird strikes involving vessel-based aircraft occurred Navy-wide. Of the 1,789 Navy-wide, wildlife strike events reported for 2002 through 2004, only 19 (1%) involved seabirds. Nine (47%) of the seabird strike events involved gulls (Navy Safety Center, 2004), which commonly occur in terrestrial environments or over nearshore waters. Few, if any, bird/aircraft strikes and associated bird mortalities or injuries are expected to occur in the Study Area under the No Action Alternative. Aircraft strikes under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft strikes over territorial waters would have no significant impact on birds. Furthermore, aircraft strikes over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Non-Explosive Practice Munitions

Non-explosive Practice Munitions Disturbance

Current Navy operations in the GOMEX Study Area include firing a variety of weapons and employing a variety of NEPM, including bombs, naval gunshells, naval medium caliber cannon ammunition, and small arms ammunition. NEPM use in the Gulf of Mexico is limited to W-151 A/B/C and the Harbor Security Group Machine Gun Area (Panama City OPAREA); W-155 A/B (Pensacola OPAREA); and MINEX Box E3 (Corpus Christi OPAREA). NEPM is not used in the New Orleans OPAREA (see Table 2.2-8 for a summary of ordnance use by training areas). Disturbance associated with weapons firing noise and direct NEPM strikes are potential stressors to birds.

As discussed above for fixed-wing aircraft and helicopter operations, bird responses to weapons firing noise would be limited to short-term behavioral or physiological responses (*e.g.*, alert response, startle response, temporary increase in heart rate). These operations are often preceded by some other type of activity in the general area such a vessel movement or target setting, which might disperse birds away from the associated weapons firing noise. Therefore, birds might not be exposed to the loudest noise levels associated with weapons firing. The general health of individual birds would not be compromised and weapons firing noise would not result in significant impacts to migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, weapons firing noise in territorial waters would have no significant impact on birds. Furthermore, weapons firing noise in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Non-explosive Practice Munitions Strikes

Fired NEPM has the potential to directly strike birds as it travels through the air to its intended target. As discussed in Sections 3.7.3 and 3.8.3, statistical modeling conducted for the GOMEX Study Area indicates that the probability of NEPM striking marine mammals and sea turtles is extremely low. Statistical modeling could not be conducted to estimate the probability of seabird/NEPM strikes because seabird density data are not available. Nonetheless, several factors discussed below indicate that the probability of NEPM directly striking a seabird is also expected to be extremely low under the No Action Alternative.

The small number of bombs that would be expended in the Study Area annually (Table 2.2-5), coupled with the often patchy distribution of seabirds (Schneider and Duffy, 1985; Haney, 1986; Fauchald *et al.*, 2002), suggest that the probability of this type of NEPM striking a seabird would be extremely low. The number of cannon shells, gunshells, and small arms rounds that would be expended annually during gunnery exercises is much higher (Table 2.2-8). However, the total number of rounds expended is not a good indicator of strike probability during gunnery exercises because multiple rounds are fired at individual targets. Human activity such as vessel or boat movement, aircraft overflights, and target setting, could cause birds to flee a target area prior to the onset of firing, thus avoiding harm. If birds were in the target area, they would likely flee the area after the initial rounds strike the target area (assuming birds were not struck by the initial rounds). Navy mitigation measures, which include, but are not limited to avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of NEPM strikes (see Chapter 5 for detailed description of mitigation measures). While a remote possibility exists that some individuals of some bird species may be directly impacted if they are in the target area and at the point of physical impact at the time of ordnance delivery, NEPM strikes under the No Action Alternative would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, NEPM strikes in territorial waters would have no significant impact on birds. Furthermore, NEPM strikes in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

As summarized below and in Tables 2.2-4 and 2.2-9, some of the training conducted under the No Action Alternative would involve underwater detonations and the use of HE ordnance:

- The No Action Alternative includes Mine Countermeasures and Mine Neutralization exercises with underwater detonations that range in net explosive weight (NEW) from 0.00514-lb shots to 20-lb charges. These operations currently take place in the MINEX Boxes located in the Panama City OPAREA (Figure 2.1-1) and Corpus Christi OPAREA (Figure 2.1-3). However, these

operations would no longer be conducted in the GOMEX Study Area under Alternatives 1 and 2. Some charges would be detonated directly on the bottom and the others would be detonated in the water column.

- The No Action Alternative includes the use of 20 anti-swimmer grenades (0.5-lb NEW) per year in MINEX Box E3 within the Corpus Christi OPAREA. These grenades detonate about 10 feet under the water's surface within four to five seconds of being deployed. The training area where these grenades are used is about 7 to 12 nm offshore in 72 to 85 feet of water.
- The No Action Alternative includes underwater detonations in the NSA Panama City Demolition Pond (Figure 2.1-6). The Demolition Pond is located in a small (5,800 m^2) bayou of St. Andrew Bay with a maximum depth of 11 feet. Up to 5-lb NEW charges are authorized in the Demolition Pond, but maximum charge included in the No Action Alternative and Alternatives 1 and 2 is 1.25-lb NEW.
- The No Action Alternative includes dropping 52 HE bombs (192.2- and 415.8-lb NEW) per year in the Hotbox, which is located more than 12 nm offshore in the Pensacola OPAREA (Figure 2.1-1). Explosions associated with HE bombs occur at or near the water's surface (about 3.3 feet below the surface) in the Hotbox where depths range from about 320 to 4,000 feet.

The potential for seabirds to be exposed to explosions is difficult to quantify and depends on several factors including the following:

- The geographic location of the explosions within the Study Area and whether or not birds are present at the time of the explosion. Table 2.2-9 provides a summary of explosions by training area.
- Position of the explosion in relationship to the sea surface (*e.g.*, altitude above the surface, at the surface, and depth below the surface). Explosions associated with HE bombs occur at or immediately below the sea surface, while underwater detonations occur on the bottom and at depths below the surface.
- Position of the bird in the environment at the time of explosion (*e.g.*, in the air, on the surface, diving below the surface). Studies show that birds are more susceptible to underwater explosions when they are submerged versus on the surface (Yelverton, *et al.*, 1973). Similarly, birds in flight are expected to be less susceptible to underwater explosions than those on the surface.
- Magnitude of the explosion (*i.e.*, NEW) and the zone of influence (ZOI) associated with the explosion. While ZOIs cannot be calculated for seabirds based on available data, higher NEWs would produce larger ZOIs. Of the explosions that occur in the Study Area, HE bombs are expected to have the largest ZOIs (see Table 2.2-9 for NEW values).

In general, the effects of explosions correspond to the distance of the animal from the explosion, ranging from lethal injury to short-term behavioral effects. Birds in the immediate vicinity of an explosion could be susceptible to lethal injury and birds on the outer edges of the ZOI could exhibit a short-term behavioral response. Yelverton *et al.* (1973) found that ducks submerged 2 feet below the surface experienced 100 percent mortality when exposed to 1-lb underwater charges at slant ranges of 28 feet or less. Mortality decreased at slant ranges of 31 to 33 feet (33%) and no mortality was observed at a slant range of 36 feet. Most birds at 36 feet experienced extensive lung hemorrhage and some experienced liver ruptures, hemorrhagic kidneys, and eardrum ruptures. No internal injuries were found at a slant range of 110 feet for submerged ducks exposed to 1-lb charges. Ducks exposed while on the water surface were less susceptible to injury and death than the submerged ducks. Death occurred at slant ranges of 13 to 14 feet for ducks on the surface when exposed to 8-lb charges. Ducks exposed to 8-lb charges while on the surface survived at slant ranges of 15 to 21 feet, but they experienced internal injuries. No mortality was observed in ducks on the surface when exposed to 1-lb charges at slant

ranges of 10 to 18 feet, but internal injuries were observed in all birds except at 18 feet (Yelverton *et al.*, 1973).

While the effects of explosions in the Study Area on seabirds cannot be quantified, lethal injury to some individuals of some bird species could occur if they were in the immediate vicinity at the time of detonation. Navy mitigation measures are expected to reduce, but not eliminate, the potential for seabird mortality from explosions. As discussed in Chapter 5 Navy mitigation measure include, but are not limited to avoidance of large *Sargassum* mats where some seabirds tend to concentrate. Human activity such as vessel movement, aircraft overflights, and target setting, could cause birds to flee a target area prior to the onset of an explosion, thus avoiding harm. In addition, birds that are in flight during an explosion would be less susceptible to harm than birds that are on the sea surface or diving underwater during an explosion.

On the other hand, seabirds could be attracted to an area to forage if an explosion resulted in a fish kill. This could be a concern for events that involve multiple explosions in the same area over a relatively long period of time. Some bombing exercises involve two aircraft, each dropping two HE bombs per event. However, the interval between bomb drops is about three minutes, so all four bombs would be dropped within a span of nine minutes.

While some seabird mortality could occur, the above analysis indicates that a small number of birds would be affected and that population level effects would not be expected. Underwater detonations and HE ordnance use under the No Action Alternative would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters would have no significant impact on birds. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Military Expended Materials

The Navy uses a variety of expended materials during training exercises conducted in the Study Area. The types and quantities of expended materials and information regarding fate and transport of these materials within the marine environment are discussed in Section 3.2. A majority of the expended materials currently used by the Navy rapidly sink to the sea floor and seabirds would not be exposed to these materials. Ordnance related materials would sink in relatively deep waters, would not present an ingestion risk to seabirds, and would have no effect on birds. Most targets are recovered after use, while some targets such as metal drums rapidly sink after use. Targets would have no effect on birds. However, seabirds could be exposed to some materials such as chaff fibers in the air or at the sea surface through direct contact or inhalation. Seabirds could also ingest some types of expended materials (chaff end-caps and pistons and self-protection flare end-caps) if the materials float on the sea surface or become entrained in *Sargassum* mats at the surface. The light and smoke generated by marine markers could elicit a short-term behavioral response, such as fleeing, in birds. For example, birds might be startled or flee the immediate area.

Based on the dispersion characteristics of chaff, large areas of air space and open water within the Study Area would be exposed to chaff, but the chaff concentrations would be very low (see Section 3.7.4.1). Several literature reviews and controlled experiments have indicated that chaff poses little environment risk except at concentrations substantially higher than those that could reasonably occur from military training use (Arfsten *et al.*, 2002; Hullar *et al.*, 1999; and USAF, 1997). Birds would occasionally come in direct contact with chaff fibers, but such contact would be inconsequential. Chaff is similar in form to fine human hair (USAF, 1997). Due to its flexible nature and softness, external contact with chaff would not be expected to adversely affect most wildlife (USAF, 1997) and the fibers would quickly

blow off or wash off shortly after contact. Inhalation of chaff fibers is not expected to have any adverse effects on birds because the fibers are too large to be inhaled into the lung. If inhaled, the fibers are predicted to deposit in the nose, mouth, or trachea and are either swallowed or expelled (Hullar *et al.*, 1999).

After falling from the air, chaff fibers float on the sea surface for some period of time depending on wave and wind action. Seabirds would be expected to unintentionally ingest low concentrations of floating chaff fibers, which consist of about 60 percent silica and 40 percent aluminum by weight. Some fibers would likely become entrained in *Sargassum* mats and remain at or near the surface for longer periods of time.

Ingestion of chaff fibers is not expected to cause physical damage to a bird's digestive tract based of the small size (ranging in lengths of 0.25 to 3 inches with a diameter of about 40 micrometers) and flexible nature of the fibers, and the small quantity that could reasonably be ingested. In addition, concentrations of chaff fibers that could reasonably be ingested are not expected to be toxic to birds. Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and mammals. Intestinal adsorption of orally ingested aluminum salts was very poor, and the small amount adsorbed was almost completely removed from the body by excretion. Dietary aluminum normally has small effects on healthy birds and mammals, and often high concentrations (>1,000 mg/kg) are needed to induce effects such as impaired bone development, reduced growth, and anemia (Nybo, 1996). A bird weighing approximately 1 kg would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg (based on chaff consisting of 40% aluminum by weight and a 5-ounce chaff canister containing 5 million fibers). As an example, an adult herring gull weighs about 0.8 to 1.2 kg (Cornell Lab of Ornithology, 2008). It is highly unlikely that a bird would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (1.8 fibers/ft^2 for an unrealistic, worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Other expended materials that could be ingested by seabirds include small plastic end-caps and pistons associated with chaff and self-protection flares (see Section 3.2 for description). The chaff end-cap and piston are both round and are 1.3 inches in diameter and 0.13 inches thick (Spargo, 2007). The self-protection flare end-cap is round and 1.4 inches in diameter. These plastic materials sink in saltwater (Spargo, 2007), which reduces the likelihood of ingestion by seabirds. However, some of the material could remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. Currently, about 7,360 chaff end-caps and pistons and 1,840 flare end-caps are released into the marine environment in W-151 A/B per year (total of 9,200 end-caps/pistons). Assuming that all end-caps and pistons would be evenly dispersed in W-151 A/B, the relative end-cap and piston concentration would be very low (1.8 pieces/nm^2/year, based on an area of 5,076 nm^2 and 9,200 end-caps/pistons per year). Actual environmental concentrations would vary based on actual release points and dispersion by wind and water currents. The number of end-caps and pistons that would remain at the surface in *Sargassum* mats and would potentially be available to seabirds is unknown, but is expected to be an extremely small percentage of the total.

Many species of seabirds are known to ingest plastic debris. For example, 21 of 38 seabird species (55%) collected off the coast of North Carolina from 1975 – 1989 contained plastic particles (Moser and Lee, 1992). Plastic is often mistaken for prey and the incidence of plastic ingestion appears to be related to a species' feeding mode and diet. Seabirds that feed by pursuit-diving, surface-seizing, and dipping tend to ingest plastic, while those that feed by plunging or piracy typically do not ingest plastic. Birds of the order Procellariiformes, which include petrels and shearwaters, tend to accumulate more plastic than do other species. Some seabirds, including gulls and terns, regularly regurgitate indigestible parts of their food items such as shell and fish bones. However, most procellariiforms have small gizzards

and an anatomical constriction between the gizzard and proventriculus that make it difficult to regurgitate solid material such as plastic (Azzarello and Van Vleet, 1987; Moser and Lee, 1992; Pierce *et al.*, 2004).

Moser and Lee (1992) found no evidence that seabird health was affected by the presence of plastic, but other studies have documented adverse consequences of plastic ingestion. As summarized by Pierce *et al*. (2004) and Azzarello and Van Vleet (1987), documented consequences of plastic ingestion by seabirds include blockage of the intestines and ulceration of the stomach; reduction in the functional volume of the gizzard leading to a reduction of digestive capability; and distention of the gizzard leading to a reduction in hunger. Studies have found negative correlations between body weight and plastic load, as well as body fat, a measure of energy reserves, and the number of pieces of plastic in a seabird's stomach. Other possible concerns that have been identified include toxic plastic additives and toxic contaminants that could be adsorbed due to the plastic from ambient seawater. Pierce *et al*. (2004) described two cases where plastic ingestion caused seabird mortality from starvation. A necropsy of an adult northern gannet revealed that a 1.5-inch diameter plastic bottle cap lodged in the gizzard, obstructed passage of food into the small intestine, and resulted in death from starvation. Dissection of an adult greater shearwater gizzard revealed that a 1.5-inch by 0.5-inch fragment of plastic blocked the pylorus, obstructed the passage of food, and resulted in death from starvation.

Based on the information presented above, if a seabird were to ingest a plastic end-cap or piston the response would vary based on the species and individual bird. The responses could range from none, to sublethal (reduced energy reserves), to lethal (digestive tract blockage leading to starvation). Ingestion of end-caps and pistons by species that regularly regurgitate indigestible items would likely have no adverse effects. However, end-caps and pistons are similar in size to those plastic pieces described above that caused digestive tract blockages and eventual starvation. Therefore, ingestion of plastic end-caps and pistons could be lethal to some individuals of some species of seabirds. Species with small gizzards and anatomical constrictions that make it difficult to regurgitate solid material would likely be most susceptible to blockage (procellariiforms). Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual birds. Nonetheless, the number of end-caps or pistons ingested by seabirds is expected to be very low based on the low relative concentration (1.8 pieces/nm^2/year) and the fact that an extremely small percentage of the total would be potentially available to seabirds (*i.e.*, those that land on *Sargassum* mats and remain at the sea surface). Plastic ingestion under the No Action Alternative would not result in a significant adverse effect on migratory bird populations because sublethal and lethal effects, if they occur, would be limited to a few individual birds.

Marine markers float on the sea surface for a period of time and produce chemical flames and regions of surface smoke. Burn times range from 10 to 60 minutes and the metal canisters sink after all burn components have been used. The light and smoke generated by the markers could elicit a short-term behavioral response in birds if they are in the immediate area. Birds might flee or avoid the immediate area while a marine marker is operational. However, the potential for birds to be exposed to marine markers is extremely low based on the small number of markers used (34 per year). The potential for a marine marker to strike a bird during deployment for an aircraft is also extremely low based on the small number of markers used. The effects of marine marker use under the No Action Alternative would be minor, short-term, and localized.

In summary, expended materials would not result in a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, expended materials in territorial waters would have no significant impact on birds.

Furthermore, expended materials in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, the No Action Alternative includes the use of Mine Warfare devices towed through the water by helicopters and ships. In addition, remotely operated vehicles are used during Mine Neutralization training. These devices are currently used in the Panama City and Corpus Christi MINEX Boxes, but they would no longer be used under Alternative 1 and 2. The effects of underwater detonations associated with the use of these devices are analyzed below in the underwater detonation and high explosive ordnance section. The effects of Mine Warfare devices towed by ships and remotely operated vehicles are expected to be the same as those described above for vessel movements. This section analyzes the effects of the MK-103, which is towed through the water by a helicopter.

Birds could be injured or killed if they were struck by the towed device or the tow line connecting the helicopter to the device. The noise, downdraft, and visual cues from the oncoming helicopter would likely cause birds to flee the immediate area. Birds could be struck by the tow line during an evasive response because the tow line might be difficult to see. However, it is expected that birds would evade the helicopter long before the tow lines present a strike risk. Similar to aircraft strikes discussed above, few, if any, bird/towed device strikes and associated bird mortalities or injuries are expected to occur in the Study Area under the No Action Alternative. Towed Mine Warfare device use under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, towed Mine Warfare device use in territorial waters would have no significant impact on birds. Furthermore, the use of towed Mine Warfare devices in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Brown Pelican

Brown Pelican - Overview

While brown pelicans in Mississippi, Louisiana, and Texas are currently listed as endangered (proposed for delisting); this species was delisted in Florida and Alabama in 1985. Therefore, ESA-listed brown pelicans are not expected to occur in portions of the GOMEX Study Area located off the coasts of Florida and Alabama (Panama City OPAREA, Pensacola OPAREA, and associated Special Use Airspace) or at the NSA Panama City (Florida) Demolition Pond. ESA-listed brown pelicans would not be exposed to operations in these areas and the No Action Alternative would have no effect on ESA-listed brown pelicans in these areas. Accordingly, the remainder of this section analyzes effects of the No Action Alternative on ESA-listed brown pelicans in portions of the GOMEX Study Area located off the coasts of Louisiana and Texas.

Brown Pelican - Vessel Movements

As discussed above for other seabirds, brown pelicans could exhibit a short-term behavioral response to passing Navy vessels, but the general health of individuals would not be compromised. Direct collisions with a vessel or interactions with a vessel's rigging could result in injury or mortality. However, the probability of a collision is extremely low because Navy vessels and brown pelicans are rarely expected to co-occur in time and space. A relatively small percentage of the total vessel steaming days for the GOMEX Study Area (180 days per year) would occur in the New Orleans and Corpus Christi OPAREAs. Brown pelicans typically forage in nearshore waters during daylight hours and roost on land at night. While Navy vessels transit nearshore waters of the GOMEX Study Area off the coast of Texas, most vessel movements occur in the offshore OPAREAs. The entire New Orleans OPAREA

is located more than 12 nm offshore and most of the Corpus Christi OPAREA is located more than 12 nm offshore, where brown pelicans are rarely found. Unlike some seabirds, brown pelicans are not expected to be more susceptible to vessel collisions at night because they are typically inactive at night and use roosting sites on land at night (Croll *et al.*, 1986; Briggs *et al.*, 1983). Vessel movements under the No Action Alternative may affect the brown pelican, but the effects of vessel collisions would be considered discountable because collisions are extremely unlikely to occur.

Brown Pelican - Aircraft Overflights

The No Action Alternative includes 328 fixed-wing aircraft sorties per year in W-92/W-54 and 3,865 sorties per year in W-228. All of these sorties would be above 3,000 feet. Brown pelican exposure to fixed-wing aircraft overflights is extremely unlikely because these warning areas are located more than 12 nm offshore, where this species rarely occurs. As discussed above for other seabirds, if brown pelicans were exposed to fixed-wing aircraft overflights they could exhibit a short-term behavioral response, but the general health of individuals would not be compromised. It is also possible that brown pelicans would not respond to overflight noise based on the high flight altitudes. Furthermore, no potential exists for fixed-wing aircraft strikes because all flights occur above 3,000 feet, where brown pelicans are not expected to occur. Therefore, aircraft strikes would have no effect on ESA-listed brown pelicans.

The No Action Alternative also includes 38 helicopter sorties per year in W-151, W155, and the Corpus Christi OPAREA. The probability of a brown pelican being exposed to a helicopter overflight is extremely unlikely based on the low number of sorties and because these sorties occur more than 12 nm offshore. Aircraft overflights under the No Action Alternative may affect the brown pelican. The effects of aircraft overflights are considered discountable because exposure is extremely unlikely.

Brown Pelican - Munitions Use/Non-explosive Practice Munitions

MINEX Box E3 is the only area where NEPM use and ESA-listed brown pelicans may co-occur under the No Action Alternative. As discussed for other seabirds NEPM is not expected to strike a brown pelican. NEPM strikes would have no effect on the brown pelican, but disturbance associated with NEPM firing may affect the brown pelican.

Brown Pelican - Underwater Detonations and High Explosive Ordnance

Areas where ESA-listed brown pelicans and underwater explosions may co-occur under the No Action Alternative would be limited to the Corpus Christi MINEX Boxes. Most of these areas are located more than 7 nm offshore, where brown pelican occurrence is expected to be infrequent. Underwater detonations and HE ordnance use for the No Action Alternative may affect the brown pelican. Exposure to underwater detonations is extremely unlikely and the effects would be considered discountable. As noted above, ESA-listed brown pelicans are not expected to occur in portions of the GOMEX Study Area located off the coasts of Florida and Alabama (Panama City OPAREA, Pensacola OPAREA, and associated Special Use Airspace) or at the NSA Panama City (Florida) Demolition Pond because the Alabama and Florida populations have been de-listed. Therefore, ESA-listed brown pelicans would not be exposed to explosions associated with BOMEX, MINEX in the Panama City OPAREA, or training in the Demolition pond.

Brown Pelican - Military Expended Materials

The No Action Alternative does not include the use of military expended materials in areas where ESA-listed brown pelicans are expected to occur, with the exception of non-explosive practice mine shapes. These practice mine shapes are recovered after use or, in the case of underwater detonations, rapidly sink to the bottom after use. Therefore, brown pelicans would not be exposed to these materials. The

use of military expended materials would have no effect on the brown pelican under the No Action Alternative.

Brown Pelican - Towed Mine Warfare Devices

The No Action Alternative includes use of the MK-103 towed Mine Warfare device in the Corpus Christi MINEX Box B. As discussed above for other seabirds, use of this device presents a limited strike risk for the brown pelican. The probability of a strike is extremely low because the MK-103 is used more than 12 nm offshore, where brown pelicans rarely occur. Furthermore, only ten sorties are conducted per year. Towed Mine Warfare device use under the No Action Alternative may affect the brown pelican. The effects of towed Mine Warfare devices would be considered discountable because exposure is extremely unlikely to occur.

3.10.3.2 Alternative 1

Vessel Movements

The total number of vessel stream days for the GOMEX Study Area would not change under Alternative 1. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 1. Vessel movements under Alternative 1 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on birds. Furthermore, vessel movements in non-territorial waters would not cause significant harm to birds in accordance with EO 12114. Effects of Alternative 1 on the federally listed brown pelican are analyzed below.

Aircraft Overflights

Alternative 1 includes approximately 5,316 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 93 sorties per year (1.8%) compared to the No Action Alternative. The additional sorties would be associated with bombing exercises in W-151 and W-155 and would involve flights below 3,000 feet. Helicopters sorties would decrease from 38 to 18 per year under Alternative 1.

Based on the increased operations under Alternative 1 more birds could be exposed to noise and/or the number of times an individual bird is exposed could increase slightly. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions (*e.g.*, alert response, startle response, temporary increase in heart rate) and the general health of individual birds would not be compromised. Birds repeatedly exposed to aircraft noise often become habituated to the noise and do not respond behaviorally (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). However, habituation seems unlikely in the Study Area given the widely dispersed nature of the operations and the relative infrequency of the operations. Aircraft noise exposures under Alternative 1 would result in negligible effects to individual birds and would not result in significant adverse effects to migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft noise over territorial waters would have no significant impact on birds. Furthermore, aircraft noise over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

The changes in aircraft overflights would also slightly increase the likelihood of bird/aircraft strikes and associated bird mortalities and injuries. As discussed above for the No Action Alternative, bird/aircraft strikes are rare in offshore areas and the numbers of bird mortalities that occur Navy-wide are insignificant from a population standpoint. Despite the increases in overflights, bird/aircraft strikes are not expected to occur. If they do occur, the number of birds affected would be small. Aircraft strikes under Alternative 1 would have no significant adverse effect on migratory bird populations as defined

by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft strikes over territorial waters would have no significant impact on birds. Furthermore, aircraft strikes over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Munitions Use/Non-explosive Practice Munitions

The amount of NEPM used would increase in the GOMEX Study Area under Alternative 1 (Tables 2.2-7 and 2.2-8). These changes would result in increased potential for birds to be exposed to weapons firing noise. The potential for bird/NEPM strikes and associated bird mortalities and injuries would also increase. However, the number of birds affected would continue to be small. Navy mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of ordnance strikes.

While a remote possibility exists that some individuals of some bird species may be directly impacted if they are in the target area and at the point of physical impact at the time of ordnance delivery, NEPM strikes under Alternative 1 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, NEPM strikes in territorial waters would have no significant impact on birds. Furthermore, NEPM strikes in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Alternative 1 would include changes in underwater detonations and HE ordnance use in the GOMEX Study Area. Underwater detonations associated with Mine Warfare exercises in the Panama City and Corpus Christi MINEX Boxes would no longer occur under Alternative 1. As such, birds would no longer be affected by these activities.

The use of anti-swimmer grenades (0.5-lb NEW) would not change under Alternative 1. Therefore, the No Action Alternative analysis for anti-swimmer grenades is applicable to Alternative 1.

As summarized in Table 2.2-6, Alternative 1 includes changes in operations at the Demolition Pond. Some annual operations would increase, while other would decrease. However, the maximum charge would continue to be 1.25-lb NEW and the number of 1.25-lb NEW charges would not change. Therefore, the effects of Alternative 1 at the Demolition Pond are expected to be the same as the No Action Alternative.

Alternative 1 would include an increase in the number of HE bombs dropped in the W-155 A/B Hotbox from 52 to 155 per year. As discussed above for the No Action Alternative, HE bombs have relatively high NEWs and large ZOIs. Therefore, the potential for seabirds to be exposed to impacts from HE bomb explosions would increase substantially under Alternative 1. While this increase is offset somewhat by the elimination of Mine Warfare underwater detonations, the overall potential for exposure to impacts from explosions is expected to be greater under Alternative 1 than the No Action Alternative. While some seabird mortality could occur, mitigation measures and factors discussed for the No Action Alternative indicate that a small number of birds would be affected and that population level effects would not be expected. Underwater detonations and HE ordnance use under Alternative 1 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters would have no significant impact on birds. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Military Expended Materials

Alternative 1 includes an increase in the number of marine markers used in the Study Area (from 34 to 124 per year). The light and smoke generated by the markers could elicit a short-term behavioral response in birds if they are in the immediate area. Birds might flee or avoid the immediate area while a marine marker is operational. However, the potential for birds to be exposed to marine markers would continue to be low based on the small number of markers used (124 per year). The potential for a marine marker to strike a bird during deployment from an aircraft also continues to be extremely low based on the small number of markers used. The effects of marine marker use under Alternative 1 would be minor, short-term, and localized. Other military expended materials that birds could be exposed to (chaff fibers, chaff/flare end-caps and pistons) would not change under Alternative 1. Military expended materials would not result in a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, military expended materials in territorial waters would have no significant impact on birds. Furthermore, military expended materials in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 1. Therefore, the effects described for the No Action Alternative would no longer occur.

Brown Pelican

Brown Pelican - Vessel Movements

While the overall number of vessel steaming days in the GOMEX Study Area would not change under Alternative 1, a decrease in vessel movements is expected in the Corpus Christi OPAREA based on realignment of NS Ingleside's surface ships to other locations. As discussed for the No Action Alternative, the effects of vessel collisions would be considered discountable because collisions are extremely unlikely to occur. Vessel movements under Alternative 1 may affect the brown pelican.

Brown Pelican - Aircraft Overflights

Alternative 1 includes a slight increase in fixed-wing aircraft sorties, but the additional sorties would take place in areas where ESA-listed brown pelicans would not be expected to occur (W-151 and W-152 off the coasts of Alabama and Florida). Alternative 1 also includes decrease in helicopter sorties from 38 to 18 per year. As discussed for the No Action Alternative, the effects of aircraft overflights would be considered discountable because exposure is extremely unlikely to occur. Aircraft overflights under Alternative 1 may affect the brown pelican. As discussed for the No Action Alternative, aircraft strikes would have no effect on ESA-listed brown pelicans.

Brown Pelican - Munitions Use/Non-explosive Practice Munitions

NEPM use in areas where ESA-listed brown pelicans are expected to occur would not change under Alternative 1. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 1. NEPM strikes would have no effect on the brown pelican, but disturbance associated with NEPM firing may affect the brown pelican.

Brown Pelican - Underwater Detonations and High Explosive Ordnance

As discussed for the No Action Alternative, ESA-listed brown pelicans are not expected to occur in portions of the GOMEX Study Area located off the coasts of Florida and Alabama (Panama City OPAREA, Pensacola OPAREA, and associated Special Use Airspace) or at the NSA Panama City (Florida) Demolition Pond because the Alabama and Florida populations have been de-listed.

Therefore, ESA-listed brown pelicans would not be exposed to explosions associated with BOMEX or training in the Demolition pond. Underwater detonations associated with Mine Warfare exercises would no longer occur in the Corpus Christi OPAREA under Alternative 1. Therefore, Mine Warfare underwater detonations would have no effect on the brown pelican. Anti-swimmer grenade use during small arms training would not change under Alternative 1. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 1. Underwater explosions from anti-swimmer grenades may affect the brown pelican under Alternative 1.

Brown Pelican - Military Expended Materials

Alternative 1 does not include the use of military expended materials in areas where ESA-listed brown pelicans are expected to occur. The use of military expended materials would have no effect on the brown pelican under Alternative 1.

Brown Pelican - Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used in the GOMEX Study Area under Alternative 1. Therefore, towed Mine Warfare devices would have no effect on the brown pelican.

3.10.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

The total number of vessel stream days for the GOMEX Study Area would not change under Alternative 2. Therefore, the analysis presented above for the No Action Alternative is applicable to Alternative 2. Vessel movements under Alternative 2 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on birds. Furthermore, vessel movements in non-territorial waters would not cause significant harm to birds in accordance with EO 12114. Effects of Alternative 1 on the federally listed brown pelican are analyzed below.

Aircraft Overflights

Alternative 2 includes approximately 5,318 fixed-wing aircraft sorties per year over the Gulf of Mexico; an increase of 2 sorties per year (0.04%) compared to Alternative 1. Helicopter sorties would decrease from 38 to 18 per year under Alternative 2 (same as Alternative 1). Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. Aircraft noise exposures under Alternative 2 would result in negligible effects to individual birds and would not result in significant adverse effects to migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft noise over territorial waters would have no significant impact on birds. Furthermore, aircraft noise over non-territorial waters would not cause significant harm to birds in accordance with EO 12114. Aircraft strikes under Alternative 2 would have no significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft strikes over territorial waters would have no significant impact on birds. Furthermore, aircraft strikes over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Munitions Use/Non-explosive Practice Munitions

The amount of NEPM used would increase in the GOMEX Study Area under Alternative 2 (Tables 2.2-7 and 2.2-8). These changes would result in increased potential for birds to be exposed to weapons firing noise. The potential for bird/NEPM strikes and associated bird mortalities and injuries would also increase. However, the number of birds affected would continue to be small. Navy mitigation

measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of ordnance strikes.

While a remote possibility exists that some individuals of some bird species may be directly impacted if they are in the target area and at the point of physical impact at the time of ordnance delivery, NEPM strikes under Alternative 2 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, NEPM strikes in territorial waters would have no significant impact on birds. Furthermore, NEPM strikes in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Mine Warfare underwater detonations would no longer occur in the GOMEX Study Area under Alternative 2, as was the case for Alternative 1. Demolition pond training for Alternative 2 would also be the same as Alternative 1. However, Alternative 2 includes a substantial decrease in the number of HE bombs dropped (four per year) relative to both the No Action Alternative (52 per year) and Alternative 1 (155 per year). As a result, the potential for seabirds to be exposed to underwater detonations and HE ordnance would decrease substantially under Alternative 2 compared to the No Action Alternative and Alternative 1. Underwater detonations and HE ordnance use under Alternative 2 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters would have no significant impact on birds. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Military Expended Materials

The amount of chaff, self-protection flares, and marine markers used under Alternative 2 would be the same as Alternative 1. Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. Military expended materials would not result in a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, military expended materials in territorial waters would have no significant impact on birds. Furthermore, military expended materials in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used under Alternative 2 and would have no effect on seabirds or migratory birds.

Brown Pelican

Brown Pelican - Vessel Movements

Vessel movements for Alternative 2 would be the same as Alternative 1. Therefore, the analysis presented for Alternative 1 is applicable to Alternative 2. Vessel movements under Alternative 2 may affect the brown pelican.

Brown Pelican - Aircraft Overflights

Alternative 2 includes a slight increase in fixed-wing aircraft sorties, but the additional sorties would take place in areas where ESA-listed brown pelicans are not expected to occur (W-151 and W-152 off the costs Alabama and Florida). Alternative 2 also includes a decrease in helicopter sorties from 38 to 18 per year. As discussed for the No Action Alternative, the effects of aircraft overflights would be considered discountable because exposure is extremely unlikely to occur. Aircraft overflights under

Alternative 2 may affect the brown pelican. As discussed for the No Action Alternative, aircraft strikes would have no effect on ESA-listed brown pelicans.

Brown Pelican - Munitions Use/Non-explosive Practice Munitions

NEPM use in areas where ESA-listed brown pelicans are expected to occur would not change under Alternative 2. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 2. NEPM strikes would have no effect on the brown pelican, but disturbance associated with NEPM firing may affect the brown pelican.

Brown Pelican - Underwater Detonations and High Explosive Ordnance

As discussed for the No Action Alternative, ESA-listed brown pelicans are not expected to occur in portions of the GOMEX Study Area located off the coasts of Florida and Alabama (Panama City OPAREA, Pensacola OPAREA, and associated Special Use Airspace) or at the NSA Panama City (Florida) Demolition Pond because the Alabama and Florida populations have been de-listed. Therefore, ESA-listed brown pelicans would not be exposed to explosions associated with BOMEX or training in the Demolition pond. Underwater detonations associated with Mine Warfare exercises would no longer occur in the Corpus Christi OPAREA under Alternative 2. Therefore, Mine Warfare underwater detonations would have no effect on the brown pelican. Anti-swimmer grenade use during small arms training would not change under Alternative 2. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 2. Underwater explosions from anti-swimmer grenades may affect the brown pelican under Alternative 2.

Brown Pelican - Military Expended Materials

Alternative 2 does not include the use of military expended materials in areas where ESA-listed brown pelicans are expected to occur. The use of military expended materials would have no effect on the brown pelican under Alternative 2.

Brown Pelican - Towed Mine Warfare Devices

Towed Mine Warfare devices would no longer be used in the GOMEX Study Area under Alternative 2. Therefore, towed Mine Warfare devices would have no effect on the brown pelican.

3.10.4 Unavoidable Significant Environmental Impacts

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to seabirds or migratory birds.

3.10.5 Summary of Environmental Impacts

3.10.5.1 Endangered Species Act

Table 3.10-3 provides a summary of the Navy's determination of effect for Alternative 2 (the Preferred Alternative) and the federally listed brown pelican. Alternative 2 may affect the brown pelican. The Study Area does not contain designated critical habitat for the brown pelican. Consequently, Alternative 2 would have no effect on critical habitat. The Navy has completed informal ESA Section 7 consultation with USFWS regarding its determination of effect for Alternative 2 and the brown pelican. In a letter dated 9 March 2009 (Appendix C), USFWS concurred with the Navy's determination that Alternative 2 may affect, but is not likely to adversely affect the listed brown pelican.

3.10.5.1 Migratory Bird Treaty Act

As discussed in the analysis presented above in Section 3.10.3 and summarized in Table 3.10-4, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a

migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required to confer with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects to migratory birds not listed under the ESA.

3.10.5.2 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.10-4, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on seabirds and migratory birds in territorial waters. Furthermore, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to seabirds and migratory birds in non-territorial waters.

TABLE 3.10-3
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR THE FEDERALLY LISTED BROWN PELICAN- ALTERNATIVE 2

Stressor	Brown Pelican
Vessel Movements	
Vessel Disturbance	May Affect
Vessel Collisions	May Affect
Aircraft Overflights	
Aircraft Disturbance	May Affect
Aircraft Strikes	No Effect
Non-explosive Practice Munitions	
Weapons Firing Disturbance	May Affect
Non-explosive Practice Munitions Strikes	No Effect
Underwater Detonations and High Explosive Ordnance	
Underwater Detonations Small Charges (Demolition Pond)	No Effect
High Explosive Ordnance Bombs (Hotbox)	No Effect
Small Arms Training Anti-swimmer Grenades (UNDET Area E3)	May Affect
Military Expended Materials	
Ordnance Related Materials	No Effect
Target Related Materials	No Effect
Chaff	No Effect
Self Protection Flares	No Effect
Marine Markers	No Effect

TABLE 3.10-4
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEABIRDS AND MIGRATORY BIRDS IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Vessel Movements	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. No long-term population-level effects.	Same as U.S. Territory.
Aircraft Overflights	Short-term behavioral responses to overflights. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.	Same as U.S. Territory.
Non-Explosive Practice Munitions	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.	Same as U.S. Territory.
Underwater Detonations and High Explosive Ordnance	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. No long-term population-level effects.	Same as U.S. Territory.
Military Expended Materials	No effects associated with ordnance related materials, targets, or marine markers. Extremely low potential for sublethal or lethal effects from ingestion of chaff or flare end-caps or pistons. No long-term population-level effects.	Same as U.S. Territory.

TABLE 3.10-4 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEABIRDS AND MIGRATORY BIRDS IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Towed Mine Warfare Devices	Extremely low potential for towed device strikes. No long-term population-level effects.	Same as U.S. Territory.
Impact Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.
Alternative 1		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action.	Same as U.S. Territory.
Non-Explosive Practice Munitions	Slight increase compared to No Action.	Same as U.S. Territory.
Underwater Detonations and High Explosive Ordnance	Decrease compared to No Action.	Increase compared to No Action.
Military Expended Materials	Same as No Action Alternative with the exception of increased marine marker use.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not Applicable.	Not applicable.
Impact Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.
Alternative 2		
Vessel Movements	No change from No Action Alternative.	No change from No Action Alternative.
Aircraft Overflights	Slight increase compared to No Action.	Same as U.S. Territory.
Non-Explosive Practice Munitions	Slight increase compared to No Action.	Same as U.S. Territory.
Underwater Detonations and	Decrease compared to No Action.	Substantial decrease compared to No Action.

TABLE 3.10-4 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEABIRDS AND MIGRATORY BIRDS IN THE GOMEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
High Explosive Ordnance		
Military Expended Materials	Same as No Action Alternative with the exception of increased marine marker use.	Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable.	Not applicable.
Impact Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.

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3.11 BIOLOGICAL RESOURCES AT MCMULLEN AND NOXUBEE COUNTY RANGES

3.11.1 Introduction and Methods

3.11.1.1 Regulatory Framework

This section addresses biological resources at McMullen County Range (Dixie and Yankee Targets) and Noxubee County Range (SEARAY Target), including vegetation, wetlands, wildlife, and threatened and endangered species. Federally listed and state-listed terrestrial species that may occur at or near the NSA Panama City Demolition Pond are also addressed in this section. Marine resources at the Demolition Pond are addressed in Section 3.6 through 3.9. The regulatory framework that governs and protects these resources is described in Appendix K and includes Section 404 of the Clean Water Act (wetlands), the Migratory Bird Treaty Act (MBTA), and the Endangered Species Act (ESA).

3.11.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for biological resources at McMullen County and Noxubee County Ranges is the same as the approach described for marine mammals in Section 3.7.1.2.

Study Area

The McMullen County Range and Noxubee County Range Study Areas for biological resources are generally defined as those areas that could potentially be affected by the proposed actions. The limits of the Study Areas vary based on the resources being addressed and the nature of the proposed training operations. Collectively, the McMullen County Range Study Area includes all areas within the Dixie and Yankee Target property boundaries, as well as areas outside the boundary where low-altitude (*i.e.*, below 3,000 feet) aircraft overflights would occur. Collectively, the Noxubee County Range Study Area includes all areas within the SEARAY Target property boundary, as well as areas outside the boundary where low-altitude (*i.e.*, below 3,000 feet) aircraft overflights would occur. The Study Areas for terrestrial vegetation and wetlands are limited to areas within the range property boundary because potential direct and indirect effects to these resources would not extend outside the boundary. The proposed activities for NSA Panama City are limited to the Demolition Pond and the Study Area includes terrestrial habitats in the vicinity of the pond where noise could potentially affect wildlife.

Data Sources

A comprehensive and systematic review of relevant literature and data was conducted to complete this analysis for biological resources to ensure that best available information was used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, Environmental Impact Statements, Integrated Natural Resources Management Plans (INRMPs), and other technical reports published by government agencies, private businesses, consulting firms, or non-governmental conservation organizations. The scientific literature was also consulted during the search for geographic location data on the occurrence of resources within the Study Area.

Factors Used to Assess the Significance of Effects

This EIS/OEIS analyzes potential effects to biological resources at McMullen County Range and Noxubee County Range in the context of Section 404 of the Clean Water Act (for wetlands only), MBTA, ESA (for listed species only), and NEPA. The factors used to assess the significance of effects vary under these Acts and are described below:

- Factors considered under Section 404 of the Clean Water Act include the extent to which an alternative could result in disturbance, filling, or permanent loss of jurisdictional wetland areas or wetland functions and values.
- Factors considered under the MBTA include the extent to which an alternative could diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem over a reasonable period of time.
- For purposes of ESA compliance, effects of the action were analyzed to make the Navy's determination of effect for listed species. The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998) and are provided in Section 3.7.1.2.
- All the factors discussed above were considered in assessing the significance of effects under NEPA.

3.11.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to biological resources at McMullen County and Noxubee County Ranges. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Final EIS/OEIS. As summarized in Table 3.11-1, potential stressors to biological resources at McMullen County and Noxubee County Ranges include aircraft overflights (disturbance and strikes), non-explosive practice munitions (NEPM) (disturbance and strikes), and military expended materials (ordnance related materials). High explosive (HE) ordnance is not used on these ranges; therefore, underwater detonations and high explosive ordnance are not applicable to this section.

TABLE 3.11-1
POTENTIAL STRESSORS TO BIOLOGICAL RESOURCES AT MCMULLEN COUNTY AND NOXUBEE COUNTY RANGES

Primary Warfare Area (Shaded) Range Operation	Training Area(s)	Aircraft Overflights	Non-Explosive Practice Munitions	Military Expended Materials
Strike Warfare (STW)				
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target	✓	✓	✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target	✓	✓	✓

3.11.2 Affected Environment

3.11.2.1 General Description

McMullen County Range

The McMullen County Range is located in southern Texas and consists of the Dixie and Yankee Targets (Figure 2.1-4). Dixie Target is located in the southwestern corner of McMullen County and Yankee Target is 10 miles to the north.

Dixie Target

Dixie Target consists of about 7,825 acres of Navy-owned land with a 360-acre impact area (Figure 3.11-1). Lands surrounding the impact area serve as a buffer zone (DoN, 2006). The buffer zone is know as the Escondido Ranch and is managed for wildlife and is used for outdoor recreation (DoN, 2003). Naval Air Station Kingsville has responsibility for natural resources management at Dixie Target. Natural resources are managed in accordance with the Naval Air Station Kingsville INRMP, which was developed in cooperation with USFWS and Texas Parks and Wildlife (DoN, 2003). Dixie Target has been used for air-to-ground training since 1965, with some periods of inactivity (DoN, 2006). It is currently used for Air-to-Ground Bombing Exercises using non-explosive practice bombs. No HE ordnance is authorized. The impact area is maintained and cleared of native vegetation to meet operational and safety requirements. The buffer zone is allowed to stay in a native vegetation state throughout much of the acreage (DoN, 2003). Dixie Target has a single conventional bomb target surrounded by 75, 150, and 300-foot radii circles (DoN, 2006). The topography is gently rolling with elevation ranging from 375 feet above mean sea level in the south to 250 feet above mean sea level along the Nueces River to the north and west (DoN, 2003).

Yankee Target

Yankee Target consists of 2,800 acres with a 400-acre impact area (Figure 3.11-2). Lands surrounding the impact area serve as a buffer zone. The Navy leases the land from a private land owner. Yankee Target has been used for air-to-ground training since 1965, with some periods of inactivity (DoN, 2006). It is currently used for Air-to-Ground Bombing Exercises using non-explosive practice bombs and Air-to-Ground Gunnery Exercises. No HE ordnance is authorized. Currently, the 149th Fighter Wing, stationed at Lackland Air Force Base, Texas manages and uses Yankee Target under an Inter Service Support Agreement with NAS Kingsville. The impact area is maintained to meet operational and safety requirements. Vegetation in the buffer zone is also managed by the land owner and the land use used for grazing (USAF, 1994). Yankee Target has several tactical targets (DoN, 2006):

- Conventional bomb circle with has 75 and 150-foot radii around center aim point.
- Rocket circle with a 75-foot radius around the center aim point.
- 57-mm AAA target is a camouflaged and revetted AAA gun.
- Tank targets are three full-scale camouflaged wooden tanks.
- Convoy target is a series of three vehicles.
- Runway targets consist of three aircraft on a simulated 1,300-foot dirt runway.
- 37-mm AAA target consists of a radar van and one mobile simulated 37-mm gun system.
- Communications site is a metal communications building and a satellite dish.
- Command Post is a small building surrounded by two tanks.
- SA-3 site is a large truck simulating a radar van surrounded by four missiles.
- Scud missile site is a single scud missile and a tow launcher.
- Tank convoy (no drop target) is a four vehicle tank convoy located outside the impact area. It is used for simulated weapons delivery training. No ordnance is allowed on this target.

- High angle strafe target is a single drag chute canted 30 degrees to the ground surface. Only 20-mm rounds are authorized.
- Low angle strafe target consists of two multi-colored drag chute strafe panels. Only 20-mm rounds are authorized.

The topography is gently rolling with elevation ranging from about 250 to 300 feet above mean sea level.

Noxubee County Range

The Noxubee County Range consists of 2,889 acres of land in a rural portion of eastern-central Mississippi, about 43 miles north of Meridian, Mississippi. The impact area consists of 654 acres and is surrounded by a 2,235-acre buffer zone (Figure 3.11-3). The Navy owns the impact area and has an easement for the buffer zone. The range has been operated and managed by the Navy since 1974 to train pilots in Air-to-Ground Bombing Exercises using non-explosive practice bombs. No high explosive ordnance is authorized. Naval Air Station Meridian has responsibility for natural resources management at Noxubee County Range. Natural resources are managed in accordance with the Naval Air Station Meridian INRMP, which was developed in cooperation with USFWS and Mississippi Department of Wildlife, Fisheries, and Parks (DoN, 2007). About 65 percent of the impact area is maintained to meet operational and safety requirements, while the remainder of the impact area and buffer zone are mostly forested. The range includes a single target with a 20-foot diameter bull's-eye surrounded by concentric rings of white-painted tires at radii of 75, 150, and 300 feet. Evaluation at the bull's-eye is about 240 feet and the range is relatively flat (DoN, 2003; DoN, 2004).

3.11.2.2 Vegetation

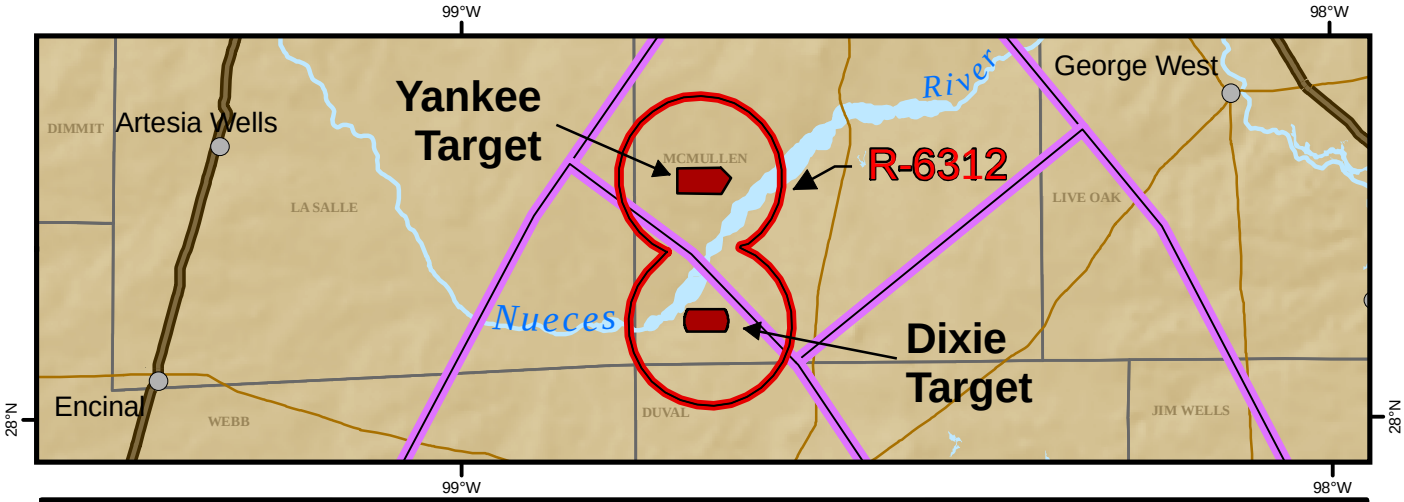
McMullen County Range

Dixie Target

The impact area at Dixie Target is maintained for operational and safety purposes and lacks native vegetation communities. The flora of the buffer zone consists of several natural plant communities in addition to areas modified by livestock or game management practices. An extensive network of jeep trails and senderos crisscross the area punctuated by an occasional cultivated plot for game food. The following descriptions of vegetation are from the INRMP (DoN, 2003), which also includes a species list from the most recent plant surveys.

Mesquite-mixed brush woodlands including mesquite, guajillo, blackbrush, mixed with a shorter shrub layer of prickly pear (*Opuntia lindheimeri*), guayacan (*Guaiacum angustifolium*), lotebush (*Ziziphus obtusifolius*), pencil cactus (*Opuntia leptocaulis*), and spiny hackberry or granjeno (*Celtis pallida*) are common on upland slopes and ridges. A blackbrush/cenizo community occupies shallower gravelly soil on small hilltops and slopes. This community is composed of many of the same trees and shrubs of the mesquite-mixed brush woodlands with blackbrush and cenizo dominant.

Dixie Target contains areas supporting brackish water and marsh vegetation in proximity to the Nueces River. These areas contain broad meadows of Gulf cordgrass (*Spartina spartinae*) and Mexican devil-weed (*Aster spinosa*) on the river terrace. A narrow riparian community of hackberry-ash riparian woodlands exists along the bank of the Nueces River with a canopy that is generally no more than one or two trees in width. Tree species found here include Mexican ash (*Fraxinus berlandieriana*), sugar hackberry (*Celtis laevigata*), retama (*Parkinsonia aculeata*), huisache, and black willow (*Salix nigra*).



Legend

- Towns
- Primary Roads
- County Boundaries
- Restricted Airspace (R-)
- Kingsville 3 MOA

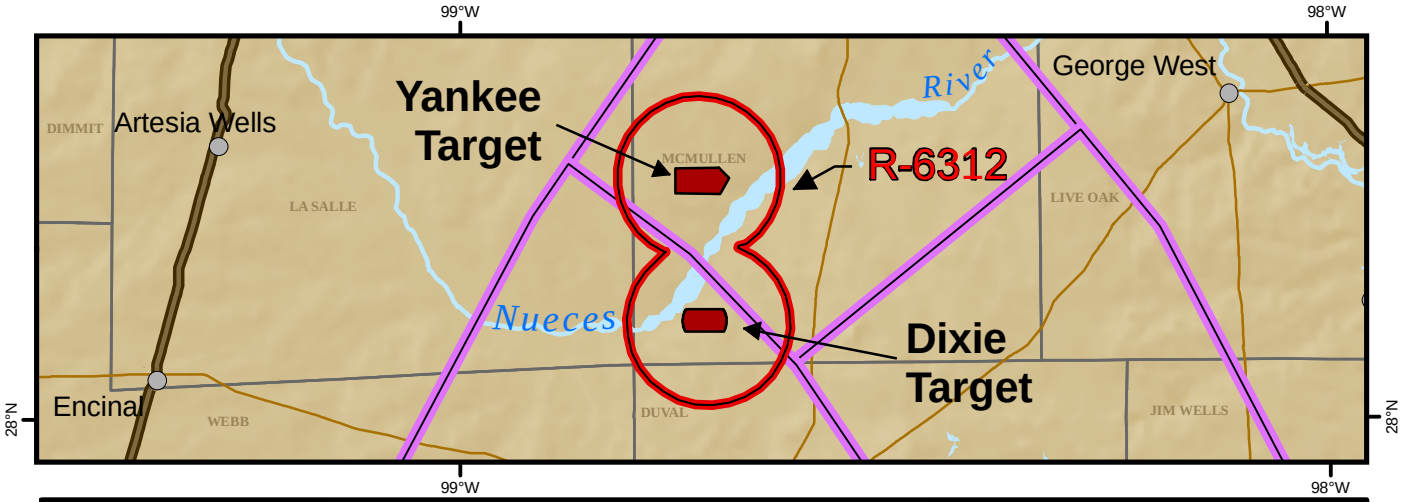
0 2.5 5 10 15 20 25

Nautical Miles

Coordinate System: WGS 1984 UTM Zone 14 (Meters)

Figure 3.11-1

McMullen County Range Dixie Target



Legend

- Towns
- Primary Roads
- County Boundaries
- Restricted Airspace (R-)
- Kingsville 3 MOA

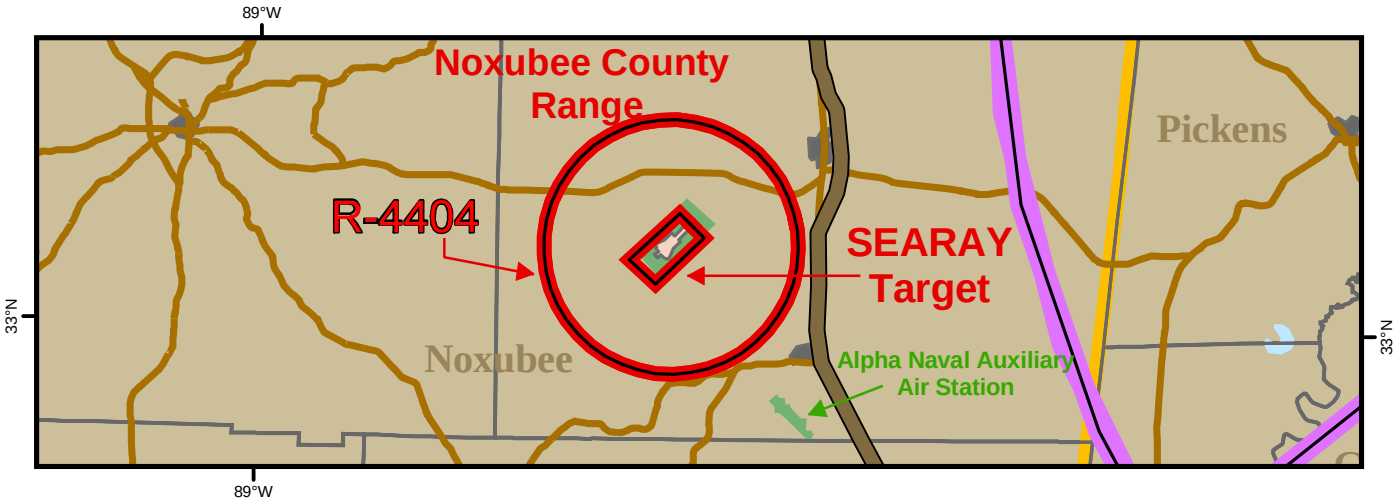
0 2.5 5 10 15 20 25

Nautical Miles

Coordinate System: WGS 1984 UTM Zone 14 (Meters)

Figure 3.11-2

McMullen County Range Yankee Target



Legend

- Primary Roads
- County Boundaries
- SEARAY Target Footprints
- Cities

Special Use Airspace

- Military Operating Areas (MOA)
- Restricted Airspace (R-)
- Military Installations

0 2.5 5 10 15
Nautical Miles

Coordinate System: WGS 1984 UTM Zone 16 (Meters)

Figure 3.11-3

Noxubee County Range SEARAY Target

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Mesquite-huisache-granjeno-retama woodlands include mesquite, huisache, granjeno, retama and other woody plants including South Texas ericameria (*Ericameria austrotexana*) and Roosevelt weed (*Baccharis neglecta*). This community occupies edges of slight depressions and natural levees. These woodlands are successional on former Gulf cordgrass meadows and the herbaceous flora is quite similar.

Yankee Target

Activities associated with past and current land uses (*e.g.*, military use, livestock grazing, and root-plowing) have resulted in substantial surface disturbance at Yankee Target, and dominant vegetation generally consists of weedy species well-suited for invasion of disturbed land. Common plants include honey mesquite (*Prosopis glandulosa*), salt cedar (*Tamarix aphylla*), and rough cocklebur (*Xanthium strumarium*) (TXANG, 1996). Native grasses, and prickly pear are also present. Areas immediately around the targets are generally devoid of vegetation. The main bomb target circle, strafe targets, and firebreaks are plowed for operational and safety purposes. Briscoe Ranch personnel (land owner) root-plow the impact area and the buffer zone. The impact area is off-limits to the public but is open to grazing and access to ranch employees. Root-plowing is used to destroy brush vegetation and allow growth of more productive grasses and forbs for livestock. Root-plowed areas are reseeded with grasses (USAF, 1994).

Noxubee County Range

The impact area at Noxubee County range consists of 442 acres of semi-improved grounds surrounding the target and 212 acre of unimproved grounds. The semi-improved grounds consist of vegetation routinely maintained for operational and safety purposes. Portions of the approach paths, the main target circle, and firebreak roads within the maintained area are kept free of vegetation. A 30-foot firebreak is disked annually around the maintained portion of the impact area. The unimproved grounds within the impact area, the buffer zone, and surrounding areas primarily consist of loblolly pine-hardwood forest (DoN, 2007).

3.11.2.3 Wetlands

McMullen County Range

Dixie Target

The Dixie Target impact area contains no jurisdictional wetlands. While some of the stock ponds may have small clusters of cattails, there have been no indicators of hydric soils discovered within the area. Areas along the Nueces River to the north support marshy vegetation (DoN, 2003).

Yankee Target

A wetlands survey conducted at Yankee Target in July 1994 identified approximately 1.88 acres of wetlands at six sites. The survey included the entire impact area, but only portions of the buffer zone. Four of the wetland areas were in the impact area, including a 1.75-acre area in the northeastern corner along the floodplain of Guadalupe Creek, which is an intermittent stream. Three very small, isolated wetlands totaling 0.013 acres were identified west and northwest of the main target area along an intermittent drainage channel. Two small wetlands totaling 0.12 acres were also identified outside the impact area to the south (TXANG, 1996).

Noxubee County Range

Wetland mapping provided in the NAS Meridian Integrated Natural Resources Management Plan (DoN, 2007) shows five areas totaling approximately 6 acres identified as wetlands in the impact area, three within the maintained portion and two areas in the approach path. No wetlands are located within

the actual target circle. A review of National Wetland Inventory maps (USFWS, 2008a) indicates that forested wetlands occur in portions of the buffer zone.

3.11.2.4 Wildlife

McMullen County Range

Dixie Target

The vegetation communities at Dixie Target provide habitat for a variety of wildlife. McMullen County is within the expected range of about 25 mammals. Common game animals at Dixie Target include white-tailed deer, wild hogs, and javelina. Other mammals common to the area include raccoon, striped skunk, Virginia opossum, coyote, bobcat, nine-banded armadillo, and several species of small rodents (DoN, 2003).

At least 84 bird species are known to be resident, migratory, or transients of the Dixie Target from surveys completed in October 1995. Based on the diversity of the south Texas bird population, it is likely that additional species of birds occur at Dixie Target. Game birds include wild turkey, scaled quail, northern bobwhite, and mourning dove. Nongame birds sighted at Dixie Target include grebes, herons, ducks, vultures, hawks, other raptors, woodpeckers, flycatchers, sparrows, warblers, and others (DoN, 2003).

At least fourteen species of reptiles and amphibians are expected to occur in McMullen County. Reptiles and amphibians observed at Dixie target include one species of newt, three species of frogs, two species of turtles, alligators, one species of gecko, four species of lizards, and two species of snakes. Along the Nueces River border of Dixie Target there is one large pond that maintains enough water to support invertebrates, fish, snakes, as well as a rather large American alligator. Largemouth bass, channel catfish and bluegill sunfish are found in the permanent pond (DoN, 2003).

Portions of the impact area that are kept clear of vegetation for operational and safety purposes, including the target circle where non-explosive practice bombs are dropped, generally lack suitable wildlife habitat. While wildlife are not expected to frequent this area, animals could pass through the area and some species might use the area for basking or dusting.

Yankee Target

Wildlife inventories have not been conducted at Yankee Target. However, the wildlife species that occur at Yankee Target are expected to be similar to those described above for Dixie Target, based on Yankee Target's proximity to Dixie Target (10 miles north). Species richness and abundance is likely lower at Yankee Target compared to Dixie Target based on the disturbed nature of the habitats in the buffer zone. Portions of the impact area that are kept clear of vegetation for operational and safety purposes, including the targets where non-explosive practice bombs are dropped and gunnery ammunition is fired, generally lack suitable wildlife habitat. While wildlife are not expected to frequent this area, animals could pass through the area and some species might use the area for basking or dusting.

Noxubee County Range

The open areas, forests, and wetlands at the Noxubee County Range provide habitat for a variety of wildlife. While the maintenance regime within the impact area likely limits the use of this area by some species, it also creates habitat that may be preferred by other species. Mammals that are expected to commonly occur at the range include white-tailed deer, gray squirrel, fox squirrel, eastern cottontail rabbit, grey fox, and several species of small rodents such as mice, shrews, and voles. Game birds such as wild turkey, northern bobwhite, and mourning dove are expected to occur at the range. A variety of nongame birds are expected to use habitats at the range including songbirds, woodpeckers, and raptors.

Common songbirds include northern cardinal, mockingbird, Carolina chickadee, field sparrow, wood thrush, brown-headed nuthatch, eastern bluebird, and various warblers. Common raptors include Cooper's hawk, red-shouldered hawk, and American kestrel. Bald eagles are known to occur in Noxubee County, but the range lacks suitable open water habitat to support nesting or foraging bald eagles. Therefore, bald eagles are not expected to occur at the range. Occurrence of waterfowl (ducks) and wading birds (herons and egrets) is expected to be limited based on the lack of open water habitat and the limited area of wetlands. Reptiles that could be present include black racers and gray rat snakes. Aquatic life is expected to be limited based on the lack of open water habitat and limited area of wetlands. However, the wetlands could support various invertebrates, aquatic insects, and amphibians (DoN, 2007).

The target circle where non-explosive practice bombs are dropped generally lacks suitable wildlife habitat because this area is kept clear of vegetation for operational and safety purposes. While wildlife are not expected to frequent this area, animals could pass through the area and some species might use the area for basking or dusting.

3.11.2.5 Federally Listed Threatened and Endangered Species

Overview

Federally listed terrestrial species that have the potential to occur at or near the Dixie Target, Yankee Target, Noxubee County Range, and the NSA Panama City Demolition Pond are summarized in Table 3.11-2. Additional information about each species and its potential occurrence at the training areas is provided below.

The American alligator (*Alligator mississippiensis*), which likely occurs at Dixie Target and near the Demolition Pond, was first classifed as endangered throughout its range in 1967 due to concern over poorly regulated or unregulated harvests. Subsequently, the alligator has recovered and is no longer biologically endangered or threatened. It is currently classified as "threatened due to similarity of appearance" to other listed crocodilians. The ESA allows for this classification when a species so closely resembles in appearance an endangered or threatened species that enforcement personnel would have substantial difficulty in differentiating between listed and unlisted species. Although biologists can readily distinguish live alligators from other listed crocodilians, enforcement personnel coiuld have considerable difficulty in making correct species identification, which could hamper enforcement efforts for other listed crocodilians. In addition, small parts and products of processed crocodilian leather are nearly impossible to distinguish when made into goods, this hampering the identification of legal alligator products from those of listed crocodilians. Thus, USFWS regulates the harvest of alligators and legal trade in the animals, their skins, and products made from them, as part of efforts to prevent the illegal take and trafficking of listed crocodilians. ESA Section 7 consultation requirements do not apply to species listed due to similarity of appearance. Therefore, the American alligator is not addressed further.

Piping Plover (*Charadrius melodus*)

Piping plovers are small shorebirds measuring just 7.25 in. in length with a 19-in.wingspan (Sibley, 2000).

Status and Management—In 1985, the piping plover was listed as endangered under the ESA in the Great Lakes watershed region of the U.S and threatened everywhere else it occurs as a result of historic hunting pressure and more modern threats of loss and degradation of habitat (USFWS, 2001; USFWS 2007a). Threats related primarily to human activity include, disturbance by humans, predation, and pressure from development occurring within its habitat.

Three populations of North American piping plovers are recognized: Atlantic, Northern Great Plains, and Great Lakes. All three populations migrate to the Gulf coast in winter. Currently, population trends overall are positive, with slow but steady increases observed in most regions (Elliott-Smith and Haig, 2004; Birdlife International, 2008a)..

TABLE 3.11-2
FEDERALLY LISTED TERRESTRIAL SPECIES THAT HAVE THE POTENTIAL TO OCCUR AT OR NEAR DIXIE TARGET, YANKEE TARGET, NOXUBEE COUNTY RANGE, AND NSA PANAMA CITY DEMOLITION POND

Common Name	Scientific Name	Federal Status	Dixie Target	Yankee Target	Noxubee County Range	Demolition Pond
Birds						
Piping plover	*Charadrius melodus*	LT	Not expected	Not expected	Not expected	May occur
Wood stork	*Mycteria americana*	LE	Not expected[(4)]	Not expected[(4)]	Not expected	May occur
Brown pelican	*Pelecanus occidentalis*	LE[(1)]	Not expected	Not expected	Not expected	Not expected[(5)]
Whooping crane	*Grus americana*	LE[(2)]	Not expected	Not expected	Not expected	Not expected
Red-cockaded woodpecker	*Picoides borealis*	LE	Not expected	Not expected	May occur	Not expected
Interior least tern	*Sternula antillarum athalassos*	LE[(3)]	May occur	May occur	Not expected	Not expected
Mammals						
Ocelot	*Leopardus (=Felis) pardalis albescens*	LE	May occur	May occur	Not expected	Not expected
Choctawhatchee beach mouse	*Peromyscus polionotus allophrys*	LE	Not expected	Not expected	Not expected	Not expected
Reptiles						
Eastern indigo snake	*Drymarchon corais couperi*	LT	Not expected	Not expected	Not expected	May occur

LT = listed as threatened, LE = listed as endangered

(1) Listed as endangered everywhere except along the U.S. Atlantic coast, FL, and AL.

(2) Listed as endangered except in experimental populations, which excludes populations in FL, LA, MS, AL, and TN. Texas population is listed.

(3) Listed as endangered in AR, CO, IA, IL, IN, KS, KY, LA (Mississippi River and tributaries N of Baton Rouge), MS (Mississippi River), MO, MT, ND, NE, NM, OK, SD, TN, and TX (except within 50 miles of coast).

(4) Wood storks that may occur at Dixie and Yankee Targets are most likely migrants from eastern Mexico and Central America rather than part of the U.S. breeding population, which tends to disperse mainly within Florida and to the northeast. The migrants from Mexico and Central America are not part of the federally listed U.S. breeding population.

(5) The Brown pelican may occur at the Demolition Pond, but this species is not listed in Florida. This species is addressed in Section 3.10 – Seabirds and Migratory Birds.

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In the Gulf coast states, over 1,284 km of shoreline and over 51,000 hectacres (ha) of land area are designated as critical wintering habitat for wintering piping plovers. In Bay County, Florida, both the Shell and Crooked islands support critical habitat for the plovers. The area designated is over 1,750 ha of habitat and occurs primarily in two areas: Tyndall Air Force base and St. Andrews State Recreation Area (USFWS, 2001). The Demolition Pond area is not designated as critical habitat.

Habitat—The piping plover is a shorebird that inhabits coastal sandy beaches and mudflats. Depending on the season (breeding, non-breeding, or migration) and the location of the population (coastal or interior) the plovers may be found in a variety of habitats (Nicholls and Baldassarre, 1990; Elliott-Smith and Haig, 2004). Only non-breeding wintering birds would be found in or near the GOMEX Range Complex. Winter habitat consists generally of sandy beaches, mudflats, and sandflats along the Gulf and Atlantic coasts. They are often found in bays, inlets, and lagoons as well as on beaches associated with barrier islands and spoil islands in the Gulf. Birds wintering at South Padres Island, Texas have shown a preference for shorelines along bays over Gulf coasts shorelines. Drake *et al.* (2001) observed that piping plovers wintering in the region prefer the sandflats and algal flats on bay shores 59 and 30 percent of the time, respectively. Other habitats, such as mudflats, island washover areas, and dredge placement areas were also utilized; Gulf coast beaches were not utilized in winter; although, some plovers do venture onto ocean beaches during fall and spring (Drake *et al.*, 2001; Elliott-Smith and Haig, 2004). Overall, 92 percent of observations in the 2001 winter census occurred in the following habitats: mudflats, sandy beaches, and sand/salt flats (Elliott-Smith and Haig, 2004; Haig *et al.*, 2005).

Distribution—During summer, breeding populations are centered around the Great Lakes (*i.e.*, Michigan, Superior, and Huron), along the Atlantic coast from as far north as Newfoundland south to northern North Carolina, and across the Great Plains including parts of central and southern Alberta, Saskatchewan, and Manitoba in Canada and parts of Montana, Minnesota, the Dakotas, Nebraska, and Colorado (Sibley, 2000; Haig *et al.*, 2005). During winter, piping plovers are found primarily along the Atlantic and Gulf coasts from North Carolina to Texas (and into Mexico). The majority of birds wintering along the U.S. Gulf coast are found in Texas. Of the nearly 2,400 birds observed in the 2001 census, 44 percent were found in Texas, including 25 percent on South Padre Island (Haig *et al.*, 2005). The census results do suggest that the distribution of wintering piping plovers has not been completely surveyed, given that the number of birds counted in winter represents only about 40 percent of the breeding population (Haig *et al.*, 2005).

GOMEX Range Complex Piping Plover Occurrence—Piping plovers are not expected to occur at Dixie Target, Yankee Target, or Noxubee County Range based on their known range and habitat requirements. Piping plovers occur along the entire Gulf coast during their non-breeding (winter) season which extends approximately from September to mid April; although, the timing may vary somewhat. This species was not observed at NSA Panama City during surveys conducted in 2001 and 2002 (NCSS, 2002). The Florida Natural Areas Inventory (FNAI) Biodiversity Matrix has no records of documented occurrences for the piping plover in the immediate vicinity of the Demolition Pond, but indicates that this species has potential to occur in the area. While the piping plover has not been documented at the demolition pond, suitable foraging habitat exists along the shoreline in this area. Therefore, the piping plover may occur at the Demolition Pond.

Whooping Crane (*Grus americana*)

Whooping cranes are the tallest North American birds standing at 52 in. Mature birds have a wingspan of 87 in. (Sibley, 2000; National Geographic, 2001).

Status and Management—The whooping crane was listed as "threatened with extinction" in 1967, and then as endangered in 1970; both listings resulted in the species' being listed as endangered under the

ESA in 1973 (CWS and USFWS, 2007). In 1978, the whooping crane was listed as endangered in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The recovery of the whooping crane is jointly managed by the U.S. and Canada, because the only naturally occurring population breeds in northern Canada and winters in the U.S. along the Texas coast (CWS and USFWS, 2007). A species review by COSEWIC in 2000 sustained the whooping crane's status as endangered, and in 2003 the species was listed as endangered (in Canada) under the Species at Risk Act (SARA) (CWS and USFWS, 2007). Protective legislation, including the Migratory Bird Treaty Act, the National Parks Act, and the ESA in the U.S., and the Migratory Birds Convention Act, the Canada Wildlife Act, and the SARA in Canada, has been very important to recovery efforts for this species.

Under the ESA, critical habitat has been designated at four sites along the whooping crane's migratory route: Cheyenne Bottoms State Waterfowl Management Area (SWMA) and Quivira National Wildlife Refuge (NWR), both located in Kansas; the Platte River bottoms between Lexington and Denman, Nebraska; and Salt Plains NWR, Oklahoma. The whooping crane's winter range in the Aransas NWR (ANWR), located along the Gulf Coast of Texas, has also been designated as critical habitat (CWS and USFWS, 2007). In Canada, critical habitat is designated through a species specific SARA Recovery Strategy or Action Plan. Breeding grounds for the whooping crane in the Wood Buffalo National Park (WBNP) are protected as potential critical habitat as are several staging areas along the crane's migratory route in Saskatchewan. Most of these areas are also protected under other Canadian Acts, and the designation of critical habitat is apparently somewhat redundant (CWS and USFWS, 2007).

Three distinct wild populations are recognized: the Aransas Wood Buffalo Population (AWBP), the Florida Population (FP), and the Eastern Migratory Population (EMP). A fourth population, the Rocky Mountain Population, ceased to exist in 2002 (CWS and USFWS, 2007). The EMP and the FP are considered non-essential, experimental populations by the USFWS and are not protected under the ESA. In 2006, the worldwide population of wild whooping cranes was estimated 343 individuals, including 313 adults and 30 young. Sixty-four percent of the total population (190 adults and 30 young) belonged to the AWBP, which is the only self-sustaining, wild population and the only population to receive protection under the ESA (CWS and USFWS, 2007; USFWS, 2007b). In 2007, the total population was estimated at 382, and a record number of individuals (261), including 73 breeding pairs and 40 chicks, made the fall migration to Texas (BirdLife International, 2008b, 2008c). Additionally, 135 individuals (22 in Canada and 113 in the U.S.) are being raised in captivity. The young produced from captive breeding programs are introduced into the FP and EMP wild flocks in an effort to increase those populations and to foster a more robust overall population (CWS and USFWS, 2007).

Habitat—Breeding habitat for whooping cranes generally consists of semi permanent or permanent wetlands such as small shallow lakes and ponds separated by low ridges or hills.

More specifically, whooping cranes prefer to breed in boreal, freshwater marshes dominated by bulrush (*Scirpus validus*); cattail (*Typha latifolia*), and aquatic macrophytes; and marshes mixed with cattail, various shrubs, and water sedge (*Carex aquatilis*) (Timoney, 1999). Vegetation on the upland ridges often includes white spruce (*Picea alauca*), black spruce (*P. mariana*), tamarack (*Larix laricina*), willows (*Salix* spp.), and an under story of dwarf birch (*Betula glandulosa*), Labrador tea (*Ledum groenlandicum*), and bearberry (*Arctosta phylos uva-ursi*) (CWS and USFWS, 2007).

During migration, whooping cranes forage in a variety of wetland habitats, including seasonally flooded croplands, palustrine and lacustrine wetlands, and, particularly in Nebraska, riverine habitat (Austin and Richert, 2001). They roost primarily in palustrine wetlands that are typically not more than 1 km from a suitable foraging area (CWS and USFWS, 2007). The principal wintering grounds are located along the Texas coast and on nearby islands consisting of salt flats and marsh habitat. The vegetation in the marshes is dominated by salt grass (*Distichlis spicata*), saltwort (*Batis maritima*), smooth cordgrass

(*Spartina alterniflora*), glasswort (*Salicornia* sp.), and sea ox-eye (*Borrichia frutescens*). Farther inland, along the margins of the salt flats, Gulf cordgrass (*Spartina spartinae*) becomes more prevalent. Whooping cranes have been observed foraging in upland regions of their wintering grounds, which are characterized as grassland or oak savannah (CWS and USFWS, 2007).

Distribution—The worldwide distribution of wild whooping cranes is limited to a geographically small area in North America. Nearly all of the whooping cranes in the AWBP—the largest and the only self-sustaining population—migrate to summer breeding grounds in the WBNP, which spans portions of the Northwest Territories and the Province of Alberta in northern Canada. Six breeding sites have been identified in the WBNP lying west of the Little Buffalo River and along the shores of the Nyarling, Klewi, and Sass rivers: 1) North Nyarling nesting area, 2) Nyarling nesting area, 3) Klewi nesting area, 4) Sass nesting area, 5) Alberta nesting area, and 6) Lobstick nesting area (CWS and USFWS, 2007).

During fall and spring, whooping cranes migrate between their breeding grounds in Canada and their wintering grounds along the Texas coast. The spring migrating begins in March or early April and, on average, last for approximately one month. The fall migration begins in September with most birds arriving along the Texas coast before November (Austin and Richert, 2001). Several staging and stopover areas along the 2,500 km flyway are utilized by the birds for roosting and foraging as they migrate (WCCA, 2006). Areas where migrating whooping cranes have been consistently observed include Cheyenne Bottoms SWMA and Quivira NWR, both in Kansas; the Platte River bottoms, Nebraska; Salt Plains NWR, Oklahoma; and Last Mountain Lake NWA in Saskatchewan, Canada. The cranes have also been observed in Montana eastern Colorado, western Missouri, and in central Texas along the narrow flyway that defines their migratory route (Austin and Richert, 2001).

During winter, whooping cranes are found in and around the ANWR located along the Texas coast. Outside of the refuge, whooping cranes are observed on nearby islands in the Gulf including Matagorda Island and San Jose Island.

GOMEX Range Complex Whooping Crane Occurrence—The whooping crane only occurs in the vicinity of the Dixie and Yankee Targets during the non-breeding season, which extends approximately from mid October through mid March. Occurrence of whooping cranes Dixie and Yankee Targets has not been documented (DoN, 2003; Natureserve, 2008); however, the Texas Parks and Wildlife Department (TPWD) lists the species as potentially occurring in McMullen County (TPWD, 2007). The potential for occurrence as a migratory transient at Dixie and Yankee Targets exists due to the proximity of the ranges to the known migratory flyway, which is more than 75 miles northeast of the targets. However, occurrence of this species is considered unlikely at Dixie and Yankee Targets. Whooping cranes have not been documented as occurring in Noxubee County and would not be expected to occur at the Noxubee County Range (MMNS, 2008).

Critical habitat has been designated in the vicinity of the ANWR located along the Gulf of Mexixco shoreline about 75 miles northeast of Dixie and Yankee targets.

Two experimental, non-essential populations of whooping cranes occur in Florida. The FP resides year-round in central Florida, and the EMP winters in the Chassahowitzka NWR in western Florida. Neither population receives protection under the ESA because of their non-essential status.

Wood Stork (*Mycteria americana*)

Wood storks are large, long-legged, wading birds, standing up to 42 in. tall, with a wingspan of 60 to 65 in. (Sibley, 2000).

Status and Management—The U.S. breeding population of wood storks was first listed as endangered under the ESA in 1984 (USFWS, 1984). At that time, breeding populations were known to occur in

Florida, Georgia, South Carolina, and Alabama. Population declines in southern Florida were attributed to changes in water resource management practices, particularly in the Everglades, which resulted in dramatic changes to the wood storks foraging and breeding habitat (Coulter *et al.*, 1987; Coulter *et al.*, 1999). Data summarized in the 2007 5-yerr review by the USFWS indicate that wood stork populations in the southeast U.S. are increasing (USFWS, 2007c). The number of breeding pairs occurring in the southeast U.S. increased from 6,245 in 1984 to 11,279 in 2006. Additionally, the number of breeding colonies has increased from 29 in 1984 to 82 in 2006 (USFWS, 2007d). Given these significant increases, the USFWS has recommended reclassifying the status of the wood stork from endangered to threatened. The review also noted that the breeding population of the wood stork has expanded to the north to include previously utilized areas of Georgia and South Carolina as well as areas in North Carolina. No critical habitat has been designated for the wood stork.

Habitat—Wood storks primarily inhabit freshwater and brackish wetlands, including marshes, swamps, lagoons, ponds, and flooded fields in warm tropical to subtropical climates. During the summer breeding season, wood storks are concentrated in suitable nesting habitat which includes areas with cypress trees, mangroves, or dead hardwoods situated over water, on islands, along streams, or adjacent to shallow lakes (Rodgers, 1996; Coulter *et al.*, 1999).

Foraging habitat is similar to breeding habitat, and consists mainly of shallow wetlands (<50 cm in depth), including flooded fields. Areas with falling water levels are particularly attractive to wood storks because their prey becomes more highly concentrated as water levels decrease (Coulter *et al.*, 1999; NatureServe, 2007). Wintering habitat is similar to breeding and foraging habitat, but may include a greater variety of suitable, shallow wetlands, such as abandoned rice fields (South Carolina) or canals (southern Florida), as birds disperse from breeding grounds (Coulter *et al.*, 1999).

Distribution—Wood storks can be found in tropical and subtropical zones with distinct wet and dry seasons. In the U.S., regular breeding populations occur in Florida, Georgia, and South Carolina. In 2005, a nesting colony was documented in Columbus County, North Carolina, indicating that wood storks continue to expand their breeding range northward (USFWS 2007c). In Florida, wood storks are distributed year-round throughout 23 counties including from Monroe and Dade counties north locally along both the Atlantic and Gulf coasts and in Leon County on the Florida panhandle (Coulter *et al.*, 1999; Sibley, 2000). Birds from the U.S. breeding population have been cited along the Gulf coast as far west as Alabama and Mississippi (USFWS, 1997).

During the non-breeding season wood storks disperse and wander beyond their breeding range along the coastal plain to North Carolina and along the entire Gulf coast (Coulter *et al.*, 1999; Sibley, 2000; National Geographic, 2001; NatureServe, 2007). Wood storks that breed in Florida migrate into northern Florida, South Carolina, and Georgia beginning in May. The dispersal period when birds leave their breeding grounds begins anywhere from May to July and lasts until October, with the more northerly breeders dispersing later. The wood storks wintering period extends from November through March (Coulter *et al.*, 1999). Although some wood storks may wander far from their breeding grounds, others may only migrate a short distance and then return to winter at or near their breeding grounds (Comer *et al.*, 1987; Coulter *et al.*, 1999). Wintering wood storks observed along the Gulf coast west of Mississippi are thought have migrated north from Mexico and Central America, and are likely not part of the endangered U.S. breeding population (Coulter *et al.*, 1999; NatureServe, 2007). Vagrant sightings occur throughout the southeastern U.S. beyond their winter range including the Atlantic coastline to eastern Canada and west to northern California, Idaho, and Montana (USFWS, 1997; Coulter *et al.*, 1999; Sibley, 2000).

GOMEX Range Complex Wood Stork Occurrence—Wood storks occur locally along the entire Gulf coast during their non-breeding season which begins as early as May and extends into March, depending

on the location of the breeding colony (Coulter *et al.*, 1999). Wood storks observed along the Texas and Louisiana coasts, and those that may be observed at Dixie and Yankee Targets are most likely migrants from eastern Mexico and Central America rather than part of the U.S. breeding population, which tends to disperse mainly within Florida and to the northeast. The migrants from Mexico and Central America are not part of the federally listed U.S. breeding population (USFWS, 1997; DoN, 2003). Therefore, wood storks that may occur at or near Dixie and Yankee Targets are not addressed in further detail.

Wood storks have not been documented as occurring in Noxubee County, Mississippi (MMNS, 2008). Therefore, this species is not expected to occur at the Noxubee County Range and is not addressed in further detail for this range.

While records exist for the wood stork in Bay County, Florida, this species was not observed at NSA Panama City during surveys conducted in 2001 and 2002 (NCSS, 2002). The FNAI Biodiversity Matrix has no records of documented occurrences for species in the immediate vicinity of the Demolition Pond and does not indicate that this species has potential to occur the immediate area. The wood stork may occur at the Demolition Pond as transient or foraging individuals.

Red-cockaded Woodpecker (*Picoides borealis*)

The red-cockaded woodpecker is a small woodpecker, measuring 8.5 in. long with a 14-in. wingspan (Sibley, 2000). This species of woodpecker engages in a cooperative breeding system, where small groups of birds, referred to as clans, are formed with a single breeding pair and up to four helpers who incubate eggs, feed nestlings and fledglings, and defend the clan's territory (NatureServe, 2007). The mating pairs are monogamous, though once a male attains breeding status in a clan it retains the position until death. Clans maintain territories throughout the year and appear to recognize precise boundaries. Their main source of nutrition is insects, though they also feed on small amounts of berries. They use their bill and feet to pry off pieces of bark and expose the insects they feed on (USFWS, 2007e; NatureServe, 2007).

Status and Management—The red-cockaded woodpecker was listed as endangered under the ESA in 1970. Quantity and quality of suitable habitat for this species are much reduced and still declining. There has been a population decline of about 97 percent over the last century. Short-term rotation timber management has eliminated mature diseased pines (*e.g.*, longleaf pine [*Pinus palustris*]) preferred for roosting, nesting, and foraging; fire suppression has allowed invasion of pine stands by hardwoods (Jackson, 1994). However, recent management innovations have alleviated threats and resulted in population increases in some areas (NatureServe, 2007).

Management focuses on maintaining old-growth pine forests and establishing an effective prescribed burning program. Burns conducted in spring and summer are most effective in controlling hardwood encroachment. Maintenance of existing nesting/roosting cavities is best accomplished by eliminating hardwoods in the vicinity of cavities, protecting trees against infestation by southern bark beetles (*Dendroctonus frontalis*), ensuring that old-growth conditions persist near cavity trees, and placing restrictor plates over cavities. Expanding the number of active cavities can be accomplished by creating artificial cavities (NatureServe, 2007). Critical habitat for the red-cockaded woodpecker has not been designated.

Habitat—Red-cockaded woodpeckers inhabit open, mature pine woodlands. Optimal habitat is characterized as a broad savanna with a scattered overstory of large pines and a dense groundcover containing a diversity of grass, forb, and shrub species (USFWS, 2007e). Midstory vegetation is sparse or absent. This habitat is characterized by low intensity fires, which historically occurred during the growing season at intervals of about 1-10 yr. Therefore, fire suppression can have a detrimental impact on red-cockaded woodpecker populations. Landscape features, such as fragmentation of foraging

habitat, total area of foraging habitat, percentage of pinewood or hardwood cover, contiguity of the canopy and forest cover, and habitat patch size and shape may affect the habitat quality (NatureServe, 2007).

Distribution—Historically, the range of the red-cockaded woodpecker extended from Texas east to the Atlantic Ocean, stretching down peninsular Florida, and up the coast to Virginia. However, it is now believed to be virtually extirpated north of North Carolina and from all interior states except for Arkansas. The population is largely fragmented with the largest population segments occurring in Florida. Estimates indicate that those populations have increased by 20 percent since 1990 (USFWS, 2007f). This species exists in the same range year-round (Jackson, 1994; Sibley, 2000).

GOMEX Range Complex Red-cockaded Woodpecker Occurrence—McMullen County, Texas is outside the red-cockaded woodpecker's known range. Therefore, this species is not expected to occur at Dixie Target or Yankee Target, and is not addressed in further detail for these areas.

A red-cockaded woodpecker colony was known to exist in Noxubee County, Mississippi next to Navy property at Noxubee County Range. The colony is no longer active and the stand where the colony occurred has been clearcut (DoN, 2007). Based on the prior existence of a colony in the area and the abundance of surrounding loblolly pine-hardwood habitat, the potential exists for red-cockaded woodpeckers to occur in the area. The impact area at Noxubee County Range is maintained and does not contain forest vegetation or suitable habitat for the red-cockaded woodpecker. This species is not expected to occur in the impact area, but may occur in forested portions of the broader Noxubee County Range Study Area.

While records exist for the red-cockaded woodpecker in Bay County, Florida, this species was not observed at NSA Panama City during surveys conducted in 2001 and 2002 (NCSS, 2002). The FNAI Biodiversity Matrix has no records of documented occurrences for the red-cockaded woodpecker in the immediate vicinity of the Demolition Pond, but indicates that this species has potential to occur in the area. Keppner and Keppner (2005) noted that the red-cockaded woodpecker occupied suitable habitat in Bay County in the not too distant past, but to their knowledge, the only currently known, active colony of this species is on the Bureau of Land Management's Lathrop Tract on Raffield Island in East Bay, which is about 20 miles southeast of the Demolition Pond. These researchers conducted the bird surveys at NSA Panama City in 2001 and 2002 (NCSS, 2002). Approximately 200 acres at NSA Panama City consists of pine and pine-hardwood forest, but the forest is highly fragmented and most is classified as poletimber (trees about 4 to 10 inches in diameter) (DoN, 2000). The installation generally lacks the open, mature pine woodlands that provide optimal habitat for the red-cockaded woodpecker. Based on the information presented above, the red-cockaded woodpecker is not expected to occur at NSA Panama City or the Demolition Pond. This species is not addressed in further detail for the Demolition Pond.

Interior Least Tern (*Sternula antillarum athalassos*)

The interior least tern (*Sternula antillarum athalossos*) is one of three subspecies of the least tern (*Sternula antillarum*). Least terns (all recognized subspecies and populations) are the smallest of the North American terns measuring 21 to 23 cm in length with a wingspan of approximately 48 to 53 cm (Thompson *et al.*, 1997).

Status and Management— The interior least tern was listed as endangered in 1985 (USFWS, 1985a). Historical catalysts for the species decline were dam and reservoir construction, channelization of waterways, and irrigation in the major river systems of the Midwest that altered hydrologic patterns and eliminated much of the tern's natural nesting habitat (Campbell, 1995). Other threats (both past and present) to the interior least tern population include high recreational use of rivers, water pollution, and

pesticide runoff contributing to degradation of nesting habitat. Critical habitat for the interior least tern has not been designated.

Habitat—Interior least tern populations nest mainly on riverine sandbars or salt flats that become exposed during periods of low water. They have also been known to occur on dike field sandbar islands, sand and gravel pits, and lake and reservoir shorelines. This species has also adapted to nesting in human-modified areas including agricultural fields, parking lots, bare land at airports, and gravel rooftops (Thompson *et al.*, 1997). Little is known regarding habitat characteristics of preferred feeding areas for interior least terns. Foraging typically occurs close to the nesting colonies and may occur in both shallow and deep water areas in main river channels or backwater lakes and overflow areas (Rumancik, 1999). Foraging distances can increase depending upon prey availability.

Distribution—Historically, the interior least tern breeding range extended from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana and Louisiana (USFWS, 1985a). They occurred in the following river systems: Red, Missouri, Arkansas, Mississippi, Ohio, Platte and Rio Grande River (Sidle and Harrison, 1990; Rumancik, 1999). Breeding continues in the historical river systems in spring and summer, but distribution within these systems is now restricted to river segments that are less altered (Sidle and Harrison, 1990). Interior least tern wintering areas are not precisely defined; however, least terns of unknown populations are found along the Central American coast and the northern coast of South America from Venezuela to northeastern Brazil (Sidle and Harrison, 1990).

GOMEX Range Complex Interior Least Tern Occurrence—Interior least terns nest, roost, and loaf primarily on riverine sand bars and salt flats. During the breeding season (approximately May to July) they are extremely unlikely to be encountered at Dixie Target, Yankee Target, or Noxubee County Range, or the Demolition Pond. Least terns present in the Gulf of Mexico coastal areas during this period are of the eastern least tern subspecies (*S. a. antillarum*) and are not part of the federally listed U.S. interior population. Likewise, interior least terns are not expected to winter in the GOMEX Range Complex. Interior least terns occur as migratory transients at Dixie Target and Yankee Target in the early fall (~July to October) or spring (~February to April).

Ocelot (*Leopardus pardalis albescens*)

The ocelot is a medium-sized, spotted cat similar in size to the bobcat (*Lynx rufus*), measuring about 30 to 41 in. in length and weighing from 15-20 lb (Campbell, 1995).

Status and Management—The ocelot was federally listed as endangered in 1972 and should have gained federal protection with the passage of the ESA in 1973. However, due to an oversight, only the foreign population was listed at that time and the U.S. ocelot population was not officially listed as endangered until 1982 (USFWS, 1982a). The ocelot subspecies potentially occurring in the GOMEX Range Complex is *L. p. albescens*.

The primary threat to the ocelot population is habitat loss and fragmentation. Historically, the South Texas Plains supported grassland or savannah type communities characterized by dense mixed brush along dry washes and floodplains of the Rio Grande (Campbell, 1995). Development over the past 60 years has converted much of this extensive habitat in the Lower Rio Grande Valley to agricultural and urban uses. It is estimated that less than 5 percent of the original vegetation remains (Campbell, 1995). Other threats include exploitation by the fur and pet trades, and predator control activities. Road mortality is also a more recent development contributing to population declines. Approximately half of all ocelot mortality documented in the past 20 years has been a result of road mortality (Campbell, 1995).

Global population size of the species is unknown. Fewer than 1,000 individuals of subspecies *albescens* (Texas and adjacent northeastern Mexico to southern Tamaulipas) are thought to survive (NatureServe,

2008). The south Texas ocelot population is estimated at 80 to120 individuals, with approximately 30 to 35 individuals living in the remaining chaparral habitat at or near the Laguna Atascosa National Wildlife Refuge (USFWS, 1990). No critical habitat has been designated for the ocelot.

Habitat—Ocelots in Texas occur in the dense thornscrub habitat of the Lower Rio Grande Valley and Rio Grande Plains (USFWS, 1990) of the Tamaulipan Biotic Province. Typical brush species in this habitat include spiny hackberry, brasil, desert yaupon (*Schaefferia cuneifolia*), wolfberry (*Lycium spp.),* lotebush, amargosa, whitebrush, catclaw (*Acacia greggii),* blackbrush (*A. rigidula*), lantana (*Lantana spp*.), guayacan (*Guajacum argustifolium*), cenizo (*Tetrazygia spp*.), elbowbush (*Forestiera spp*.), and Texas persimmon (*Diospyros texana*). Interspersed trees such as honey mesquite (*Prosopis glandulosa*), live oak (*Quercus virginiana*), Texas ebony, and hackberry may also occur (USFWS, 1990).

Ocelots have been found in four habitat types in the Lower Rio Grande Valley. These include: Mesquite-Granjeno Parks, Mesquite-Blackbrush Brush, Live Oak Woods/Parks, and Rio Grande Riparian (USFWS, 1990). Canopy cover and shrub density are important habitat components in identifying ocelot habitat. Optimal habitat consists of 95 percent or greater canopy cover of the shrub layer, with marginal habitat consisting of 75 to 95 pecent canopy cover. Less than 75 percent shrub canopy cover is considered inadequate ocelot habitat (Tewes and Everett, 1986).

Tracts of at least 100 acres of isolated dense brush, or at least 75 arces of brush habitat interconnected by brush corridors are considered very important. Roads, narrow water bodies, and rights-of-way are not considered barriers to movement. Smaller brush tracts (as small as 5 arces) may even be utilized when adjacent to larger areas of habitat (Campbell, 1995). Only about 1 percent of the South Texas area supports what is currently defined as optimal habitat. The amount of habitat available to ocelots in the Lower Rio Grande Valley is estimated to be less than 20,000 ha (49,400 acres [ac]), with the largest block of thorn forest (3,352 ha/8,280 ac) located in the Laguna Atascosa NWR (USFWS, 1990). They den within suitable habitat areas is a cave in a rocky bluff, a hollow tree, or the densest part of a thorny thicket, or the spaces between the closed buttress roots of large trees.

Distribution—Ocelots are widely distributed from southern Texas and Arizona to South America. Two ocelot subspecies are found in the U.S., the Texas ocelot (*Felis pardalis albescens*) and the Sonoran ocelot (*F.p. sonoriensis*). The two populations are isolated from each other by the Sierra Madre highlands (USFWS, 1990). The Sonoran ocelot historically ranged from the foothills of the Sierra Madre Occidental through Sonora and into southeastern Arizona (USFWS, 1990). The Texas ocelot historically occurred throughout south Texas, the southern Edward's Plateau Region, and along the Coastal Plain. Current Texas counties that are known to contain ocelot occupied habitat are Cameron, Duval, Hidalgo, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio, Starr, Willacy, and Zapata (USFWS, 1990; NatureServe 2008). Ocelots can occur in suitable habitat areas year-round.

GOMEX Range Complex Ocelot Occurrence—The potential for ocelot occurrence within the GOMEX Range Complex exists only in Dixie and Yankee Targets. Previous biological surveys have been conducted for NAS Kingsville, NALF Orange Grove, and the McMullen County Range in an effort to determine the presence of endangered or threatened species or appropriate habitat (DoN, 2003). Texas A&M University conducted surveys for the presence of ocelot and jaguarundi (due to similar habitat preference) for NAS Kingsville properties in 1986. This investigation revealed that, while portions of the the McMullen County Range had the vegetation preferred by these species of cats, their presence was not confirmed, and the likelihood that these cats are found on or near either installation is remote (DoN, 2003). However, due to the fact that the biological surveys are dated and ocelot occupied habitat exists within McMullen County, this species may occur at Dixie and Yankee Targets.

Choctawhatchee Beach Mouse (*Peromyscus polionotus allophrys*)

The Choctawhatchee beach mouse (*Peromyscus polionotus allophrys*) is one of five subspecies of the oldfield mouse (*P. polionotus*) that inhabit coastal dune communities along the Gulf coast of Florida and Alabama (USFWS, 2005).

Status and Management—The Choctawhatchee beach mouse was federally listed as endangered in 1985 (USFWS, 1985b). The Choctawhatchee beach mouse is endemic to Florida and was once present in more or less continuous populations along the coastal dunes between the entrances to Choctawhatchee and St. Andrew Bay (Holler, 1992). Presently, it persists in only a few isolated populations at Topsail Hill Preserve State Park, Shell Island/West Crooked Island, Grayton Beach State Park, and Deer Lake State Park, as well as on adjacent privately owned lands (USFWS, 2007g).

Critical habitat for the Choctawhatchee beach mouse was originally designated in 1985, but has undergone subsequent revisions. In October 2006, the final rule was published designating 973 hectares of critical habitat in shoreline areas along the Gulf coast for the remaining Choctawhatchee beach mouse populations (USFWS, 2006). Choctawhatchee beach mouse critical habitat consists of five units in coastal areas extending from Henderson Beach State Park eastward along the coastline to just east of the entrance channel of St. Andrews Bay. The Demolition Pond is not located within critical habitat for this species.

Habitat—Typical beach mouse habitat generally consists of several rows of sand dunes paralleling the shoreline. Sand dune habitat is characterized by primary dunes (characterized by sea oats [*Uniola paniculata*] and other grasses), secondary dunes (similar to primary dunes but frequently include plants such as woody goldenrod [*Chrysoma pauciflosculosa*] and false rosemary [*Conradina canescens*]), and interior or scrub dunes (often dominated by scrub oaks [*Quercus geminate*] and yaupon holly [*Ilex vomitoria*]) (USFWS, 2005). Recent research has determined that scrub habitat, once considered to be of lesser importance or preference by beach mice, actually serves a very important role in beach mouse population. Food availability in scrub habitat is more stable than seasonally abundant resources in primary and secondary dune habitats. Therefore, scrub habitat food resources become crucial when food is scarce or non existent in primary and secondary dunes, whether as a result of seasonality or severe weather events such as hurricanes. Scrub dune habitat also provides a higher elevation refuge during storm events and alternative habitat when primary and secondary dune habitats are destroyed or recovering (USFWS, 2005).

Distribution—The Choctawhatchee beach mouse historically ranged from Destin Pass, Choctawhatchee Bay in Okaloosa County, eastward along the coast to East Pass in St. Andrew Bay, Bay County, Florida (USFWS, 1985b). They were considered widespread and abundant in the 1950's, but residential and commercial coastal development caused significant habitat loss and fragmentation in coastal areas and Choctawhatchee beach mice were soon reduced in distribution to a portion of their historical range (Holler, 1992). By 1979, the Choctawhatchee beach mouse had been extirpated from seven of nine historic localities and only 40 percent of its original habitat remained (Humphrey and Barbour, 1981). As noted above, only four remaining populations of the Choctawhatchee beach mouse exist in Florida.

GOMEX Range Complex Choctawhatchee Beach Mouse Occurrence—Dixie Target, Yankee Target, and Noxubee County Range are located outside the range of the Choctawhatchee beach mouse. Therefore, this species is not expected to occur at these locations. The existing populations of the Choctawhatchee beach mouse and its designated critical habitat occur in the general vicinity of the Demolition Pond. However, this species is not expected to occur at or near the Demolition Pond because suitable coastal dune habitat is not present. The Choctawhatchee beach mouse is not addressed in further detail.

Eastern Indigo Snake (*Drymarchon corais couperi*)

The Eastern indigo snake (*Drymarchon corais couperi*) is the longest North American snake with a maximum recorded length of 2.63 m (Moler, 1992).

Status and Management—The Eastern indigo snake was federally listed as endangered in 1978 (USFWS, 1978). The primary impetus for listing was due to population declines brought on by collection for the pet trade. Although significant mortality was also a result of 'gassing' of gopher tortoise burrows used to collect rattlesnakes (Moler, 1992). Due to the difficulties of observing and capturing indigo snakes, and large territory size, population trend data is unknown. The primary threat currently facing the eastern indigo snake is habitat loss. Human population growth and development within the species range continues to significantly reduce available native habitat. No critical habitat has been designated by the USFWS for the eastern indigo snake (USFWS, 2008b).

Habitat—The Eastern indigo snake is found in a broad range of habitat types including pine flatwoods, scrub flatwoods, high pine, dry prairie, tropical hardwood hammocks, freshwater marsh edges, agricultural fields, coastal dunes, and human altered habitats (USFWS, 1982b). In peninsular Florida, the indigo snake may be found in mangrove swamps, wet prairies, xeric pinelands, or scrub habitats (Moler 1992). In the northern parts of its range, it forages in more hydric habitats during the warmer months (Hipes *et al*,. 2001). Below ground shelter is an important habitat component for thermoregulation utilized by indigo snakes year round. In Georgia and northern Florida, indigo snakes rely on xeric sandhill habitat primarily due to the availability of gopher tortoise burrows during the winter (USFWS, 2008c).

Distribution—Historically, the Eastern indigo snake occurred throughout Florida, and in the coastal plain of Georgia, Alabama, and Mississippi (USFWS 2008c). Because the most recent sightings (confirmed and unconfirmed) or museum specimens date back to the 1950s and 1960s in Alabama, Mississippi, and South Carolina, it is believed that populations no longer exist in those states (USFWS, 2008c). The only current, viable populations of the Eastern indigo snake occur in Georgia and Florida (USFWS, 2008c).

The Florida distribution of Eastern indigo snakes occurs throughout the entire state; however, in the Florida panhandle they persist in lower numbers (USFWS, 2008c). Eastern indigo snake populations are known to occur on public lands in the Florida panhandle at Allen Mill Pond Conservation Area, Appalachicola National Forest, Blackwater River State Forest, Eglin Air Force Base, Lafayette Blue Springs State Park, Middle Aucilla Conservation Area, Troy Springs Conservation Area, Twin Rivers State Forest, and Withlacoochee West Conservation Area (USFWS, 2008c). They also rely on xeric sandhill habitats in northern Florida primarily due to the availability of gopher tortoise burrows during the winter. In peninsular Florida, Eastern indigo snakes may be found in all terrestrial habitats that have not been subjected to high levels of urban development (USFWS, 2008c).

Eastern indigo snakes have large activity ranges and exhibit seasonal habitat use variability. Upland habitat types are utilized more frequently during the winter, and hydric habitats more frequently in the warmer months; however, this is more prevalent in the northern portions of their range where seasonal temperature fluctuations are more extreme (Moler, 1992).

GOMEX Range Complex Eastern Indigo Snake Occurrence—The Eastern indigo snake is not expected to occur at Dixie Target, Yankee Target, and Noxubee County Ranges because these areas are outside the known range of this species.

This species has not been documented during general reptile surveys at NSA Panama City (NCSS, 2002), but intensive, species-specific survey protocols were not used. The FNAI Biodiversity Matrix has no records of documented occurrences for the Eastern indigo snake in the immediate vicinity of the

Demolition Pond, but indicates that this species has potential to occur in the area. Historical records exist for the Eastern indigo snake in Bay County, Florida. However, Gunzburger and Aresco (2007) reviewed recent records (since 1990) of valid sightings in the Florida panhandle and found a total of 11 sightings in six counties, but none from Bay County. Most sightings were from Eglin Air Force Base and areas of protected land along the Suwannee River (Gunzburger and Aresco, 2007). While pockets of potentially suitable Eastern indigo snake habitat, including gopher tortoise burrows, may exist at the installation, the habitat appears to be highly fragmented and marginal. In 1997, 14 tortoise burrows were surveyed and the population was estimated at 0 to 4 tortoises. Neither burrows nor tortoises were observed during surveys conducted in 2001 and 2002. Turtle tracks were observed on one occasion during the 2001-2002 surveys, but it was not possible to determine if the tracks were made by a gopher tortoise or a box turtle (NCSS, 2002). The Eastern indigo snake may occur near the Demolition Pond, but occurrence is unlikely based on the lack of recent sightings in Bay County and the marginal habitat at the installation.

3.11.2.6 State-Listed Species

McMullen County Range

Laws and regulations pertaining to threatened or endangered animal species are contained in Chapters 67 and 68 of the Texas Parks and Wildlife Code and Sections 65.171 through 65.176 of Title 31 of the Texas Administrative Code. Listing and recovery of endangered species in Texas is coordinated by the Wildlife Division of the Texas Parks and Wildlife Department.

Texas rare, threatened and endangered species potentially occurring on or near the McMullen County Range are provided in Table 3.11-3.

Noxubee County Range

The Mississippi Comprehensive Wildlife Conservation Strategy identifies species in greatest conservation need. Species are categorized into tiers: tier 1 species are defined as those in need of immediate conservation action and/or research because of extreme rarity, restricted distribution, unknown or decreasing population trends, specialized habitat needs and/or habitat vulnerability; tier 2 species are those that are in need of timely conservation action and/or research because of rarity, restricted distribution, unknown or decreasing population trends, specialized habitat needs or habitat vulnerability or significant threats. Mississippi further categorizes species by ecoregion: Noxubee County is within the Upper East Gulf Plain ecoregion.

Habitat areas within the Noxubee County Range include the following:

Dry to mesic shortleaf/loblolly pine forests: dry to mesic loblolly and shortleaf pine forests are common on upland hills or flat on soils with moderate moisture.

TABLE 3.11-3
STATE OF TEXAS RARE, THREATENED, AND ENDANGERED SPECIES POTENTIALLY OCCURRING ON OR NEAR MCMULLEN COUNTY RANGE (DIXIE AND YANKEE TARGETS)

Common Name	Species Name	Habitat	State Status
AMPHIBIANS			
Black-spotted newt	*Notophthalmus meridionalis*	Can be found in wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods; Gulf Coastal Plain south of the San Antonio River.	Threatened
BIRDS			
American peregrine falcon	*Falco peregrinus anatum*	Year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from northern breeding areas in U.S. and Canada, winters along coast and farther south; occupies wide range of habitats during migration, concentrates along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines and barrier islands.	Endangered
Arctic peregrine falcon	*Falco peregrinus tundrius*	Migrant throughout state from far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.	Threatened
Audubon's oriole	*Icterus graduacauda audubonii*	Scrub and mesquite areas; nests in dense trees, or thickets, usually along water courses.	Rare
Interior least tern	*Sterna antillarum athalassos*	Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams and rivers; also known to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc.); when breeding forages within a few hundred feet of colony.	Endangered

TABLE 3.11-3 (Continued)
STATE OF TEXAS RARE, THREATENED, AND ENDANGERED SPECIES POTENTIALLY OCCURRING ON OR NEAR MCMULLEN COUNTY RANGE (DIXIE AND YANKEE TARGETS)

Common Name	Species Name	Habitat	State Status
Mountain plover	*Charadrius montanus*	Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression. Non-breeding: shortgrass plains and bare dirt fields (plowed).	Rare
Western burrowing owl	*Athene cunicularia hypugaea*	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows.	Rare
Whooping crane	*Grus americana*	Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.	Endangered
Wood stork	*Mycteria americana*	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt water. Usually roosts communally in tall snags, sometimes in association with other wading birds (i.e., active heronries). Breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas;	Threatened
MAMMALS			
Black bear	*Ursus americanus*	Bottomland hardwoods and large tracts of inaccessible forested areas; field characteristics similar to Louisiana black bear.	Threatened
Cave myotis bat	*Myotis velifer*	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Texas panhandle during winter.	Rare
Ocelot	*Leopardus pardalis*	Dense chaparral thickets; mesquite-thorn scrub and live oak mottes; avoids open areas.	Endangered
Plains spotted skunk	*Spilogale putorius interrupta*	Open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie.	Rare

TABLE 3.11-3 (Continued)
STATE OF TEXAS RARE, THREATENED, AND ENDANGERED SPECIES POTENTIALLY OCCURRING ON OR NEAR MCMULLEN COUNTY RANGE (DIXIE AND YANKEE TARGETS)

Common Name	Species Name	Habitat	State Status
Red wolf	*Canis rufus*	Brushy and forested areas as well as coastal prairies.	Endangered
MOLLUSKS			
Golden orb	*Quadrula aurea*	Sand and gravel in some locations and mud at other locations; intolerant of impoundment in most instances; Nueces River basin.	Rare
REPTILES			
Indigo snake	*Drymarchon corais*	South of the Guadalupe River and Balcones Escarpment; thornbush-chaparral woodlands of south Texas, in particular dense riparian corridors; requires moist microhabitats, such as rodent burrows, for shelter.	Threatened
Reticulate collared lizard	*Crotaphytus reticulatus*	Requires open brush-grasslands; thorn-scrub vegetation, usually on well-drained rolling terrain of shallow gravel, caliche, or sandy soils. Often on scattered rock flats below escarpments or isolated rock outcrops among scattered clumps of prickly pear and mesquite.	Threatened
Spot-tailed earless lizard	*Holbrookia lacerata*	Central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas.	Rare
Texas horned lizard	*Phrynosoma cornutum*	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive.	Threatened
Texas tortoise	*Gopherus berlandieri*	Open brush with a grass understory is preferred; open grass and bare ground is avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects.	Threatened

Source: Texas Parks and Wildlife Department (www.tpwd.state.tx.us)

Dry hardwood forests: often a mixed oak, oak-pine, or mixed hardwood community on moderate and lower slopes. These communities are often included in fire management regimes.

Bottomland hardwood forests: typically species rich on moist or occasionally wet sites on lower slopes and terraces of streams and rivers.

Urban and suburban lands: areas on which development and maintenance measures are performed regularly.

Species of greatest conservation need potentially occurring on or near Noxubee County Range are provided in Table 3.11-4. Since there is limited wetland areas and a lack of open water habitat on the range, aquatic species are not included in Table 3.11-4. Species habitat and tier level, as defined in the Mississippi Comprehensive Wildlife Conservation Strategy are also listed.

TABLE 3.11-4
STATE OF MISSISSIPPI SPECIES OF GREATEST CONSERVATION NEED POTENTIALLY OCCURRING ON OR NEAR NOXUBEE COUNTY RANGE

Common Name	Species Name	Habitat	Tier Level
AMPHIBIANS			
Mississippi gopher frog	*Rana sevosa*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	1
Ornate chorus frog	*Pseudacris ornata*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	2
BIRDS			
Little blue heron	*Egretta caerulea*	Bottomland hardwood forests.	2
Rusty blackbird	*Euphagus carolinus*	Bottomland hardwood forests.	2
Wood stork	*Mycteria americana*	Bottomland hardwood forests.	2
White ibis	*Eudocimus albus*	Bottomland hardwood forests.	2
Cerulean warbler	*Dendroica cerulea*	Dry hardwood forests, bottomland hardwood forests.	2
Swainson's warbler	*Limnothlypis swainsonii*	Bottomland hardwood forests.	2
Southeastern American kestrel	*Falco sparverius paulus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	1
Red-cockaded woodpecker	*Picoides borealis*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	2
Bachman's sparrow	*Aimophila aestivalis*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	2
Common ground dove	*Columbina passerina*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, urban and suburban lands.	2
Grasshopper sparrow	*Ammodramus savannarum*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	2
Le Conte's sparrow	*Ammodramus leconteii*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	2
Bewick's wren	*Thryomanes bewickii*	Dry hardwood forests, urban and suburban lands.	1
Migrant songbirds	various	Bottomland hardwood forests.	1
Swallow-tailed kite	*Elanoides forficatus*	Bottomland hardwood forests	2

TABLE 3.11-4 (Continued)
STATE OF MISSISSIPPI SPECIES OF GREATEST CONSERVATION NEED POTENTIALLY OCCURRING ON OR NEAR NOXUBEE COUNTY RANGE

Common Name	Species Name	Habitat	Tier Level
MAMMALS			
Southeastern myotis	*Myotis austroriparius*	Bottomland hardwood forests, urban and suburban lands.	1
Louisiana black bear	*Ursus americanus luteolus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests, bottomland hardwood forests.	1
Hoary bat	*Lasiurus cinereus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests, bottomland hardwood forests.	2
Gray myotis	*Myotis grisescens*	Bottomland hardwood forests.	2
Northern yellow bat	*Lasiurus intermedius*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests, bottomland hardwood forests.	2
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	Bottomland hardwood forests, urban and suburban lands.	2
Northern myotis	*Myotis septentrionalis*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests, bottomland hardwood forests.	2
Little brown myotis	*Myotis lucifugus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests, bottomland hardwood forests.	2
Black bear	*Ursus americanus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests, bottomland hardwood forests.	2
Eastern spotted skunk	*Spilogale putorius*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests.	2
Oldfield mouse	*Peromyscus polionotus*	Dry hardwood forests.	2
REPTILES			
Mimic glass lizard	*Ophisaurus mimicus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	1
Black pine snake	*Pituophis melanoleucus lodingi*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests.	1
Gopher tortoise	*Gopherus polyphemus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests.	2
Eastern coral snake	*Micrurus fulvius*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests.	2
Eastern diamondback snake	*Crotalus adamanteus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests.	2
Slender glass lizard	*Ophisaurus attenuatus*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests.	2

TABLE 3.11-4 (Continued)
STATE OF MISSISSIPPI SPECIES OF GREATEST CONSERVATION NEED POTENTIALLY OCCURRING ON OR NEAR NOXUBEE COUNTY RANGE

Common Name	Species Name	Habitat	Tier Level
Mole kingsnake	*Lampropeltis calligaster rhombomaculata*	Dry longleaf pine and dry to mesic shortleaf/loblolly pine forests, dry hardwood forests.	2
Prairie kingsnake	*Lampropeltis calligaster calligaster*	Dry hardwood forests.	2

Source: NAS Meridian INRMP (DoN, 2007)

Naval Support Activity Panama City Demolition Pond

The Florida Fish and Wildlife Conservation Commission maintains the state list of animals designated as endangered, threatened, or species of special concern, in accordance with Rules 68A-27.003, 68A-27.004, and 68A-27.005, respectively, Florida Administrative Code. The state lists of plants, which are designated endangered, threatened, and commercially exploited, are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, Florida Administrative Code. Table 3.11-5 provides a summary of state-listed species that have been documented at NSA Panama City based on surveys and information presented by Keppner Biological Services (NCSS, 2002).

TABLE 3.11-5
STATE OF FLORIDA LISTED SPECIES KNOWN TO OCCUR AT NAVAL SUPPORT ACTIVITY PANAMA CITY

Common Name	Species Name	Habitat	State Status
BIRDS			
Little blue heron	*Egretta caerulea*	Tidal and freshwater wetlands.	Species of Special Concern
Snowy egret	*Egretta thula*	Tidal and freshwater wetlands.	Species of Special Concern
Tricolored heron	*Egretta tricolor*	Tidal and freshwater wetlands.	Species of Special Concern
Least tern	*Sterna antillarum*	Coastal areas.	Threatened
PLANTS			
Godfrey's goldenaster	*Chrysopsis godfreyi*	Dunes and coastal scrub.	Endangered
Godfrey's gayfeather	*Liatris provincialis*	Coastal grasslands, dunes, and sandhills.	Endangered
Gulf Coast lupine	*Lupinus westianus*	Coastal sand dunes, coastal scrub, and well-drained sandy soils of the sandhills area.	Threatened
Largeleaf jointweed	*Polygonella macrophylla*	Sand pine-oak scrub.	Threatened

TABLE 3.11-5
STATE OF FLORIDA LISTED SPECIES KNOWN TO OCCUR AT NAVAL SUPPORT ACTIVITY PANAMA CITY (Continued)

Common Name	Species Name	Habitat	State Status
REPTILES			
American alligator	*Alligator mississippiensis*	Freshwater, brackish, and saltwater wetlands.	Species of Special Concern
Gopher tortoise	*Gopherus polyphemus*	Sandhills, pine flatwoods, scrub, scrubby flatwoods, dry prairies, xeric hammock, pine-mixed hardwoods, and coastal dunes	Threatened

Source: NCSS, 2002. State status for anaimals is based on FWC, 2009 and state status for plants is based on the Florida Regulated Plant Index (Florida Administrative Code 5B-40.0055)

3.11.3 Environmental Consequences

3.11.3.1 No Action Alternative

Aircraft Overflights

Overview

Fixed-wing jet aircraft are used at Dixie Target, Yankee Target, and Noxubee County Range for air-to-ground exercises, which may occur during the day or at night. The No Action Alternative includes 306 sorties per year at Dixie Target, 652 sorties per year at Yankee Target, and 12,800 sorties per year at Noxubee County range. Aircraft altitudes range from 23,000 feet AGL to no less than 1,200 feet AGL during these exercises. Aircraft approach the target area, execute a NEPM drop or simulate a drop using a no-bomb drop delivery training system over the target area, make a left or right hand turn, and repeat the process. The average time for these exercises is about one hour, with two aircraft participating in the exercise. The typical NEPM release altitude is between 3,000 and 8,000 feet AGL, but could be as low as 1,500 feet AGL. Representative noise levels for the aircraft are provided in Section 3.5.

Wildlife

Disturbance Associated With Aircraft Overflights

The No Action Alternative would include some relatively low-altitude aircraft overflights (*i.e.*, less than 3,000 feet AGL). As a result, wildlife occurring in some parts of the Dixie Target, Yankee Target, and Noxubee County Range Study Areas could be exposed to noise and visual cues associated with aircraft overflights.

Numerous studies have documented that wild animals respond to human-made noise, including low-altitude aircraft overflights (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). The manner in which animals respond to overflights depends on several factors including life-history characteristics of the species, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. A primary concern is that low-altitude overflights may cause physiological and/or behavioral responses that reduce the animals' fitness or ability to survive. Researchers have documented a range of behavioral responses to overflights, ranging from indifference to extreme panic. Behavioral responses could interfere with raising young, habitat use, and physiological energy budgets. Most studies have focused on ungulates and birds, while little or no research has been conducted on carnivorous mammals, small mammals, reptiles, and amphibians (National Park Service, 1994). While difficult to measure in the field, some behavioral responses are likely accompanied by physiological responses, such as increased heart rate, or stress.

Chronic stress can compromise the general health of animals, but stress is not necessarily indicative of negative consequences to individuals or to populations (Larkin, 1996; National Park Service, 1994). For example, the reported behavioral and physiological responses of birds to noise exposure are within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. Unless repeatedly exposed to loud noises or simultaneously exposed to synergistic stressors, it is possible that individuals would return to homeostasis almost immediately after exposure and the individual's overall metabolism and energy budgets would not be affected. Studies have also shown that animals can become habituated to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). Little is known about physiological responses of birds that have habituated to noise.

Fixed-wing aircraft overflights under the No Action Alternative would result in short-term, localized increases in noise levels within the Study Area. Biological receptors on the ground and directly under the flight track could be exposed to elevated noise levels. Exposure levels would decrease with increasing distance from the flight track centerline. The duration of exposure to fixed wing-aircraft noise would be very brief (seconds) as an aircraft quickly passes overhead. When compared to a typical commercial airport, the number of exposures to fixed-wing aircraft noise would be relatively infrequent at Dixie and Yankee Targets based on the low number of sorties (306 and 652 per year, respectively) and the short duration of the exercises (about one hour). Wildlife exposed to low-altitude aircraft overflights could exhibit short-term behavioral and/or physiological responses, but infrequent exposures are not expected to result in chronic stress or compromise the general health of individuals or populations.

At Noxubee County Range, resident wildlife could be frequently exposed to aircraft overflights based on the high number of sorties (12,800 per year). This increases the possibility of chronic stress. Some animals could react by permanently leaving or avoiding areas with elevated noise levels. However, animals repeatedly exposed to aircraft noise often become habituated to the noise and do not respond behaviorally. It is likely that most wildlife currently in the immediate area of Noxubee County Range have habituated to the noise because the range has been operational for more than 30 years. Furthermore, the range is located in a rural area surrounded by more than 100,000 acres of similar habitat. The amount of wildlife habitat that would be affected by aircraft overflights would be negligible when considered in this context. Population-level effects are not anticipated because resident wildlife species have likely habituated to aircraft noise and the area exposed to aircraft overflights would be relatively small.

The effects of aircraft overflights on federally listed and state-listed species would be similar to those described previously for wildlife. Any impacts to federally listed or state-listed species would be short-term, minor, and localized. The effects of aircraft overflights on federally listed species are discussed in more detail below.

In accordance with NEPA, disturbance associated with aircraft overflights in the McMullen County Range (Dixie Target and Yankee Target), and Noxubee County Range (SEARAY Target) Study Areas would have no significant impact on wildlife. Disturbance associated with aircraft overflights would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities.

Aircraft Strikes

Wildlife/aircraft strikes are a major concern for the Navy because they can cause harm to aircrews, damage to equipment, and injury or mortality to wildlife. From 2002 through 2004 an annual average of 596 known wildlife/aircraft strike events occurred Navy-wide and most of these events involved birds (Navy Safety Center, 2004). While all wildlife/aircraft strikes are considered serious and dangerous events, the number of animals injured or killed annually is small considering the number of Navy-wide

aircraft operations. The potential for fixed-wing aircraft strikes at Dixie Target, Yankee Target, and Noxubee County Range is low because the aircraft typically operate above 1,500 feet AGL and do not take off or land at these ranges. The high number of sorties at Noxubee County Range (12,800 per year) increase the possibility of a strike to occur. Nonetheless, few, if any, wildlife/aircraft strikes and associated wildlife mortalities or injuries are expected to occur in the McMullen County Range (Dixie Target and Yankee Target), and Noxubee Range (SEARAY Target) Study Areas under the No Action Alternative based on the flight altitudes and absence of takeoffs and landings. Similarly, the probability of an aircraft striking a federally listed or state-listed species is low. Individual federal species are discussed below.

In accordance with NEPA, aircraft strikes in the McMullen County Range and Noxubee Range Study Areas would have no significant impact on wildlife. Aircraft strikes would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities.

Whooping Crane at Dixie and Yankee Targets

As discussed in Section 3.11.2.2, there is a low probability that the whooping crane occurs at Dixie and Yankee Targets during migration as a transient. If present within the Study Area, whooping cranes could be exposed to low-altitude aircraft overflights and could exhibit short-term behavioral and/or physiological responses. The infrequent exposures are not expected to result in chronic stress or compromise the general health of individuals or populations. Disturbance from aircraft overflights under the No Action Alternative may affect the whooping crane at Dixie and Yankee Targets, but the effects would be insignificant. The effects could also be considered discountable based on the unlikelihood of occurrence.

Most migrating whooping cranes have been observed below about 2,000 ft above ground level, but higher altitude migration (up to about 6,400 ft) is not unusual (Kuyt, 1992). While migrating whooping cranes and aircraft may co-occur in time and space at Dixie and Yankee Targets, the likelihood of aircraft strikes is low based on infrequent occurrence of this species in the area. Therefore, the effects of aircraft strikes would be considered discountable. Aircraft strikes under the No Action Alternative may affect the whooping crane at Dixie and Yankee Targets.

Interior Least Tern at Dixie and Yankee Targets

As discussed in Section 3.11.2.2, the interior least tern may occur at Dixie and Yankee Targets as a migratory transient. If present within the Study Area, interior least terns could be exposed to low-altitude aircraft overflights and could exhibit short-term behavioral and/or physiological responses. The infrequent exposures are not expected to result in chronic stress or compromise the general health of individuals or populations. Disturbance from aircraft overflights under the No Action Alternative may affect the interior least tern at Dixie and Yankee Targets, but the effects would be insignificant. The effects could also be considered discountable based on the unlikelihood of occurrence.

While migrating interior least terns and aircraft may co-occur in time and space at Dixie and Yankee Targets, the likelihood of aircraft strikes is low based on infrequent occurrence of this species in the area. Therefore, the effects of aircraft strikes would be considered discountable. Aircraft strikes under the No Action Alternative may affect the interior least tern at Dixie and Yankee Targets.

Ocelot at Dixie and Yankee Targets

While the ocelot has not been documented at Dixie or Yankee Targets, potentially suitable habitat exists and this species is known to occur in McMullen County, Texas. If present within the Study Area, ocelots would be exposed to low-altitude aircraft overflights and could exhibit short-term behavioral and/or physiological responses. The infrequent exposures are not expected to result in chronic stress or

compromise the general health of individuals or populations. Disturbance from aircraft overflights under the No Action Alternative may affect the ocelot at Dixie and Yankee Targets, but the effects would be insignificant. Aircraft strikes would have no effect on the ocelot because aircraft do not take off or land at Dixie and Yankee Targets.

Red-cockaded Woodpecker at Noxubee County Range

While the red-cockaded woodpecker has not been documented at Noxubee County Range, past sightings and the presence of potentially suitable habitat indicate that this species may occur within the Study Area. If present within the Study Area, the red-cockaded woodpecker could be frequently exposed to aircraft overflights based on the high number of sorties (12,800 per year). This increases the possibility of chronic stress. Some animals could react by permanently leaving or avoiding areas with elevated noise levels; however, animals repeatedly exposed to aircraft noise often become habituated to the noise and do not respond behaviorally. It is likely that any red-cockaded woodpeckers in the immediate area of the range have habituated to the noise because the range has been operational for more than 30 years. Disturbance from aircraft overflights may affect the red-cockaded woodpecker, but the effects would be insignificant.

The probability of an aircraft striking a red-cockaded woodpecker is low because the birds and aircraft are not expected to co-occur in time and space at Noxubee County Range. Aircraft typically operate above 1,500 feet AGL and do not take off or land at this range, while the red-cockaded woodpecker nests and forages under the forest canopy. Aircraft strikes under the No Action Alternative may affect the red-cockaded woodpecker at Noxubee County Range, but strikes would be extremely unlikely to occur and the effects would be considered discountable.

Non-Explosive Practice Munitions

Overview

Air-to-Ground Bombing Exercises at Dixie Target, Yankee Target, and Noxubee County Range involve dropping various NEPMs from fixed-wing aircraft within the designated target areas. The No Action Alternative includes dropping 1,433 NEPMs per year at Dixie Target, 2,636 per year at Yankee Target, and 21,045 per year at Noxubee County Range. Air-to-Ground Gunnery Exercises at Yankee Target involve firing 25,000 20 mm rounds per year.

Vegetation and Wetlands

Most NEPM would impact the ground surface in the designated target areas, which lack vegetation. Some NEPM could impact in areas that support maintained vegetation, but natural vegetation communities would not be affected. Baseline conditions for vegetation and wetlands would not change under the No Action Alternative. Although no plant survey data is available, state-listed plant species would not be expected to be present within these maintained or de-vegetated impact areas. Therefore, NEPM use is not expected to adversely affect state-listed plants near these impact areas. In accordance with NEPA, NEPM use at McMullen County Range (Dixie Target and Yankee Target) and Noxubee County Range would have no significant impact on vegetation or wetlands.

Wildlife

When a NEPM makes contact with the target kinetic energy would be transferred and sound would be generated. Sound associated with the impact event is typically of low frequency (less than 250 Hz) and of a short enough duration (*i.e.*, impulsive sound) that it produces negligible amounts of acoustic energy. Wildlife in the immediate vicinity of the target might respond to this sound, but any effects would be minor and short-term.

Terrestrial wildlife could be injured or killed by a NEPM strike if they were in the target area and at the point of physical impact at the time of NEPM delivery. However, the probability of direct strikes is low because the target areas generally lacks suitable wildlife habitat. If direct strikes were to occur, only a small number of animals would be affected and no population-level effects would occur. While a remote possibility exists that some individuals of some wildlife species may be directly impacted, NEPM strikes under the No Action Alternative would have no significant impact on wildlife or state-listed species. Individual federally listed species are discussed below. NEPM use would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities.

Whooping Crane and Interior Least Tern at Dixie and Yankee Targets

The whooping crane and interior least tern may occur near Dixie and Yankee Targets as migratory transients, but are not expected to use habitats within the impact area. Therefore, NEPM strikes under the No Action Alternative would have no effect on the whooping crane or interior least tern at Dixie and Yankee Targets. Noise from NEPM firing could elicit short-term reactions from these species if they were passing through the area. NEPM disturbance may affect the whooping crane and interior least tern, but the effects would be insignificant.

Ocelot at Dixie and Yankee Targets

Exposure of ocelots to NEPM strikes at Dixie and Yankee Target is not expected based on several factors. First, ocelots are very rare and occurrence at Dixie and Yankee Targets is unlikely. If ocelots were present, they would not be expected to frequent the open habitats of the impact areas, but would most likely use dense thornscrub habitat areas outside of the impact areas. NEPM strikes under the No Action Alternative would have no effect on the ocelot at Dixie and Yankee Targets. Noise from NEPM firing could elicit short-term reactions from ocelots. NEPM disturbance may affect the ocelot, but the effects would be insignificant.

Red-cockaded Woodpecker at Noxubee County Range

The impact area at Noxubee County Range lacks suitable nesting or foraging habitat for the red-cockaded woodpecker. Therefore, this species is not expected to occur in the impact area and would not be exposed to NEPM strikes. NEPM use under the No Action Alternative would have no effect on the red-cockaded woodpecker at Noxubee County Range. Noise from NEPM firing could elicit short-term reactions from red-cockaded woodpeckers. NEPM disturbance may affect the red-cockaded woodpecker, but the effects would be insignificant.

Underwater Detonations and High Explosive Ordnance (Demolition Pond)

Underwater detonations and HE ordnance use do not occur at Dixie Target, Yankee Target, or Noxubee County Range. Therefore, the analysis presented here focuses on ESA-listed terrestrial species that may occur at or near the Demolition Pond and underwater detonation of small charges (up to 1.25-lb NEW) in the Demolition Pond.

Piping plovers forage along sandy beaches and mud flats in the Gulf coast region from approximately September through mid-April. Piping plovers may be encountered in the vicinity of the Demolition Pond to the extent that foraging habitat is available around the circumference of or on sand bars within the pond. This species is not expected to use open water habitats of the Demolition Pond. Piping plovers potentially foraging along the pond's shoreline would be expected to leave the immediate area prior to detonations due to human disturbance. If present during a detonation, piping plover could exhibit short-term behavioral responses (*e.g.*, fly away and leave the immediate area) to the noise generated by the detonation, but direct physical injury or mortality would not occur. The short-term responses to human disturbance or the detonation noise would be considered insignificant. Underwater

detonations at the Demolition Pond under the No Action Alternative may affect the piping plover. These activities would have no effect on piping plover critical habitat based on its distance from the Demolition Pond (about 2.8 miles southeast).

Wood storks forage in shallow freshwater and brackish wetlands along the Gulf coast during their non-breeding season (dispersal and wintering seasons) and may be encountered in the vicinity of the Demolition Pond as early as May and extending through the summer, fall, and winter to the following March (Coulter *et al*., 1999). While foraging, wood storks wade in water up to depths of 50 cm (usually only 10 to 30 cm) with their bills open and partially submerged. They feed by touch rather than sight and prey upon a variety of small vertebrates (*e.g*., fish and frogs) as well as crabs, insects, and dead fish (Pearson *et al*., 1992; Coulter *et al*., 1999). Reduced water levels in wetlands (*e.g*., estuaries, salt marshes, tidal creeks, and ponds) effectively concentrate prey, creating more suitable foraging habitat for wood storks. During periods when water levels at the Demolition Pond are low (*i.e*., low tide), wood storks may be present in the vicinity of the Demolition Pond.

A study investigating the effect of human disturbance on foraging and loafing birds calculated that wood storks flushed (*i.e*., reacted to a disturbance by fleeing an area) when an approaching boat came within a mean distance of 26 m (Rodgers and Smith, 1997). Where appropriate (*e.g.*, at a National Wildlife Refuge) the study recommended maintaining a buffer of 77 m around known wood stork foraging areas and suggested additional mitigation measures that could be implemented to reduce the size of a buffer, should one be established. The Demolition Pond measures only 86 m in diameter, suggesting that human activity around the Demolition Pond would likely flush wood storks before any detonations take place. Considering that underwater detonations would only be used up to 90 days per year and that wood storks forage in shallow water close to the shoreline with only their bills and feet submerged, it is unlikely that any physical injury or mortality from the use of explosives at the Demolition Pond would occur. The short-term responses to human disturbance or the detonation noise would be considered insignificant. Underwater detonations at the Demolition Pond under the No Action Alternative may affect the wood stork.

If Eastern indigo snakes were present in vegetated habitat, gopher tortoise burrows, or foraging along wetland edges they could potentially be affected by the underwater detonations at the Demolition Pond. Because the species forages along wetland/habitat edges and would not be expected in the water, direct physical injury or mortality as a result of detonations is unlikely. Eastern indigo snakes would be expected to leave the area prior to detonations due to human disturbance, or exhibit short term behavioral responses to detonations (*e.g*., flee/seek shelter). These effects would be insignificant. Underwater detonations causing short-term, localized increases in noise levels and disturbance in the Demolition Pond vicinity may affect the eastern indigo snake.

Similar to the federally listed species discussed above, state-listed birds and reptiles (Table 3.11-5) could exhibit short-term, behavioral responses to training activities at the Demolition Pond, but injury or population-level effects are not anticipated. State-listed plants would not be affected by training in the Demolition Pond.

Military Expended Materials

The only military materials expended at Dixie Target, Yankee Target, and Noxubee County Range would be NEPM, including non-explosive practice bombs and 20-mm rounds (Yankee Target only). As discussed in Section 3.2, these materials are inert and are not expected to result in environmental contamination that would affect wildlife. These materials are expected to stay intact upon impact and would be too large to present an ingestion risk to wildlife. Furthermore, these materials are periodically cleared from the impact areas in accordance with the range clearance plans. In accordance with NEPA, military expended materials would have no significant impact on biological resources, including state-

listed species, in the McMullen County Range and Noxubee County Range Study Areas. Individual federally listed species are discussed below. Military expended materials would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities.

Whooping Crane and Interior Least Tern at Dixie and Yankee Targets

The whooping crane and interior least tern may occur near Dixie and Yankee Targets as migratory transients, but are not expected to use habitats within the impact area. Therefore, military expended materials under the No Action Alternative would have no effect on the whooping crane or interior least tern at Dixie and Yankee Targets.

Ocelot at Dixie and Yankee Targets

Military expended materials are expected to stay intact upon impact and would be too large to present an ingestion risk to the ocelot. Furthermore, these materials are periodically cleared from the impact areas in accordance with the range clearance plans. Therefore, military expended materials would have no effect on the ocelot at Dixie and Yankee Targets under the No Action Alternative.

Red-cockaded Woodpecker at Noxubee County Range

Red-cockaded woodpeckers are not expected to use open habitats within the impact area at Noxubee County Range because they nest and forage in forested areas. Military expended materials would have no effect on the red-cockaded woodpecker at Noxubee County Range under the No Action Alternative.

Piping Plover, Wood Stork, and Eastern Indigo Snake at Demolition Pond

Some materials that are expended at the Demolition Pond, such as marine markers, produce flames, light, and smoke that could elicit a short-term behavioral response in terrestrial wildlife. As discussed above in the analysis of underwater detonations, human activity prior to use of such materials at the Demolition Pond would likely cause piping plovers, wood storks, and Eastern indigo snakes to leave the immediate area or seek shelter. Therefore, exposure to light or smoke is unlikely. If these species were exposed to light or smoke, the effects would be short-term and insignificant (fleeing or seek shelter). Ingestion of expended materials by piping plovers, wood storks, and Eastern indigo snakes is unlikely because Navy mitigation measures require that these materials be removed to the extent practicable upon completion of each exercise. Military expended materials under the No Action Alternative may affect the piping plover, wood stork, and Eastern indigo snake at the Demolition Pond.

3.11.3.2 Alternative 1

Alternative 1 does not include any changes in operations at Dixie Target, Yankee Target, and Noxubee County Range. Alternative 1 includes minor changes in operations at the Demolition Pond. Some annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW and the number of 1.25-lb charges would not change. Therefore, the effects of Alternative 1 at the Demolition Pond are expected to be the same as the No Action Alternative. Therefore, the analyses presented above for the No Action Alternative are applicable to Alternative 1. In accordance with NEPA, Alternative 1 would have no significant impact on biological resources in the McMullen County Range and Noxubee County Range Study Areas. Alternative 1 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities.

3.11.3.3 Alternative 2

Alternative 2 does not include any changes in operations at Dixie Target, Yankee Target, and Noxubee County Range. Alternative 2 includes minor changes in operations at the Demolition Pond. Some

annual operations would increase, while others would decrease. However, the maximum charge would continue to be 1.25-lb NEW and the number of 1.25-lb charges would not change. Therefore, the effects of Alternative 2 at the Demolition Pond are expected to be the same as the No Action Alternative. Therefore, the analyses presented above for the No Action Alternative are applicable to Alternative 2. In accordance with NEPA, Alternative 2 would have no significant impact on biological resources in the McMullen County Range and Noxubee County Range Study Areas. Alternative 2 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities.

3.11.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to biological resources in the McMullen County Range (Dixie Target and Yankee Target), Noxubee County Range (SEARAY Target), and Demolition Pond Study Areas.

3.11.5 Summary of Environmental Effects (NEPA and EO 12114)

3.11.5.1 Endangered Species Act

Tables 3.11-6, 3.11-7, and 3.11-8 present the Navy's determinations of effect for Alternative 2 (the Preferred Alternative) and federally listed terrestrial species at McMullen County Range (Dixie Target and Yankee Target), Noxubee County Range (SEARAY Target), and NSA Panama City Demolition Pond, respectively. Alternative 2 may affect the interior least tern, whooping crane, and ocelot at Dixie and Yankee Targets. Alternative 2 would have no effect on whooping crane critical habitat. Alternative 2 may affect the red-cockaded woodpecker at Noxubee County Range. Proposed activities under Alternative 2 at the Demolition Pond would have no effect on the Choctawhatchee beach mouse or its critical habitat. Alternative 2 may affect the piping plover, wood stork, and Eastern indigo snake at the Demolition Pond. Alternative 2 would have no effect on piping plover critical habitat. The Navy has completed informal ESA Section 7 consultation with USFWS for Alternative 2 and terrestrial species. In a letter dated 9 March 2009 (Appendix C), USFWS concurred with the Navy's determination that Alternative 2 would have no effect or may affect, but is not likely to adversely affect listed terrestrial species.

TABLE 3.11-6
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED SPECIES AT MCMULLEN COUNTY RANGE (DIXIE AND YANKEE TARGETS) – ALTERNATIVE 2 (PREFERRED ALTERNATIVE)

Stressor	Interior Least Tern	Whooping Crane	Ocelot
Aircraft Overflights			
Aircraft Disturbance	May Affect	May Affect	May Affect
Aircraft Strikes	May Affect	May Affect	No Effect

TABLE 3.11-6
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED SPECIES AT MCMULLEN COUNTY RANGE (DIXIE AND YANKEE TARGETS) – ALTERNATIVE 2 (PREFERRED ALTERNATIVE) (Continued)

Stressor	Interior Least Tern	Whooping Crane	Ocelot
Non-explosive Practice Munitions			
Non-explosive Practice Munitions Strikes	No Effect	No Effect	No Effect
Non-explosive Practice Munitions Disturbance	May Affect	May Affect	May Affect
Military Expended Materials			
Ordnance-related Materials	No Effect	No Effect	No Effect

TABLE 3.11-7
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED SPECIES AT NOXUBEE COUNTY RANGE (SEARAY TARGET) – ALTERNATIVE 2 (PREFERRED ALTERNATIVE)

Stressor	Red-cockaded Woodpecker
Aircraft Overflights	
Aircraft Disturbance	May Affect
Aircraft Strikes	May Affect
Non-explosive Practice Munitions	
Non-explosive Practice Munitions Strikes	No Effect
Non-explosive Practice Munitions Disturbance	May Affect
Military Expended Materials	
Ordnance-related Materials	No Effect

TABLE 3.11-8
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED TERRESTRIAL SPECIES AT NAVAL SUPPORT ACTIVITY PANAMA CITY DEMOLITION POND – ALTERNATIVE 2 (PREFERRED ALTERNATIVE)

Stressor	Piping Plover	Wood Stork	Eastern Indigo Snake	Choctawhatchee Beach Mouse
Underwater Detonations and High Explosive Ordnance				
Underwater Detonations – Small Charges (Demolition Pond)	May Affect	May Affect	May Affect	No Effect
Military Expended Materials				
Ordnance-related Materials	May Affect	May Affect	May Affect	No Effect
Marine Markers	May Affect	May Affect	May Affect	No Effect

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3.11.5.2 Migratory Bird Treaty Act

As discussed in the analysis presented above in Section 3.11.3, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The

proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required to confer with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects to migratory birds.

3.11.5.3 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.11-9, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on biological resources within Demolition Pond, the McMullen County Range, or Noxubee County Range of the GOMEX Study Areas.

TABLE 3.11-9
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON BIOLOGICAL RESOURCES IN THE MCMULLEN COUNTY RANGE AND NOXUBEE COUNTY RANGE STUDY AREAS

Alternative and Stressor	Summary of Effects and Impact Conclusion
No Action	
Aircraft Overflights	Short-term behavioral responses to overflights. Low potential for wildlife injury/mortality from aircraft strikes. No long-term population-level effects.
Non-Explosive Practice Munitions	Localized disturbance to maintained terrestrial vegetation the impact areas. Low probability of direct strikes from NEPM. No long-term population-level effects.
Military Expended Materials	No effect.
Impact Conclusion	No significant impact to biological resources.
Alternative 1	
Aircraft Overflights	No change from No Action Alternative.
Non-Explosive Practice Munitions	No change from No Action Alternative.
Military Expended Materials	No change from No Action Alternative.
Impact Conclusion	No significant impact to biological resources.
Alternative 2	
Aircraft Overflights	No change from No Action Alternative.
Non-Explosive Practice Munitions	No change from No Action Alternative.
Military Expended Materials	No change from No Action Alternative.
Impact Conclusion	No significant impact to biological resources.

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3.12 LAND USE (INCLUDES COASTAL ZONE MANAGEMENT AND INLAND USE)

3.12.1 Introduction and Methods

Land use is the classification of either natural or human-modified activities occurring at a given location. Land use is typically limited in offshore operations to public access and safety issues to include potential dangers inherent in flight operations, mine laying, and underwater demolition. It is the policy of the Navy to observe every possible precaution in the planning and execution of all operations that occur onshore or offshore to prevent injury to people or damage to property.

Offshore activities are military, commercial, and recreational. Although the Federal Aviation Administration (FAA) has established warning areas for military operations, virtually all airspace and seaspace are available for co-use the majority of the time. Exclusive use of the land areas only occurs when hazardous activities are planned, and time for these activities are scheduled and broadcast through Notices to Mariners (NOTMAR), issued by the U.S. Coast Guard (USCG) and Notices to Airman (NOTAM), issued by the FAA.

3.12.1.1 Assessment Methods and Data Used

Historical Naval training and environmental studies contributed to the development of the land use section. Unless otherwise indicated, the existing conditions information provided in this section was derived from the Operational Range Clearance Plan for the SEARAY Target, Meridian Range Complex, Noxubee County, Mississippi (DoN, 2007a), Draft Operational Range Clearance Plan, McMullen Bombing and Gunnery Range, GOMEX Range Complex (DoN, 2007b), the Range Complex Management Plan (DoN, 2006a), and applicable Range Installation Air Compatibility Use Zone (RAICUZ) studies (DoN, 2006d).

3.12.1.2 Warfare Areas and Associated Land Use Environmental Stressors

Impacts to land use are assessed in terms of a proposed action's compatibility with existing land use, continued consistency with existing land use plans and policies, and incompatibility with adjacent land use to the extent that public health or safety is threatened.

Stressors that would likely impact land use activities are identified in Table 3.12-1. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities affecting land use that were included in the Alternatives.

3.12.2 Affected Environment

The land areas evaluated within this Final EIS/OEIS are the McMullen County Range, located in Texas and composed of Yankee and Dixie Targets; the Noxubee County Range, consisting of the SEARAY Target, located in Mississippi; and the NSA Panama City Demolition Pond Area. Offshore activities in the proposed action are not assessed in this section as the factors used to determine land use compatibility are not applicable to offshore areas. Offshore, the Minerals Management Service does have 113 projects in production in Gulf of Mexico "deep water" at the start of 2008. They are anticipating four additional projects in 2008, however, coordination between the MMS and DoN, as well as other federal, state, and local agencies ensures de-confliction occurs prior to beginning any projects in the Study Area (MMS, 2008).

TABLE 3.12-1
SUMMARY OF POTENTIAL STRESSORS TO LAND USE

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Mine Warfare (MIW)				
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Mine Neutralization –Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Surface Warfare (SUW)				
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox	✓	✓	✓
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B	✓	✓	✓
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox	✓	✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓	✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Panama City OPAREA	✓	✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Corpus Christi OPAREA UNDET BOX E3	✓	✓	✓

TABLE 3.12-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO LAND USE

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓		
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓	
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓		✓
Air Warfare (AW)				
Air Intercept Control (AIC)	W-151; W-155		✓	
Strike Warfare (STW)				
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓	✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓	✓
Amphibious Warfare				
Firing Exercise (FIREX) with IMPASS	W-151A/B; W-155A	✓		✓
Electronic Combat (EC)				
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓	✓
Chaff Exercises (CHAFFEX)	Brownwood MOAs	✓	✓	✓
Flare Exercises (FLAREX)	W-155A/B	✓	✓	✓

TABLE 3.12-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO LAND USE

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Flare Exercise (FLAREX)	Brownwood MOAs	✓	✓	✓
Mission Area Training[46]				
Mission Area Flight Training	W-92; W-54; Brownwood MOAs		✓	
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312		✓	
Salvage Diver Training	NSA Panama City Demolition Pond			✓
EOD Tech Training	NSA Panama City Demolition Pond			✓
Security Force Training	NSA Panama City Demolition Pond			✓
Diver Training	NSA Panama City Demolition Pond			✓

McMullen County Range

The McMullen County Range is located in south central McMullen County and occupies approximately 10,625 acres in Texas. The McMullen Range Complex is made up of two ranges; Yankee Target and Dixie Target. The McMullen Range Complex has a Hunting Lodge area and associated maintenance facilities. The property is cleared and mowed with the majority of the property in native condition for use as a recreational and hunting preserve (DoN, 2006b).

Yankee Target

The Yankee Target is the northern target area within the McMullen County Range. The Yankee Target was established in 1965 through a lease with ranch owner Dolph Briscoe. The Briscoe lease was last

[46] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

updated in 2002 for a 10-year period. In 1974 the Texas Air National Guard (TANG) began using the range. In 1993 range oversight was transferred to NAS Kingsville. Currently the 149th Fighter Wing at Lackland AFB manages and uses Yankee Target under an Inter-Service Agreement with NAS Kingsville. The 147th Fighter Wing at Ellington Field, Texas and the 435th and 560th Fighter Training Wings at Randolph AFB, Texas occasionally uses Yankee Range. Right-of-way leases are held by the Navy with W.L. Flowers, Bobby Hindes and his wife, and Nueces Land and Livestock Company for access to the Yankee Range. The Yankee Target comprises a total of 2,800 acres, which includes a centrally located 400-acre munitions impact area and an additional 2,400 acres of buffer zone land that surrounds the target impact area.

TANG maintains a compound in the southern portion of the Yankee Target buffer zone (~0.25 miles from the impact area) that includes a control tower, and four primary buildings used for carpentry, administration, communications, and vehicle/equipment maintenance, surrounded by a locked chain-link fence. Multiple storage sheds for flammables, waste flammables, non-hazardous wastes, and unused Smokey SAM (surface-to-air missile) simulators are also maintained in the TANG compound. Since 1999, TANG personnel have been responsible for the operation and maintenance of the Yankee Target, range vehicle/equipment maintenance, and fuel storage (truck and trailer-mounted storage tanks). A target storage area contains old and new targets such as fixed and rotary wing aircraft, fuselages, trailers, military ground vehicles, etc., south of the Yankee Target impact area (DoN, 2007b).

Dixie Target

The Dixie Target is the southern target area within the McMullen County Range. The Dixie Target comprises a total of 7,825 acres, which includes a centrally located 360-acre munitions impact area and an additional 7,465 acres of buffer zone land that surrounds the central target impact area (DoN, 2006a).

The U.S. Government filed a Declaration of Taking in 1981 for approximately 2,796 acres of land in McMullen County, Texas, for the Dixie Target. The leasehold interests provide the government exclusive leasehold for the establishment, maintenance, and operation and use of the impact area in Parcel One. A non-exclusive leasehold interest consisting of right to access over parcels and regulate the presence of human beings in Parcels two through four, and a non-exclusive leasehold for rights-of-way for access and utilities over and across Parcels five and six. Approximately 1,735 acres of the main Dixie Target property is now owned by the Navy and the remainder (~6,093 acres) continues to be leased by the Navy from a private owner (DoN, 2006d). The Navy also continues to lease an additional 47 acres to access the site from a private owner (DoN, 2006a/d). The Navy also has a long range radar facility on the Dixie property outside the impact area.

Noxubee County Range

In 1976 the U.S. Government filed a civil declaration for approximately 2,889 acres of land in Noxubee County, Mississippi for the SEARAY Target (DoN, 2005). Seven parcels were initially designated for fee simple interest and eight other outlying parcels were initially designated for perpetual and assignable easements. The easement provides the Government the right, power, privilege, and authority to maintain and control the premises for Government purposes, including the rights to prohibit human habitation, construction of structures of any kind, and hunting, and to post signs indicating the nature and extent of the Government's control (DoN, 2006a).

The eight easement parcels in the buffer area include commercial timber (primarily pine forest) and logging rights are granted in the easement agreements. The Government subsequently purchased an additional ~125 acres at the approach end (Parcel 4-A) as a zone to safely contain premature drops on the SEARAY Target. An additional 112 acres of forested land along the target overrun area (Parcels 7-A and 3-A) were purchased by the Navy because pine trees in that area were contaminated with 20 mm

rounds and became unusable for lumbering purposes. A RAICUZ study completed for the SEARAY Target recommended obtaining an additional parcel of 87 acres of land outside the perpetual and assignable easements areas of Navy-owned or Navy-controlled land to eliminate potential noise-level problems in rural and undeveloped land northeast of the current range boundary (DoN, 2005).

The Range Condition Assessment Report (RCA) for SEARAY Target (DoN, 2007c) indicates that the 654-acre range impact area is further subdivided into 442 acres of semi-improved vegetation managed (cleared) land in the immediate vicinity of the target and an additional 212 acres of unimproved (forested) lands to the northeast and southwest of the target. Much of the range acreage within the impact area is maintained as cleared, semi-improved space in the immediate area of the target. Firebreak roads and the main bombing circle within the main impact area on the SEARAY Target are kept free of vegetation. A 30-foot wide firebreak is disked annually around the maintained Navy property range perimeter. There are approximately 237 acres of unimproved land to the northeast and southwest of the target forested with loblolly pine and hardwood trees. The 2,235-acre SEARAY Target buffer zone is heavily vegetated and is commercially logged in coordination with NAS Meridian. The easement parcel landowners schedule timber harvest in conjunction with range maintenance activities or other scheduled non-operational range periods to reduce potential interference with Navy training activities (DoN, 2007c).

NSA Panama City Demolition Pond Area

The installation containing the NSA Panama City Demolition Pond abuts dense residential and commercial development. The unincorporated area of Bay County and the city of Panama City, Florida, have and will continue to experience rapid urban development. At this time, most of the operational activities are focused around the waterfront, which has resulted in a crowded industrial area around Alligator Bayou. In the central area of the installation, a variety of community-based activities, such as the administrative facilities, public works, and bachelor housing, are interspersed with vacant land uses. The northernmost section of the installation is dedicated to base housing activities, while the land south of Alligator Bayou is occupied by the Naval Diving and Salvage Training Center, the U.S. Coast Guard Station, Florida Fish and Wildlife Conservation Commission, and ordnance storage facilities. The south part of the installation, where Demolition Pond is located is almost completely encumbered by Explosive Safety Quantity Distance arcs and/or a non-electromagnetic operations area (DoN, 2006c).

Range Air Installations Compatible Use Zones

SEARAY Target A RAICUZ study was prepared for Noxubee County (Mississippi) Target Range SEARAY in 2005. The aircraft primarily using the range come from NAS Meridian in Mississippi. The study recommended acquiring further real estate interests to buffer the Range Safety Zone (RSZ) A and monitor land under R-4404 for any changes in land use that may be incompatible (DoN, 2005).

McMullen Range, including the Dixie and Yankee Targets The RAICUZ Study for the McMullen Range is a draft document still under development (DoN, 2006d).

3.12.3 Environmental Consequences

3.12.3.1 No Action Alternative

The Department of the Interior has been conducting environmental planning in the Gulf of Mexico, specifically relating to the effects of Outer Continental Shelf (OCS) oil and gas development since the inception of the National Environmental Policy Act in 1969. It is the policy of MMS to utilize the EIS process as an avenue for early identification, avoidance, and resolution of potential conflicts. This is accomplished through coordination with federal, state, and local agencies (to include the Navy) when developing plans for oil and gas development within the Study Area for this Final EIS/OEIS. Based on

this coordination, plans for OCS activities are either modified or amended prior to approval or disapproved. As a result conflicts with current and proposed naval activities are avoided (MMS, 2007).

McMullen County Range The stressors of aircraft overflight, and military expended materials are associated with BOMBEX (A-G) at Yankee and Dixie Targets (795 sorties) and GUNEX (A-G) at Yankee Target (163 sorties) and under the No Action Alternative, these levels will not change (See Table 2.2-4). As a result, the range will remain compatible with existing land use, existing land use plans and policies, and adjacent land use. Implementation of No Action Alternative Navy training activity in U.S. Territory would have no impact on land use at the McMullen County Range.

Noxubee County Range The stressors of aircraft overflight, and military expended materials are associated with the air-to-ground bombing at SEARAY target (12,800 sorties) and under the No Action Alternative, this level will not change (See Table 2.2-4). As a result, the range will remain compatible with existing land use, existing land use plans and policies, and adjacent land use. Implementation of No Action Alternative Navy training activity in U.S. Territory would have no impact on land use at the Noxubee County Range.

NSA Panama City Demolition Pond Area The stressors of aircraft overflight are not applicable to the NSA Panama City Demolition Pond Area. Under the No Action Alternative annual training at the pond is conducted for 90 days and a total of 1,374 lbs net explosive weight (NEW) of military expended materials are annually expended, these levels will not change. The pond will remain compatible with the existing land use, existing land use plans and policies, and adjacent land use. Implementation of No Action Alternative Navy training activity in U.S. Territory would have no impact on land use at the NSA Panama City Demolition Pond Area.

3.12.3.2 Alternative 1

McMullen County Range If Alternative 1 were chosen for implementation, the McMullen County Range stressors (aircraft overflight, and military expended materials) would remain the same as baseline levels. There would be no change in land use compatibility, compatibility with land use plans and policies, or adjacent land use. Alternative 1 Navy training activity in U.S. Territory would have no impact on land use at the McMullen County Range.

Noxubee County Range If Alternative 1 were chosen for implementation, SEARAY Target stressors of aircraft overflight, and military expended materials would remain the same as baseline levels. There would be no change in land use compatibility, compatibility with land use plans and policies, or adjacent land use. Alternative 1 Navy training activity in U.S. Territory would have no impact on land use at the Noxubee County Range.

NSA Panama City Demolition Pond Area If Alternative 1 were chosen for implementation, the annual training at the pond would be conducted for 90 days annual and the expended NEW would remain the same as the No Action Alternative level. The pond will remain compatible with the existing land use, existing land use plans and policies, and adjacent land use. Alternative 1 Navy training activity in U.S. Territory would have no impact on land use at the NSA Panama City Demolition Pond Area.

3.12.3.3 Alternative 2 (Preferred Alternative)

McMullen County Range The proposed activities associated with Alternative 2 at McMullen County Range would be the same as those assessed for Alternative 1. Proposed activities and associated stressors of aircraft overflight and military expended materials for McMullen County Range under Alternative 2 are the same as those proposed under the No Action Alternative and Alternative 1. There is no change to compatibility of land use, compatibility of land use plans and policies, or compatibility

of adjacent land use. Alternative 2 Navy training activity in U.S. Territory would have no impact on land use at the McMullen County Range.

Noxubee County Range The proposed activities associated with Alternative 2 at McMullen County Range would be the same as those assessed for Alternative 1. Proposed activities and associated stressors of aircraft overflight and military expended materials for SEARAY Target under Alternative 2 are the same as those proposed under the No Action Alternative and Alternative 1. There is no change to compatibility of land use, compatibility of land use plans and policies, or compatibility of adjacent land use. Alternative 2 Navy training activity in U.S. Territory would have no impact on land use at the Noxubee County Range.

NSA Panama City Demolition Pond Area If Alternative 2 were chosen for implementation, the training at the pond would be conducted for 90 days annually while the NEW would decrease to 1,311 lbs., the same as Alternative 1. The Demolition Pond would remain compatible with the existing land use, existing land use plans and policies, and adjacent land use. Alternative 2 Navy training activity in U.S. Territory would have no impact on land use at the NSA Panama City Demolition Pond Area.

3.12.4 Unavoidable Significant Environmental Effects

Based on the proceeding analysis, there are no unavoidable significant environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.12.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.12-2, there would be no impact to land use if the No Action Alternative, Alternative 1, or Alternative 2 were chosen for implementation.

TABLE 3.12-2
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Aircraft Overflight (Disturbance)	Continuation of activities at McMullen County Range, SEARAY Target, and NSA Panama City Demolition Pond Area will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use.	Offshore activities are not assessed in this section and potential harm in non-territorial waters is not applicable to this section.
Military Expended Materials		

TABLE 3.12-2 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Impact Conclusion	Naval activities at McMullen County Range, Noxubee County Range and NSA Panama City Demolition Pond Area would have no impact on land use within the U.S. Territory.	Offshore activities are not assessed in this section and potential harm in non-territorial waters is not applicable to this section.
Alternative 1		
Aircraft Overflight (Disturbance)	Activities proposed under Alternative 1 at McMullen County Range, Noxubee County Range, and NSA Panama City Demolition Pond Area will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use.	Offshore activities are not assessed in this section and potential harm in non-territorial waters is not applicable to this section.
Military Expended Materials		
Impact Conclusion	Naval activities in U.S. Territory would have no impact on land use at McMullen County Range, Noxubee County Range, or NSA Panama City Demolition Pond Area under Alternative 1.	Offshore activities are not assessed in this section and potential harm in non-territorial waters is not applicable to this section.
Alternative 2		
Aircraft Overflight (Disturbance)	Activities proposed under Alternative 2 at McMullen County Range, Noxubee County Range, and NSA Panama City Demolition Pond Area will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use.	Offshore activities are not assessed in this section and potential harm in non-territorial waters is not applicable to this section.
Military Expended Materials		
Impact Conclusion	Naval activities in U.S. Territory would have no impact on land use at McMullen County Range, Noxubee County Range, or NSA Panama City Demolition Pond Area under Alternative 2.	Offshore activities are not assessed in this section and potential harm in non-territorial waters is not applicable to this section.

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3.13 CULTURAL RESOURCES

3.13.1 Introduction and Methods

The GOMEX Range Complex covers a vast geographic area where some prehistoric sites may date back as far as 12,000 years, and historic sites in the complex date as far back as the early 1500s (Milanich and Fairbanks, 1980). Because of the wide variation in environments and geomorphology, the types and ages of sites also vary. For these reasons, the Affected Environment discussion is divided into: 1) Cultural Resources in the Offshore OPAREAs (Pensacola,, Panama City, New Orleans, and Corpus Christi); and 2) Cultural Resources at the GOMEX Range Complex Land Ranges (McMullen County and Noxubee County Ranges and the NSA Demolition Pond).

Cultural resources include prehistoric and historic sites, structures, objects, landscapes, and ethnographic resources, as well as other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources are typically discussed in terms of archaeological sites, including both prehistoric and historical occupations, architectural resources, and locations of concern to Native American groups, including Traditional Cultural Properties.

Regulatory Framework

Procedures for the identification, evaluation, and treatment of cultural resources are contained in a series of federal and state laws and regulations and agency guidelines. Archaeological, architectural, and Native American resources are protected by a variety of laws and their implementing regulations: the National Historic Preservation Act (NHPA) of 1966 as amended in 2000; the Archeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979; the American Indian Religious Freedom Act of 1978; the Native American Graves Protection and Repatriation Act of 1990; the Submerged Lands Act of 1953; the Abandoned Shipwreck Act of 1987; the Sunken Military Craft Act; and OPNAVINST 5090.1B. The Advisory Council on Historic Preservation (ACHP) further guides treatment of archaeological and architectural resources through the regulations, Protection of Historic Properties (36 CFR 800). Historic properties, as defined by the NHPA, represent the subset of cultural resources listed on, or are eligible for, inclusion on the National Register of Historic Places (NRHP). Additional regulations and guidelines for shipwrecks include 10 USC 113, Title XIV for the Sunken Military Craft Act; the Abandoned Shipwreck Guidelines prepared by the National Park Service (NPS, 2007); and the Guidelines for Archaeological Research Permit Applications on Ship and Aircraft Wrecks under the Jurisdiction of the Department of the Navy (36 CFR 4, Part 767) overseen by the Naval Historical Center.

Consultation with the State Historic Preservation Officers of Florida, Alabama, Mississippi, Louisiana, and Texas, American Indian tribes, and with the public and state and federal agencies as required by Section 106 of the NHPA and by government-to-government consultation required by EO 13007 would be accomplished as part of the NEPA process. No sites associated with federally recognized American Indian tribes were identified for this project (see Appendix G) for contact letters.

3.13.1.1 Assessment Methods and Data Used

This Final EIS/OEIS evaluates project effects on significant cultural resources; *e.g.*, historic properties listed in or eligible for inclusion in the NRHP. (The term "historic properties" is synonymous for NRHP-eligible or listed prehistoric, historic, or traditional cultural resources.) Cultural resources not formally evaluated may also be considered potentially eligible (i.e., a Consensus Determination in consultation with the SHPO) and, as such, are afforded the same regulatory consideration as listed properties.

Historic properties must meet one or more of the NRHP criteria defined at 36 CFR 60.4. That is, properties must:

- Be associated with events that have made a significant contribution to the broad patterns of American history; or
- Be associated with the lives of persons significant in the American past; or
- Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Yield, or may be likely to yield, information important in prehistory or history.

A historic property also must possess integrity of location, design, setting, materials, workmanship, feeling, and association to qualify for the NRHP. Unfortunately, very few shipwrecks within the APE have been fully documented or evaluated for their NRHP significance, so for purposes of this Final EIS/OEIS, all unevaluated shipwrecks are considered potentially eligible for inclusion on the NRHP.

Data Used. Information on the locations of resources, the probability of affecting currently unknown resources, general prehistory and history of the area, and ethnographic concerns was obtained from various sources including the ICRMP NSA Panama City (DoN, 2005b); Cultural Resources Overview for Gulf of Mexico Range Complex (DoN, 2005a); Draft Phase I Archaeological Survey of Dixie Target and the Operations Center, McMullen Range Complex, McMullen County, Texas (DoN, 2006), Tiller's Guide to Indian Country: Economic Profiles of American Indian Reservations (2005); and Final Phase I Archaeological Survey of the SEARAY Target Range, Noxubee County, Mississippi (DoN, 2007a). Other sources are as cited.

Information on underwater archaeological resources obtained from the respective SHPOs is substantially refined and locations have been verified. This information is specifically excluded from the Freedom of Information Act in accordance with Section 304 of the NHPA. Numbers of shipwrecks used in this Final EIS/OEIS are estimates compiled from information obtained from these sources. No comprehensive underwater surveys have been completed for the area of potential impact, and data changes are made yearly as additional discoveries are made. When the Navy conducts analysis of these resources in relation to Navy operations and potential mitigation measures, public disclosure of these sites will not occur unless permission is expressly given. Warfare Areas and Associated Cultural Resources Stressors

Much of the GOMEX Range Complex consists of sea and airspace where there is limited potential for affects to cultural resources. However, prehistoric and historic archaeological resources, structures and historic districts, and traditional cultural resources may be vulnerable to a variety of training operations ("stressors"). For example:

- Shipwrecks and underwater or coastal archaeological sites and structures could inadvertently be damaged by EOD activities, bomb drops, gunnery exercises, or anchoring.
- Sites on land could be damaged by explosions (at NSA Panama City only), direct strike from practice bombs, gun fire or other expendable materials.

Aspects of the proposed action with the potential to act as stressors to cultural resources were identified by conducting an analysis of the warfare areas, operations, and specific activities included in the alternatives. A listing of potential stressors is presented in Table 3.13-1.

TABLE 3.13-1
SUMMARY OF POTENTIAL STRESSORS TO CULTURAL RESOURCES

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**High Explosive Ordnance**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Mine Warfare (MIW)					
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B		✓	✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓	✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓	✓	✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Boat)	Panama City OPAREA	✓		✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Boat)	Corpus Christi UNDET BOX E3	✓	✓	✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓			
MSO to include VBSS/MIO- Helo	W-151/W-155	✓			

TABLE 3.13-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO CULTURAL RESOURCES

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**High Explosive Ordnance**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓	✓	✓	
Air Warfare (AW)					
Air Intercept Control (AIC)	W-151; W-155				
Strike Warfare (STW)					
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target			✓	
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓	✓	
Amphibious Warfare (AMW)					
Firing Exercises (FIREX) with IMPASS (No live 5")	W-151A/B; W-155A				
Electronic Combat (EC)					
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A			✓	
Chaff Exercises (CHAFFEX)	Brownwood MOAs			✓	
Flare Exercises (FLAREX)	W-155A/B				
Flare Exercises (FLAREX)	Brownwood MOAs				
Mission Area Training[47]					
Mission Area Flight Training	W-92; W-54; Brownwood MOAs				
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312			✓	
Salvage Diver Training	NSA Panama City Demolition Pond			✓	
EOD Tech Training	NSA Panama City Demolition Pond			✓	

[47] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

3.13.2 Affected Environment

Most of the cultural influences and relationships among the Gulf Coasts of Florida, Mississippi, Louisiana, Texas and the surrounding regions appear to have come from the north and northwest as peoples moved into or across the region and adapted to new or local conditions (Milanich and Fairbanks, 1980:16). Large river systems afforded early residents access to more northern areas, helping to spread cultural influences, and the coast line made access toward the west and the Mississippi River possible (Milanich and Fairbanks, 1980:24).

During the Paleoindian period, sea levels were much lower and cooler temperatures and semi-arid conditions prevailed. Some of these early sites submerged by the rising level of water during the postglacial period occur in the shallow waters of the Gulf adjacent to coastlines.

Dryer climates and rising sea levels during the Archaic contributed to increased population pressures and new food sources, accompanied by corresponding changes in tools and social groupings. Much of the Gulf Coast consists of a coastal strand (ocean, beach, and dunes) and a lagoon system. The open beaches were not a favored spot for prehistoric habitation but the area just beyond and behind the high dunes contained lagoons or marshes. Fed by drainage from the interior and sheltered from coastal winds, these areas offered a broad, rich range of resources to Archaic and later peoples.

During the Mississippian period, prehistoric Northwest Florida cultures came to resemble the complex chiefdoms and social and political systems of southeastern Mississippian cultures. These cultural similarities reflect contacts to the north with other emerging Mississippian peoples that brought new ideas to the Florida tribes. It appears the Apalachee Indians encountered by Spanish expeditions in Northwest Florida in the early 1500s correspond to these peoples who left behind large coastal shell and refuse middens and temple mounds along the coast lines, bays and estuaries, like those sites found at Panama City.

Spanish explorers entered the Gulf of Mexico area during the 1500s, exploring the territory known as *La Florida*. Although the gold sought by the Spanish expeditions failed to materialize, the Spaniards established military settlements to solidify their claims on the New World and to make the area safe for Spanish navigation (Florida Department of State, 2008). The Gulf of Mexico itself was the "scene of intense competition in North America" from the 1600s well into the early 19th century (Louisiana Department of Culture, 2008). The French and Indian War (1753/4-1763) and the subsequent Peace of Paris established the world stage for the continuing geopolitical struggle for land, power, and resources in the region that would end with possession of the GOMEX coastal areas by the United States, and decimation, pacification, and removal of North America's Aboriginal peoples (Anderson 2005:228-229).

3.13.2.1 Cultural Resources in the GOMEX OPAREAS

Panama City and Pensacola OPAREAs. Shipwrecks are a cultural resource that can be affected by Navy operations. As shown in Section 3.6, Figure 3.6-6 depicts shipwrecks within the various OPAREAs. This figure is adapted from the *Final Marine Resources Assessment for the Gulf of Mexico* (DoN, 2007c), which also provides background on some of these wrecks. The following discussion is taken from this assessment.

Many of these shipwrecks in the Panama City and Pensacola OPAREAS vicinity resulted from navigational hazards such as reefs and shoals. Shipwrecks are more frequent in areas of intense maritime traffic such as approaches and entrances of seaports and the mouths of navigable rivers and straits (MMS, 2002 cited in DoN, 2007c). Other shipwrecks in GOMEX are the result of intentional sinking during armed conflicts such as the Civil War and World War II. More recently, some decommissioned ships have been sunk as part of artificial reefs.

Beginning with Spanish Exploration in the 15th century and continuing into the modern age of shipping and commerce, more than 400 ships have sunk on the outer continental shelf of the GOMEX, and thousands more lie closer to shore in state waters. Two-thirds of the total number of shipwrecks occur within 1.5 km of the shoreline; the rest are located between 1.5 and 10 km of the coast. Most shipwrecks in the GOMEX are in the eastern Gulf, and the most well known shipwrecks date to the 1800s and 1900s (DoN, 2007c).

More than 500 shipwrecks occur off Florida's coast in the GOMEX area in state waters (213 along the west coast and 297 off the Florida Panhandle). Most of the approximately 77 shipwreck sites within the Panama City OPAREA are in shallow water with depths ranging from 32.8 to 295.2 feet deep. The remaining shipwrecks are located in deeper waters ranging from 328 to 2,952 feet deep (Figure 3.6-6). There are approximately six shipwrecks in near proximity to the Panama City MINEX Boxes, all these wrecks are located at depths of 2.8 to 295.2 feet deep.

Documentation of shipwrecks of the sixteenth through the eighteenth centuries is rarely accurate so these shipwrecks are much less well known. Many Confederate blockade-runners, as well as other Union and Confederate vessels were sunk during the Civil War; most of these, including the *Spitfire* and the *Mary Jane* were sunk in Florida state waters (Singer 1998 cited in DoN, 2007c).

A notable shipwreck near Panama City is the Tarpon, which was originally commissioned in 1896 under the name *Naugatuck*, and was upgraded and renamed the *Tarpon* in 1903 (Florida Department of State, 1997). The *Tarpon* was purchased in Philadelphia in 1903 and was in operation for nearly 30 years as a reliable cargo ship that commonly transported people and goods along the Florida gulf coast where roads and highways did not exist. The *Tarpon* sunk in 1937 due to rough seas and human error; the shipwreck is nearly eight miles off shore in the Panama City OPAREA (Florida Department of State, 1997).

Some of the 56 vessels sunk by German submarines during World War II are located in state or federal waters off the coast of Florida (MMS, 2002 cited in DoN, 2007c). The *USS Massachusetts* is located south of the Pensacola pass shoreline and north of the Pensacola OPAREA. The *USS Massachusetts* is one of the oldest American battleships and was officially commissioned by the Navy in 1896 (Florida Department of State, 2008). With nearly 30 years of service, the battleship was decommissioned in 1919 and was sunk in 1921 to be used as a target for military operations (Florida Department of State, 2008). The ship lies in approximately 26 feet of water and is frequented by numerous divers.

Shipwrecks along the coastlines generally are less well preserved that those found in deeper water because of biological, mechanical, and chemical erosion. That is, wrecks are scoured by the abundant fluvial sediments driven by coastal currents and heavy wave action. Ferrous metal oxidation is accelerated by elevated seawater temperature, and shipworms consume wooden ship members (MMS, 2001, 2002a cited in DoN, 2007c). Deep water wrecks are better preserved because the lower seawater temperatures at depth slow the oxidation of ferrous metals and eliminate wood-eating shipworms. Because deep water wrecks are likely to be better preserved and less disturbed, they are more likely to be eligible for nomination as archaeological sites than are wrecks in shallower waters (MMS 2001, 2002a cited in DoN, 2007c).

As a result of German submarine activity during WW II, ships were torpedoed and sunk in the Panama City and Pensacola OPAREAS. Some of these ships may be associated with loss of life. As these shipwrecks may contain human remains, they are considered war grave sites.

A literature review was undertaken for the eight potential Bottom Impact areas (Panama City Harbor Security Group Machine Gun Range, Panama City MINEX boxes Echo, Foxtrot, Golf, Lima, Mike, and November, and the Pensacola BOMBEX Hot Box) in the Panama City and Pensacola OPAREAs

(Southeastern Archaeological Research, Inc. [SEARCH], 2009). Review of available databases identified no shipwrecks, obstructions, hangs, navigational aids, or unknown soundings within the Panama City Harbor Security Group Machine Gun Range or the six Panama City MINEX boxes (SEARCH, 2009). Six known wreck sites (*Gandy Dancer*, *Bachelors II*, *James C. Clifford*, *Vila Y. Hermano*, *Ingram* barge, and an unknown vessel), a damaged or lost oil/gas rig (Rig *Zapata Yorktown*), one obstruction (Fish Haven PT 4), and one artificial reef occur within the Pensacola BOMBEX Hot Box. However, only the *James C. Clifford* (built 1886, abandoned 1909), the *Vila Y. Hermano* (lost 1905), and the unknown wreck are considered historic shipwrecks; the remainder are modern (SEARCH, 2009). Results of the predictive model indicate that the Pensacola BOMBEX Hot Box has the highest potential for submerged cultural resources within all Potential Bottom Impact Areas within the Panama City and Pensacola OPAREAs (SEARCH, 2009). All of the MINEX boxes located off Panama City have an extremely low potential for containing potentially significant submerged cultural resources (SEARCH, 2009).

Because no comprehensive survey or evaluation of submerged resources has occurred in the Study Area and the area is considered high to low probability for shipwrecks, additional shipwrecks are likely to occur, and some existing and new shipwrecks could be considered eligible for the NRHP.

The locations of known shipwrecks as identified in the literature review prepared by SEARCH, Inc. will be provided to Navy operators so these resources may be avoided during training activities. As previously discussed, exact locations of these resources are considered sensitive information and specifically excluded from public dissemination under Section 304 of the NHPA.

New Orleans OPAREA. Because the New Orleans OPAREA under consideration in this Final EIS/OEIS is some distance at sea outside the New Orleans land area, shipwrecks are the only cultural resources discussed for this OPAREA.

Shipwrecks abound in the waters around Louisiana's coastline (Figure 3.6-6). However, within the New Orleans OPAREA, three shipwrecks occur in the 3,280 to 6,232 feet deep range, while the remaining two shipwrecks are located in the range of 32.8 to 295.27 feet deep. The two shipwrecks in the shallower water of the OPAREA are also near the shelf break.

One of the vessels sunk off the Louisiana coast is the *El Cazado*, sunk in 1784. The *El Cazado* was discovered when it was inadvertently snagged by a fishing boat in 1993 off Grand Isle, Louisiana. This vessel had been sent by Spain from New Orleans to pick up Mexican coins for Spanish holdings in Louisiana to help stabilize their currency (Broad, 1993).

During World War II (1942 and 1943), German submarines entered the Gulf in an attempt to disrupt the vital flow of oil carried by tankers from ports in Louisiana and Texas (MMS, 2002 as cited in DoN, 2007c). Of the 56 vessels sunk by the Germans, 39 are believed to be in state or federal waters off Texas, Louisiana, and Florida (Figure 4-5; MMS, 2002). The only German submarine sunk in the Gulf was the U-166; it lies in 1,524 m of water 83 km from the mouth of the Mississippi River, along with its target, the passenger freighter S.S. *Robert E. Lee* (MMS 2002a cited in DoN, 2007c).

Vessels also have been found in the deep water portions of the Gulf of Mexico. Such wrecks include a copper-clad vessel located at 2650 feet below surface (thought to be a historic naval vessel), the steam yacht *Anona* sunk in 1944 and found at about 4,000 feet deep, and World War II wrecks, some at depths greater than 5,000 feet (MMS, 2008). Deepwater archaeological investigations are currently in progress at the Mardi Gras Shipwreck. This ship (of unknown identity) sank perhaps 200 years ago in the Gulf of Mexico some 35 miles off the coast of Louisiana where it lies buried beneath about 4,000 feet of water. However, of the hundreds of shipwrecks along the Louisiana, only five or six have been identified within or near the New Orleans OPAREA (Figure 3.6-6).

As a result of German submarine activity during WW II, ships were torpedoed and sunk in the New Orleans OPAREA. Some of these ships may be associated with loss of life. As these shipwrecks may contain human remains, they are considered war grave sites.

Corpus Christi OPAREA. The Corpus Christi OPAREA is an offshore area adjacent to NAS Corpus Christi and NS Ingleside. There are approximately 45 shipwreck locations within the Corpus Christi OPAREA, and several known shipwrecks occur between the western boundary of the Corpus Christi OPAREA and the shore line (Figure 3.6-6). Of these shipwrecks, two are located in deep water 328 to 2,952 feet deep, while the remaining shipwrecks occur in shallower waters (32.8 to 295.27 feet deep). The greatest extent of shipwrecks is in the western portion of the OPAREA, which is also the shallowest (32.8 to 295.27 feet deep).

A literature review was undertaken for the six potential Bottom Impact areas (Corpus Christi MINEX Boxes A, B, C1, C2, D, and E3) in the Corpus Christi OPAREA (SEARCH, 2009). Review of available databases identified three vessels (*Hill*, *Miss Anita Bryant*, and *Ocean Bride*), one object, and at least 37 hangs occur within the Corpus Christi MINEX boxes. The *Hill* (built 1946) and the *Ocean Bride* (built 1928) are considered historic shipwrecks; the *Miss Anita Bryant* is modern (SEARCH, 2009). Application of the predictive model indicates that six Potential Bottom Impact Areas have a moderate to low potential to contain submerged cultural resources (SEARCH, 2009). Corpus Christi MINEX Boxes C1 and D have a moderate potential for submerged cultural resources. The remaining Corpus Christi MINEX Boxes (A, B, C2, and E3) have a low probability for historic shipwrecks (SEARCH, 2009).

Because no comprehensive survey or evaluation of submerged resources has occurred in the Study Area and the area is considered low to moderate probability for shipwrecks, additional shipwrecks are likely to occur, and some existing and new shipwrecks could be considered eligible for the NRHP.

The locations of known shipwrecks as identified in the literature review prepared by SEARCH, Inc. will be provided to Navy operators so these resources may be avoided during training activities. As previously discussed, exact locations of these resources are considered sensitive information and specifically excluded from public dissemination under Section 304 of the NHPA.

3.13.2.2 Cultural Resources in the GOMEX Land Ranges

NSA Panama City Demolition Pond. NSA Panama City is located on a 648-acre parcel on the west side of St. Andrew Bay. Most early explorers bypassed the St. Andrew Bay area, thinking it was merely the entrance to a small river. During the 1820s, wealthy plantation owners came to this area to summer beside the sea, but later, during the Civil War, the few cottages at Old Town St. Andrews were destroyed by a federal attack. In 1885, the area was promoted for potential citrus production by the St. Andrews Railroad, Land and Mining Company (which was never extended to the area), and numerous lots were sold nationwide. With the coming of the Atlanta & St. Andrews Bay Railway Company in 1906, the area began to grow and in 1909 became Panama City, named after the Panama Canal (Panama City Centennial Celebration, 2008). NSA Panama City includes numerous structures and buildings, including offices, warehouses, laboratories, *etc*. None of these are listed on or eligible for the NRHP (DoN, 2005b).

However, the Panama City area is highly sensitive for prehistoric archaeological resources. Some of the sites here were the first in North America to be subject to intensive excavations, and include sand burial mounds and other similar resources. The area's numerous archaeological investigations are itemized in the Cultural Resources Overview (DoN, 2005a). Six archaeological sites are eligible for the NRHP: Holley Mound (8BY1), Sowell Mound (8BY3), Dummond Magazine (8BY4), Marina (8BY58), Plant (8BY71), and Non-Magnet Old Inlet (8BY844). The majority of these sites occur near St. Andrews Bay.

Noxubee County Range. The SEARAY Target Range occupies 2,889 acres in Noxubee County, Mississippi, about 35 miles north-northwest of NAS Meridian. SEARAY Target Range is an active air-to-ground range using inert (practice) ordnance, and is a subordinate facility to NAS Meridian. The target range is an irregularly shaped clearing within a wooded area. The center portion of the target has been cleared down to bare earth in an arrow shape.

Paleoindian groups likely entered this area at least 10,000 years before present, but Noxubee County and the upper Tombigbee River appear to have been peripheries of the more intensively occupied region to the northeast. By the Late Paleoindian period, regionalization increased, along with use of local raw materials for manufacture of stone tools. The warmer dryer climatic conditions of the Archaic Period (8000 to 500 B.C.) contributed to increases in population and decreases in mobility, along with use of a wider variety of food resources and tools. The production of pottery marks the beginning of the Gulf Formational Period (1000 B.C. to 100 B.C.). During the subsequent Woodland period (100 B.C. to A.D. 1100) cord and fabric marked pottery, burial mound ceremonialism, increased trade, and corn horticulture accompanied the regional emergence of more complex societies.

From about A.D. 1100 to 1540 (the Mississippian Period), complex agricultural chiefdom societies developed in the floodplains of the southeastern United States. These societies were "characterized by an elaborate, stratified social system, the construction of large ceremonial mounds, and the presence of mostly plain, crushed mussel shell-tempered ceramics" (DoN, 2007a).

The Protohistoric Period (A.D. 1540 to 1762) reflects the time period between the earliest exploration and first permanent settlement by Europeans. In 1540, Spanish explorer Hernando DeSoto and his army were the first recorded Europeans to enter what would become the state of Mississippi. The French began to explore areas of Mississippi in the late 1600s, and established forts and settlements throughout the area. However, by the time France ceded Mississippi to the British in 1763 as part of the Treaty of Paris, Native hostilities had reduced French settlement in Mississippi to locations along the Gulf Coast (DoN, 2007a).

After the War of 1812, an influx of settlers originating in Tennessee and northern Alabama moved into the area and in 1817, the Mississippi Territory was divided into the Alabama Territory and the State of Mississippi. Pressured to allow settlers into traditional tribal lands, the Choctaw and Chickasaw signed away their land claims between 1820 and 1832. Subsequently these groups were "removed" and resettled in Indian Territory, much of which later became the state of Oklahoma. Over the next century, Noxubee County grew, mostly due to the fertile soil and network of rivers that provided transportation of goods and people.

Meridian became an air station in 1968, and SEARAY Target Range opened in 1975 to "provide tactical fighter pilots a training facility for the delivery of munitions" and to "train student pilots and navigators in the delivery of air-to-ground munitions" (DoN, 2007d:1). The area surrounding SEARAY Target Range is sparsely settled and is primarily used for forestry-related activities.

The SEARAY Target Range has been included in the Integrated Cultural Resources Management Plan for NAS Meridian, and an archaeological survey was conducted in 2006 (DoN, 2007a). SEARAY Target Range has experienced a high level of ground disturbance caused by historic logging, and by range construction, use, and maintenance activities. It is unlikely that intact archaeological resources are present within the project area, and given the level of disturbance documented in the field, additional unidentified NRHP-eligible archaeological resources are not anticipated to be present at the range. There are no historic structures or buildings within the range.

McMullen County Range. The McMullen County Range is located in southwestern McMullen County, 54 miles northwest of NAS Kingsville. The Range was established in 1966 to replace the

decommissioned Padre Island Ranges on the Texas coast. The area surrounding the range is largely composed of ranchland interspersed with oil fields.

The 10,625-acre range is composed of two separate targets, Yankee Target on the north and Dixie Target to the south. The ranges are nine miles apart on opposite sides of the Nueces River and are used for training in air-to-surface gunnery and inert ordnance delivery.

The Yankee Target is owned by the Navy but is maintained by the Air Force; the target consists of a range of three targets in a large rectangle visible from the air. It does not appear that any cultural resource surveys have been conducted at the Yankee Target, so the status of archaeological and architectural sites at this area is unknown.

The Dixie Target is owned by the Navy and is managed by NAS Kingsville. The Escondido Ranch, also managed by NAS Kingsville, is directly adjacent to the Dixie Target. A phase I archaeological survey was conducted by Versar, Inc. in 2006 to locate and identify archaeological resources in 1,735 acres of Dixie Target owned by the Navy and in the 2.3-acre Operations Center, as well as to provide preliminary recommendations of NRHP eligibility for any identified resources (DoN, 2006). The survey recorded thirty-nine prehistoric archaeological sites and 16 isolated finds (also prehistoric); these sites consisted of low density lithic artifact scatters dating from the Early Archaic period (as early as 6000 B.C.) through the latter end of the Late Prehistoric period (A.D. 1500). All the sites had been subject to severe erosion, and in each case, depositional contexts had been compromised. Recommendations in the archeological survey report suggest that none of the sites are eligible for the NRHP, but the evaluation process is still underway. The only standing structures on the property appear to be two observation towers and a control tower associated with the circular "bulls-eye" target in the center of the property. These structures date to 1966 or later.

Tribes formerly affiliated with the McMullen County, Texas area include the Mescalero Apache Tribe of the Mescalero Reservation, New Mexico, and the Lipan Apache Tribe and its various bands who now reside mainly in New Mexico and Texas. Historically, by about 1740, Apache groups had been forced south and west on the Great Plains. As pressure from settlers and from other tribes such as the Comanche increased, the Mescalero Apache moved west into what had been the homeland of the Jumano. The Lipan Apache groups went south into the south Texas region once occupied by the Coahuiltecan cultures and into part of the western end of the Karankawa lands.

3.13.3 Environmental Consequences

An undertaking is considered to have an effect on a historic property when the undertaking may alter characteristics of the property that may qualify it for inclusion in the NRHP. An effect is considered adverse when it diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Adverse effects as defined by Section 106 of the NHPA include, but are not limited to:

1. Physical destruction, damage, or alteration of all or part of the property;
2. Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the NRHP;
3. Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
4. Neglect of a property resulting in its deterioration or destruction; and
5 Transfer, lease, or sale of the property (36 CFR 800.5 (a)(2)).

For the purposes of this Final EIS/OEIS, a significant impact under NEPA is defined as an unresolvable "adverse effect" under Section 106 of the NHPA. Section 106 criteria of adverse effect were applied to cultural resources that could be affected by the project, and ways were considered to avoid, minimize, or mitigate adverse effects as described below.

Note that adverse effects under the National Historic Preservation Act (NHPA) also include reasonably foreseeable effects caused by the alternatives, and those that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5(a)(1)). Because cultural resources are nonrenewable, all adverse effects on NRHP-eligible cultural resources in the GOMEX Study Area, as addressed in this Final EIS/OEIS, would be long term.

Impacts to archaeological sites, specifically shipwrecks, may include, but not be limited to, physical disturbance through collision impacts from underwater equipment, vibration from HE detonations, and removal of shipwreck features and artifacts. Any physical disturbance in the area of an NRHP-eligible or potentially eligible archaeological site, or modification to such a site, can affect the physical integrity of that cultural resource, resulting in alteration or destruction of those characteristics or qualities which make it potentially eligible for inclusion in the NRHP and thus, would be an adverse effect under Section 106 of the NHPA.

Previous research indicates that aircraft noise vibration on historic structures would have little potential for structural damage to historic structures (FAA, 1985). Also, because the Navy does not allow jets to travel over land at speeds that could cause sonic booms, the potential for damage is further reduced. Thus, the topic of noise vibration on cultural sites was not evaluated under "Cultural Resources."

3.13.3.1 No Action Alternative

OPAREAs. Navy training could have an impact on submerged cultural resources if significant disturbance of the ocean bottom occurs in the vicinity of an underwater archeological site or shipwreck. Training activities that have the potential to affect shipwrecks and submerged cultural sites include: airborne and surface mine countermeasures exercises (MCM), mine neutralization or explosive ordnance disposal (EOD), and bombing exercises (BOMBEX). MCM events may be launched from a ship (SMCMEX) using a mechanical sweep or a remotely operated vehicle (ROV), or may involve a helicopter with minesweeping and mine hunting gear (AMCM) using one of several systems.

In the airborne exercise, the helicopter typically flies low over the surface of the water while towing the appropriate system, which may be towed on the surface and/or down to a depth of 150 feet or less. The towed sled cuts the mine loose and then is streamed for recovery. The freed mine is neutralized using an explosive charge.

Shipboard SMCMEX exercises use mechanical, magnetic, and acoustic devices to seek and sweep moored and bottom mines. The AN/SLQ-38 uses a mechanical sweep from the ship to seek moored mines, and cut them loose with cutters attached to the diverted sweep wire. The AN/SLQ-48 system uses a ROV to identify and render mines safe. The ROV is tethered to the ship; it places an explosive destructive charge on bottom mines or cuts the cables of moored mines so they can be rendered harmless.

To ensure the integrity of shipwrecks in OPAREAS, the Navy uses several protective measures, including avoidance of known wrecks when conducting exercises such as mine detection and identification, mine laying, or demolition that could affect the sea bottom or reef structures where shipwrecks may be found.

To identify known wrecks in an area scheduled for exercises, the Navy would seek out and maintain current shipwreck location information from the Minerals Management Service, NOAA, and other similar sources. Known wrecks located within or near training areas where activities could impact the sea floor would be evaluated to determine their NRHP eligibility; eligible historic properties would be avoided, and/or mitigation measures would be developed in consultation with the appropriate SHPO and the ACHP.

In areas where sea floor impacts may be anticipated, and where it appears there may be historic properties present, remote sensing surveys would be implemented, and wrecks would be avoided during operations. Wherever possible, the Navy uses legal measures to protect sunken U.S. Naval vessels from looting and destruction.

Under the No-Action Alternative, a total of 20 AMCM exercises per year (using MD54 NEW) are conducted in the Corpus Christi and Panama City OPAREAs (10 in each area). SMCMEX events using mechanical sweeps and remotely operated vehicles total 12 events per year each in Corpus Christi and Panama City OPAREAs. These various mine location events have the potential to damage shipwrecks. For example, if personnel are unaware of the locations of shipwrecks in the OPAREA, the towed system and attachment cable or the tethered ROV system could inadvertently encounter, snag, and damage a shipwreck or structural remains such as sunken aircraft, docks, *etc.* where they may be situated in relatively shallow water and/or at low tide. Both Panama City and Corpus Christi OPAREAs have numerous underwater cultural resources (Figure 3.6-6). In summary, vessel movements and towed or mechanical sweep mine warfare devices would have the potential for long-term, direct, minor adverse effects (*no adverse effect* under Section 106*)* to shipwrecks and other submerged cultural resources if the tether or other parts of the device encounter the cultural resource during the sweep. The potential for damage would be slightly increased when seeking bottom mines. Because of preventative measures (above), encounters with shipwrecks would be rare.

Under the No Action Alternative, explosive ordnance disposal (EOD) units or devices would use explosive charges (up to 60 pounds NEW for ROV vehicles) to destroy or neutralize simulated mines. Mine neutralization training also would include use of explosive charges to neutralize simulated mines, and may involve the detonation of explosive charges equivalent to up to 20 pounds of TNT. Under the No Action Alternative, the total number of EOD training exercises at Panama City OPAREA is 18; charges range from five pounds NEW to 20 pounds NEW (most events would use 5 pound charges). At the Corpus Christi OPAREA there would be a total of 47 events using five, 10, and 20 pound NEW charges, with most in the 10 pound NEW category.

Because of the properties that allow water to rapidly transmit shock waves, such charges could damage cultural sites in the vicinity depending on the NEW, the distance from the detonation, area topography, and numerous other factors. Underwater detonation also may leave behind a blast hole that could, potentially, affect submerged resources. Research indicates that "hydrodynamic forces affect the spatial distribution of exposed artifacts and therefore disturb horizontal stratigraphy and artifacts" (Stojanowski, 2002). Water and debris churned up by MCM could contribute to such adverse effects. Preplanning and implementation of protective measures (especially avoidance) prior to initiation of exercises would help prevent resource damage. As part of Navy protective practices, mines would not be inserted in areas containing known shipwrecks or submerged resources. There is a limited potential for damage to submerged cultural resources from use of explosive charges (*e.g.*, long-term, direct, minor adverse effects on cultural resources in selected areas; this is a *no adverse effect* finding under Section 106).

BOMBEX at-sea training using live munitions also has the potential to affect submerged cultural resources should a bomb stray from the target and land near a shipwreck or other submerged resource.

Out of 37 BOMBEX events listed under the No Action Alternative, 13 use live ordnance (*e.g.*, twenty-eight 500 pound NEW bombs and twenty-four 1000 pound NEW bombs). While this is not a large number of bombs, the NEW of these bombs does have the potential to disturb submerged resources, particularly if the bomb is programmed to explode underwater and is used in the shallower portions of the range.

However, the BOMBEX would be conducted within the Eastern GOMEX BOMBEX Hotbox located in the Pensacola OPAREA where only two shipwrecks have been reported (Figure 3.6-6). (Note there could be other presently unidentified wrecks or submerged resources in the Hotbox). The ships are located in waters that range from 328.08 to 2,952.7 feet deep. A direct hit on a shipwreck eligible for the NRHP would have a direct, long-term major adverse effect on the wreck. In addition, if the bomb explodes in the vicinity of a shipwreck, most of the energy would be dissipated within a few feet, and damage to the shipwreck would be probably be negligible to minor. However, given the scattered nature of the wrecks, the depth of the water, and the size of the Hotbox, the chance of a direct hit would be extremely rare, and virtually all training missions would have no effects on submerged resources (*no historic properties affected under Section 106*).

GUNEX at sea (surface-to-surface ship firing at a target) and FIREX (amphibious) would be conducted in warning areas W-151A/B and W-155A. These areas have numerous cultural resources lying in fairly shallow water. However use of NEPM rounds and care in choosing activity areas would help ensure there were no effects on cultural resources (*no historic properties affected under Section 106*). The same is true for AIC, Mission Area training, and chaff training exercises.

MIW, GUNEX, and BOMBEX can deposit debris on the ocean bottom in the vicinity of shipwrecks or other archeological resources. However, even if bomb fragments, inert or expended ordnance should sink to the ocean bottom, it is unlikely it would come into contact with a wreck. If this expended material should sink in the vicinity of a wreck, the expended materials would not affect the historic characteristics of the shipwreck or other cultural resource, and eventually all would be covered by sediments.

Land Ranges. The NSA Panama City Demolition Pond would continue to have numerous training activities (*e.g.*, salvage diver training, EOD technician training, and diver training) throughout the year. When a mine/blast detonates, some of the energy is lost to the atmosphere as a noise and/or concussion. Sound energy spreads as it radiates from its source, decreasing the loudness at a rate of 6 dBA per doubling of the distance (detailed discussion provided in Section 3.5). The atmosphere absorbs some of the sound energy, with the amount of absorption dependent on the sound frequency and temperature and relative humidity of the atmosphere. Landforms, and to a modest extent, vegetation also can reduce sound.

Sometimes, explosive energy from the detonation may travel through the ground in all directions, somewhat like a wave motion. Although the energy level diminishes rapidly with distance from the blast, there could be a limited potential for explosions to contribute to sloughing of banks along shorelines (depending on the distance from the blast and other factors such as soil composition). This could, potentially, expose archaeological resources to erosion and effects of weathering.

Training exercises at the Demolition Pond are confined to the previously disturbed pond area, and nearby archeological resources have been either excavated or stabilized. The Cultural Resources Overview (DoN, 2005a) identified no outstanding cultural resources issues that would affect training activities at Panama City, and no further archaeological surveys were recommended for the facility.

Some buildings and structures in the Demolition Pond vicinity would require reevaluation for NRHP eligibility when they reach 50 years of age. No damage to cultural resources from blast percussion has

been identified for NSA Panama City, and it is unlikely that noise from the training exercises would physically affect buildings or structures (FAA, 1985). Although the noise might be audible in surrounding areas containing historic structures and buildings, military operations have been a vital part of the history of this area for many years, and would not be inconsistent with continuation of this historic use.

The Government-to-Government consultation process, as part of this Final EIS/OEIS, has not identified any concerns about resources traditionally valued by tribes. At the present level of training, no effects on archeological, ethnographic or architectural resources would be expected at the Demolition Pond (*no historic properties affected under Section 106)*.

BOMBEX (Air-to-Ground) would be conducted at the SEARAY, Dixie, and Yankee Targets. These targets are in sparsely populated areas where military overflights are common, and non-explosive practice munitions (NEPM) would be used. Military uses of these target ranges for bombing and strafing exercises have introduced expended ordnance and projectiles into the soil (DoN, 2007a). Dropping 25-lb. practice bombs from airplanes causes impact craters where the ordnance hits the ground. At SEARAY, the practice bombs are left in place and the impact pits are graded over once a year. Given the level of disturbance at the SEARAY Target Range, no unidentified NRHP-eligible resources are anticipated to be present at the range.

The Dixie Target has been surveyed for cultural resources, resulting in identification of 39 sites and a number of isolated prehistoric artifacts (DoN, 2006). Severe erosion has damaged these sites, so none of them are considered eligible for the NRHP; however, the NRHP evaluation process is still underway, so resources would be considered potentially eligible until concurrence is reached. Standing structures at Dixie are non-historic, dating to 1966 or later. Although no archeological surveys have been conducted of the Yankee Target, it is unlikely that intact archaeological resources are present within the target, given the level of disturbance from past military activities, including gunnery exercises at Yankee Target. There are no historic structures or buildings within the Yankee Target Range.

Thus, under the No-Action Alternative, BOMBEX using NEPM would not have an effect (*no historic properties affected under Section 106)* on cultural resources at SEARAY. BOMBEX (with NEPM) at Dixie Target would have the potential to cause direct long-term, negligible to minor adverse effects on archeological sites (*no adverse effects* under Section 106). Impacts would be minor because a) the potential for a direct hit on a site is limited, and b) because past use of the area has severely disturbed both the sites and their context.

Because no surveys of the Yankee Target have been completed, the effects of BOMBEX and Air to Ground gunnery exercises at this target cannot be evaluated at this time. However, because of existing disturbance from previous military exercises, it is unlikely that any significant archeological, ethnographic, or historic structures and buildings exist at Yankee Target.

3.13.3.2 Alternative 1

OPAREAS. Under Alternative 1, at-sea mine warfare training would be eliminated. Thus, there would be no potential effects to cultural resources from mine warfare training under Alternative 1 (*no historic properties affected under Section 106)*. BOMBEX unit level training events conducted in the W-155 BOMBEX Hotbox Pensacola OPAREA would increase by 35 events and 110 bombs over the numbers for the No Action Alternative. However, because the Hotbox area contains a very small number of documented shipwrecks, the chances of long-term adverse effects from a direct hit would be rare, and almost all training missions would have no effects on submerged resources (*no historic properties affected under Section 106)*.

The number of GUNEX (S-S) events would remain the same as described for the No Action Alternative. However, the number of rounds would be sharply reduced, and use of NEPM during GUNEX events would help ensure that no adverse effects occur to submerged resources from these training events (*no historic properties affected under Section 106)*. FIREX, AIC, Mission Area, and chaff training exercises would have no effects (*no historic properties affected under Section 106)* on at-sea cultural resources.

Land Ranges. The number of BOMBEX sorties and bombs dropped at the SEARAY, Dixie, and Yankee targets would be the same as described for the No Action Alternative. Thus, air-to-ground BOMBEX using NEPM would have no effect on cultural resources (*no historic properties affected under Section 106*) at SEARAY. BOMBEX (with NEPM) at Dixie Target would have the potential to cause direct long-term, negligible to minor adverse effects on archeological sites (*no adverse effects* under Section 106). Impacts would be minor because a) the potential for a direct hit on a site is limited, and b) because past use of the area has severely disturbed both the sites and their context.

Due to lack of knowledge about cultural resources at Yankee Target, the effects of BOMBEX and Air-to-Ground gunnery exercises cannot be evaluated at present; however, no significant effects would be expected, given the previous disturbance in the area. Air Intercept Control, chaff, flare exercises and increased use of commercial air services would have no effects on cultural resources (*no historic properties affected under Section 106)*.

Underwater demolition training at NSA Panama City Demolition Pond Area would be modified to meet Navy goals. Some annual NEW amounts would decrease and others would increase, but overall the charges would typically remain small. The training events would remain the same as described for the No Action Alternative as would impacts: no effects on archeological or architectural resources would be expected (*no historic properties affected under Section 106*) because of previous surveys and mitigation efforts, and because the area has been extensively disturbed. Ethnographic concerns, if any, would be identified during consultation for this Final EIS/OEIS.

3.13.3.3 Alternative 2 (Preferred Alternative)

OPAREAS. As in Alternative 1, there would be no mine warfare under Alternative 2; thus, no potential effects from sea mine warfare training in GOMEX (*no historic properties affected under Section 106)*. BOMBEX unit level training events conducted in the W-155 BOMBEX Hotbox Pensacola OPAREA would be decreased to one unit level event using four 1,000 pound NEW bombs. Documented shipwrecks in the Hotbox are rare, so the probability of long-term adverse effects from a direct hit would be rare, so with avoidance almost all training missions would have no effects on submerged resources (*no historic properties affected under Section 106*).

The number and type of GUNEX (S-S) events and rounds would be the same as described for Alternative 1, resulting in no effects on submerged resources (*no historic properties affected under Section 106)*. FIREX, AIC, Flare and chaff training exercises would have no effect (*no historic properties affected under Section 106)* on at-sea cultural resources.

Land-Based Training. As under Alternative 1, training at the NSA Panama City Demolition Pond Area would have no effects on archeological or architectural resources (*no historic properties affected under Section 106)* because of previous surveys and mitigation efforts, and because the area has been extensively disturbed. Any ethnographic concerns would be identified during consultation for this Final EIS/OEIS.

Effects of BOMBEX training activities at the SEARAY, Dixie, and Yankee targets would be the same as described for Alternative 1; no effect (*no historic properties affected under Section 106)* on cultural

resources at SEARAY, and undetermined but no significant effects expected at Dixie and Yankee Targets (*no adverse effects under Section 106).*

3.13.4 Unavoidable Significant Environmental Effects

Based on the proceeding analysis, there are no unavoidable environmental effects as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.13.5 Summary of Environmental Effects (NEPA and EO 12114)

Less than significant overall impacts to cultural resources are anticipated under the No Action Alternative, Alternative 1, or the Preferred Alternative (Alternative 2). Discarded training materials would be deposited in offshore areas, most of which would become buried in the sea floor sediment, and would have no substantial environmental effects. There is a remote possibility that discarded training materials would settle on or near offshore shipwrecks. The overall volume of expended training items would increase in Alternative 1 and the Preferred Alternative (Alternative 2) in correlation to changes in operations. Table 3.13-2 provides a summary of the operation, proximity of the operation to the U.S. shoreline and, hence, whether the expended training item associated with the operation falls within the U.S. Territory (NEPA) or outside U.S. waters in the global commons.

TABLE 3.13-2
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON CULTURAL RESOURCES IN THE GOMEX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Vessel Movements/MIW devices	Localized disturbance to shipwrecks or underwater sites from towed array, ROV	Very little potential for vessel to encounter a shipwreck/underwater site (deeper water).
Ordnance Strikes	Localized disturbance to land area or sea bottom; limited potential to strike a cultural resource or strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
Explosions	Limited potential for explosions to occur at the location of a cultural resource or shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
Expended Materials	Localized accumulation of expended materials at range or on sea bottom; limited potential for expended materials to accumulate at the location of a cultural resource or shipwreck.	Localized accumulation of expended materials on sea bottom; limited potential for expended materials to accumulate at the location of a shipwreck.
Impact Conclusion	Less than significant impacts to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).	Less than significant harm to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).

TABLE 3.13-2 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON CULTURAL RESOURCES IN THE GOMEX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Alternative 1		
Vessel Movements/MIW devices	Limited potential for vessel to encounter shipwreck/underwater site.	Very little potential for vessel to encounter shipwreck/underwater site (deeper water).
Ordnance Strikes	Localized disturbance to land area or sea bottom; limited potential to strike a cultural resource or strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
Explosions	Limited potential for explosions to occur at the location of a cultural resource or shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
Expended Materials	Localized accumulation of expended materials at range or on sea bottom; limited potential for expended materials to accumulate at the location of a cultural resource or shipwreck.	Localized accumulation of expended materials on sea bottom; limited potential for expended materials to accumulate at the location of a shipwreck.
Impact Conclusion	Less than significant impacts to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).	Less than significant harm to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).
Alternative 2		
Vessel Movements/MIW devices	Limited potential for vessel to encounter shipwreck/underwater site.	Limited potential for vessel to encounter shipwreck/underwater site (deeper water).
Ordnance Strikes	Localized disturbance to land area or sea bottom; limited potential to strike a cultural resource or strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
Explosions	Limited potential for explosions to occur at the location of a cultural resource or shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
Expended Materials	Localized accumulation of expended materials at range or on sea bottom; limited potential for expended materials to accumulate at the location of a cultural resource or shipwreck.	Localized accumulation of expended materials on sea bottom; limited potential for expended materials to accumulate at the location of a shipwreck.
Impact Conclusion	Less than significant impacts to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).	Less than significant harm to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).

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3.14 TRANSPORTATION

3.14.1 Introduction and Methods

Transportation analysis addresses the marine, air, and land transportation within the GOMEX Range Complex Study Area as shown in Figure 1.5-1. Military and civilian use of the offshore sea and air areas is generally compatible. Where naval vessels and aircraft conduct operations that are not compatible with commercial or recreational transportation (*e.g.*, weapons firing), they are confined to OPAREAs away from shipping lanes and inside designated Special Use Airspace (SUA). Dangerous operations are communicated to all vessels and aircraft by use of Notice to Mariners (NOTMAR), issued by the United States Coast Guard (USCG), and Notice to Airmen (NOTAM), issued by the Federal Aviation Administration (FAA).

Advance notice of scheduled operation times are made available to the public via NOTMARs and NOTAMs. NOTMARs and NOTAMs provide recreational boaters and aircraft pilots and other users notice that the military will be operating in a specific area, and allow them to plan their own activities accordingly. Schedules are updated when changes occur up until the date of the operation. If operations are cancelled at any time, this information is posted and the area is again identified as clear for public use. NOTMARs advise the public, fishermen, divers, and aircraft pilots in advance of ongoing military activities that may temporarily relocate civilian/recreational activities. NOTAMs are available on the internet at https://www.notams.jcs.mil and NOTMARs can be found on the internet at www.nga.mil/portal/site/maritime.

Ocean Traffic. Ocean traffic is the transit of commercial, private, or military vessels at-sea, including submarines. Ocean transportation flow in congested waters, especially near coastlines, is controlled by the use of directional shipping lanes for large vessels (cargo, container ships, and tankers). Traffic flow controls are also implemented to ensure that harbors and ports-of-entry remain as uncongested as possible. There is less control on ocean transportation involving recreational boating, sport fishing, commercial fishing, and activity by naval vessels. In most cases, the factors that govern shipping or boating transportation include the following: adequate depth of water, weather conditions (primarily affecting recreational vessels), the availability of fish of recreational or commercial value, and water temperature (higher water temperatures increase recreational boat traffic and diving activities).

Exclusive Economic Zones are sea zones that were established by the Third United Nations (UN) Convention on the Law of the Sea in 1982. Part V, Article 55 of the Convention establishes that the Exclusive Economic Zone is "an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in this Part, under which the rights and jurisdiction of the coastal State and the rights and freedom of other States are governed by the relevant provisions of this Convention." (UN, 1982). The Exclusive Economic Zones extend 200 nm from the coastal baseline (the baseline usually follows the low-water line). Within the Exclusive Economic Zones, the coastal nation has sole exploitation rights over all natural resources; however, foreign nations have the freedom of navigation and over-flight, subject to the regulation of the reigning coastal state (NOAA, 2007). The Exclusive Economic Zones specifically for the U.S. were established by Presidential Proclamation 5030 in 1983 (NOAA, 2007).

Internal waters are those waters and waterways on the landward side of the baseline. Territorial waters extend from the baseline to 12 nm. These areas were defined by the 1982 Law of the Sea Convention and established the coastal state's right to establish laws, regulate use and have use of any resource in internal and territorial waters (NOAA, 2007).

Air Traffic. Air traffic refers to movements of aircraft through airspace. Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. Accordingly, regulations

applicable to all aircraft are promulgated by the FAA to define permissible uses of designated airspace, and to control that use. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation. The regulatory scheme for airspace and air traffic control varies from highly controlled to uncontrolled. Less controlled situations include flight under Visual Flight Rules (VFR) or flight outside of U.S. controlled airspace (*e.g.*, flight over international waters off the east coast). Examples of highly controlled air traffic situations are flights in the vicinity of airports where aircraft are in critical phases of flight, either take-off or landing and flight under Instrument Flight Rules (IFR), particularly flights on high or low altitude airways.

The FAA owns and operates the air traffic control system. The system of airspace designation makes use of various definitions and classifications of airspace to facilitate control. "Controlled Airspace" is a generic term that covers different classes of airspace. The controlling agency of any airspace is the FAA Air Traffic Control facility that exercises control of the airspace when SUA is not active. SUA is specially designated airspace that is used for a specific purpose and is controlled by the military unit or other organization whose activity established the requirement for the SUA (FAA, 2006). SUA includes restricted areas, military operations areas, as well as warning, prohibited, alert, and controlled firing areas.

- Airways are established routes used by commercial aircraft, general aviation, and military aircraft. There are two types of airway route structures: low altitude routes (those below 18,000 feet mean sea level [MSL]) and high altitude routes (those above 18,000 feet MSL).
- Victor Routes are the network of airways serving commercial aviation operations up to 18,000 MSL. The designated classes of airspace are as follows:
  - Class A extends from 18,000 MSL up to and including 60,000 MSL and includes designated airways for commercial aviation operations at those altitudes.
  - Class B airspace extends from the ground to 10,000 MSL surrounding the nation's busiest airports.
  - Class C and D airspace are defined areas around certain airports, tailored to the specific airport.
  - Class E is controlled airspace not included in Class A, B, C, or D.
  - Class G is uncontrolled airspace (*i.e.*, not designated as Class A-E).

SUA refers to areas with defined dimensions where flight activities are confined due to their nature and need to restrict or limit non-participating aircraft. SUA is established under procedures outlined in Title 14 Code of Federal Regulations (CFR) Part 73. The majority of SUA is established for military activities, and may be used for commercial or general aviation when not reserved for military activities. There are multiple types of SUA. A Restricted Area is a type of SUA within which non-military flight activities are closely restricted. Other types of SUA include Military Operating Areas (MOAs), alert areas, and controlled firing areas; each SUA designation carries varying restrictions on the types of military and non-military activities that may be conducted. One type of SUA of particular relevance to the GOMEX EIS/OEIS Study Area is a Warning Area, which is defined in 14 CFR Part 1 as follows:

> "A warning area is airspace of defined dimensions, extending from 3 nm outward from the coast of the United States that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of potential danger. A warning area may be located over domestic or international waters or both."

Warning areas are established to contain a variety of aircraft and non-aircraft activities, such as aerial gunnery, air and surface missile firings, bombing, aircraft carrier operations, surface and subsurface operations, and naval gunfire. Warning areas contain hazardous activities; where these activities are

conducted mainly in international airspace, the FAA regulations may warn against, but do not have the authority to prohibit, flight by nonparticipating aircraft.

Land Transportation. Transportation on land refers to the movement of vehicles on roadway networks from one place to another. Primary roads, such as major interstate highways, are designed to move traffic and do not necessarily provide access to all adjacent areas. Secondary roads, commonly referred to as surface streets, are used to gain access to residential and commercial areas, hospitals, and schools. The Study Area for transportation includes the McMullen County and Noxubee County Ranges and the NSA Panama City Demolition Pond.

3.14.1.1 Assessment Methods and Data Used

In addition to its national defense role as one of the five U.S. Armed Services, the USCG is charged with a broad scope of regulatory, law-enforcement, humanitarian, and emergency-response duties. In addition to ensuring maritime safety and security, the USGS focuses on personal watercraft and boating. Information regarding personal watercraft was obtained in part from the USGS. State tourism and parks and recreation divisions also provided sources for state-specific personal watercraft and recreational boating data.

Sport diving industry statistics are not maintained for numbers of individuals participating in specific regions of the country or for commonly used sites (Davison, 2007; DEMA, 2006). Dive locations identified in this document were established through the use of the Veridian Corporation's 2001 Global Maritime Wrecks Database, a survey of state dive charter company websites, and state tourism and parks and recreation information.

Shipping lane information was obtained from the National Waterway Network, which is a comprehensive network database of the nation's navigable waterways. The National Waterway Network is part of the Research and Innovative Technology Administration's Bureau of Transportation Statistics (RITA/BTS) National Transportation Atlas Database (NTAD). The waterway network represents actual shipping lanes or serves as representative paths in open water where no defined shipping lanes exist.

The Texas, Mississippi, and Florida Departments of Transportation (DOT) report annual average daily traffic (AADT) counts on DOT-maintained roads. The AADT is the total volume of traffic on a highway segment for one year, divided by the number of days in the year.

3.14.1.2 Warfare Areas and Associated Transportation Stressors

Impacts to transportation could occur through disruption or improvement of current transportation patterns and systems; deterioration or improvement of existing levels of service; and changes in existing levels of transportation safety. Impacts may arise from physical changes to circulation (*i.e.*, closing, rerouting, or creation of new traffic patterns), or changes in daily or peak-hour traffic volumes created either by direct or indirect changes to transportation activities. Stressors that would likely impact transportation activities are identified in Table 3.14-1. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the proposed action.

TABLE 3.14-1
SUMMARY OF POTENTIAL STRESSORS TO TRANSPORTATION RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Mine Warfare (MIW)				
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Surface Warfare (SUW)				
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox	✓	✓	✓
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B	✓	✓	✓
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox	✓	✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓	✓	✓

TABLE 3.14-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO TRANSPORTATION RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Panama City OPAREA	✓	✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Corpus Christi OPAREA UNDET BOX E3	✓	✓	✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓		
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓	
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓		✓
Air Warfare (AW)				
Air Intercept Control (AIC)	W-151; W-155		✓	
Strike Warfare (STW)				
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓	
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓	
Amphibious Warfare				
Firing Exercise (FIREX) with IMPASS	W-151A/B; W-155A	✓		✓
Electronic Combat (EC)				
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓	✓
Chaff Exercises (CHAFFEX)	Brownwood MOAs	✓	✓	✓
Flare Exercises (FLAREX)	W-155A/B	✓	✓	✓
Flare Exercises (FLAREX)	Brownwood MOAs	✓	✓	✓

TABLE 3.14-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO TRANSPORTATION RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Mission Area Training[48]				
Mission Area Flight Training	W-92; W-54; Brownwood MOAs		✓	
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312		✓	
Salvage Diver Training	NSA Panama City Demolition Pond			✓
EOD Tech Training	NSA Panama City Demolition Pond			✓
Security Force Training	NSA Panama City Demolition Pond			✓
Diver Training	NSA Panama City Demolition Pond			✓

3.14.2 Affected Environment

3.14.2.1 Ocean Transportation

The affected environment for ocean transportation is the offshore portions of the GOMEX Range Complex Study Area which are co-existing military and civilian use areas.

Military

The surface and subsurface OPAREAs associated with the GOMEX Range Complex covers 17,520 nm^2 of ocean and includes the following OPAREAs: Panama City; Pensacola: New Orleans; and Corpus Christi. The Navy uses these areas for a variety of surface vessel movements associated with Navy

[48] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

training, including, mine warfare, gunnery exercises (surface-to-surface), and chaff exercises. Refer to Table 3.19-2 for a list of the controlling and scheduling authorities for surface and subsurface OPAREAs. The scheduling authority promulgates NOTMARs and NOTAMs, as applicable. Through close coordination, controlling authorities ensure that hazardous activities are carefully scheduled to avoid conflicts with civilian activities and safety standards are maintained while allowing the maximum amount of civilian access to airspace and sea space.

Civilian

The Gulf of Mexico is heavily traveled by marine vessels, with several commercial ports occurring near Navy OPAREAs. Three major ports within the GOMEX Range Complex, Corpus Christi, New Orleans and Pensacola, were ranked in the top 150 U.S. ports by tonnage in 2000 (RITA/BTS, 2002). Recreation activities offshore consist of game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, and other recreational boating activities. Recreational boats range throughout the coastal waters, depending on season and weather conditions. The number of registered recreational boats and their nationwide ranking for each state bordering the GOMEX OPAREAs is:

- Florida – 973,859 (ranking 1st nationwide in registered recreational boats)
- Texas – 614,616 (ranking 6th nationwide in registered recreational boats)
- Louisiana – 308,104 (ranking 15th nationwide in registered recreational boats)
- Alabama – 265,172 (ranking 18th nationwide in registered recreational boats)
- Mississippi – 208,466 (ranking 23rd nationwide in registered recreational boats)

(NMMA, 2007; USCG, 2003; USCG, 2005)

Commercial shipping lanes do traverse the GOMEX Range Complex, but are controlled by the use of directional shipping lanes for large vessels (cargo, container ships, and tankers) (Figure 3.14-1). Traffic flow controls are also implemented to ensure that harbors and ports-of-entry remain as uncongested as possible. Military and civilian use of the offshore areas is compatible because naval vessels conducting hazardous operations are confined to areas away from shipping lanes. Hazardous operations are communicated to all vessels and operators by use of NOTMARs published by the USCG.

Popular sport diving sites within the Study Area consist of natural and artificial reefs as well as shipwrecks. In 1999 an estimated 83,780 dive trips occurred offshore between Texas and Alabama (MMS, 2001). A popular diving destination in the Gulf of Mexico is the Flower Garden Banks National Marine Sanctuary, which consists of the East and West Flower Gardens and Stetson Bank (NOAA, 2008a, b, c). The sanctuaries are approximately 130 miles northeast of the Corpus Christi OPAREA and approximately 190 miles west of the New Orleans OPAREA.

3.14.2.2 Air Traffic

The GOMEX Range Complex contains approximately 43,390 nm^2 of SUA. Portions of this SUA are over land and over water. Refer to Table 3.19-2 for a list of the controlling and scheduling authorities for SUAs within the GOMEX Study Area.

Air traffic control facilities within the GOMEX Range Complex are required to provide air traffic separation consistent with FAA guidelines to ensure the safe and efficient flow of air traffic. Radar surveillance and radio communications facilitate air traffic control separation between high-performance military aircraft and the high volume of commercial aircraft transiting along the Gulf Coast.

Fort Worth, Houston, Jacksonville, and Memphis ARTCCs control the airspace within the GOMEX Range Complex when it is not being used for military purposes. Each Navy entity wishing to conduct training posing a hazard to non-participating aircraft requests use of the Warning Areas from the

scheduling authority who coordinates its use with the appropriate FAA center. Operations conducted in these Warning Areas include all weather flight training, refueling, test flights, bombing, fleet training, independent unit training, ASW, aircraft carrier, ship and submarine operations, and surface gunnery. Details of the SUA are available in Chapter 2. The airspace manager at FACSFAC Jacksonville is the Navy's Regional Airspace Coordinator with FAA throughout the GOMEX Range Complex.

Civilian

Coordination among agencies is critical for successful operations at the GOMEX Range Complex. Civilian aircraft may use the MOAs and warning areas until a military aircraft is enroute to that area. The scheduling and/or controlling agency is responsible for the coordination of their respective airspace or OPAREA to ensure that civilian air transits do not conflict with military exercises.

Other coordination procedures within the GOMEX Range Complex include the following:

- Coordination is required between NSA Panama City and Eglin AFB for scheduling of W-151 airspace.
- NAS Pensacola is the liaison for Navy units requesting use of W-453 and W-151.

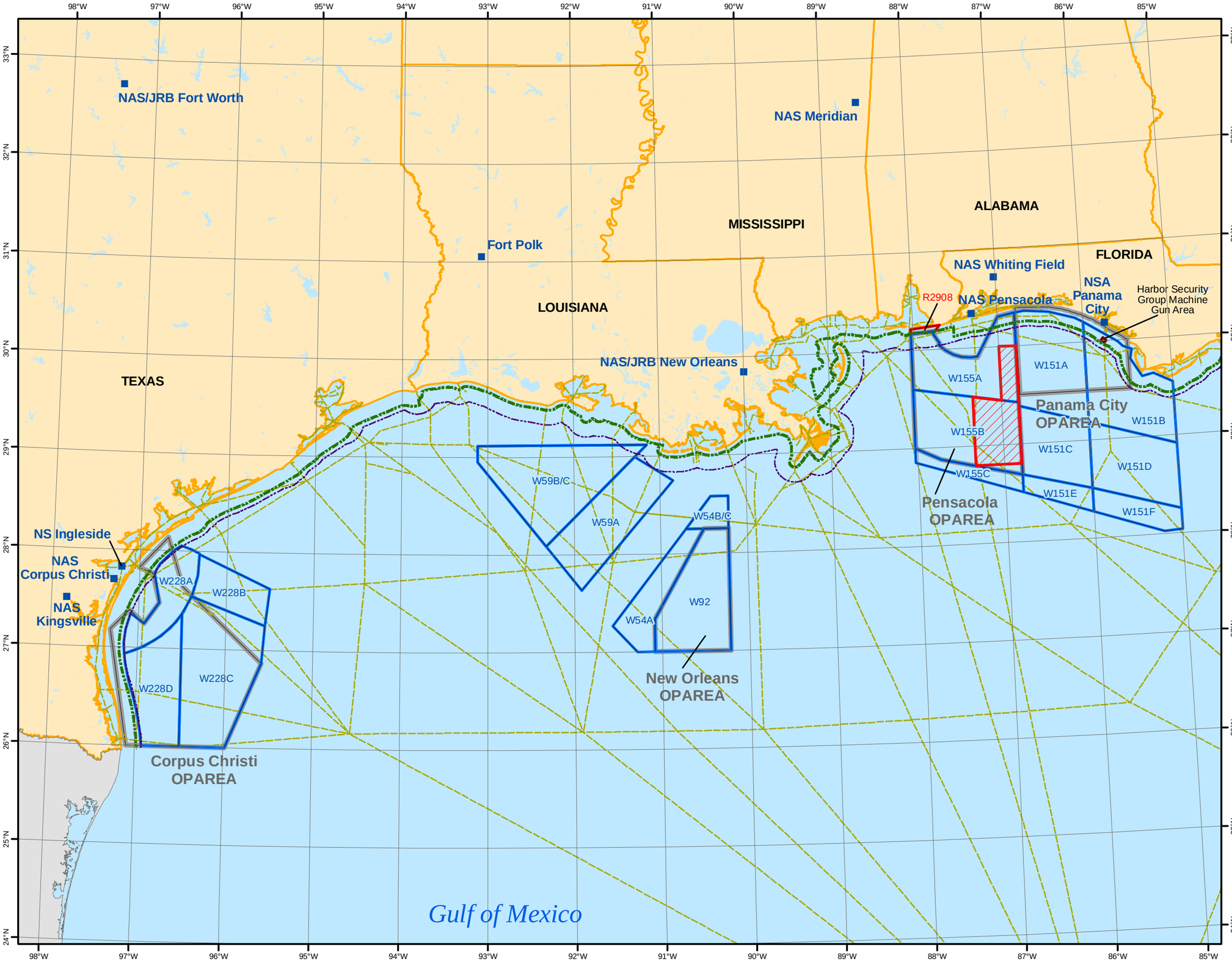
The offshore airspace portion of the Study Area is in international airspace and the procedures outlined in International Civil Aviation Authority (ICAO) Document 444, *Rules of the Air and Air Traffic Services* are followed.

3.14.2.3 Land Transportation

Inland Ranges

The McMullen County Range, consisting of the Dixie and Yankee Targets, is located approximately 75 miles northwest of NAS Kingsville in south-central Texas. Most of the range is surrounded by ranch land. State Route (SR) 16 running in a north to south direction and Ranch Road 624 running in an east to west direction are the closest state highways to the McMullen County Range (see Figure 2.1-4). In 2006 the nearest segment of SR 16 to the McMullen County Range experienced 1,100 vehicles, computed AADT, two-way reported (TxDOT, 2008).

The Noxubee County Range is located in Mississippi approximately 30 nm northwest of NAS Meridian. The range is approximately three miles south of SR 14 and approximately six miles west of U.S. 45 (see Figure 2.1-5). In 2006, the closest segments of SR 14 and U.S. 45 received 2,200 and 4,100 vehicles, respectively (MDOT, 2008).



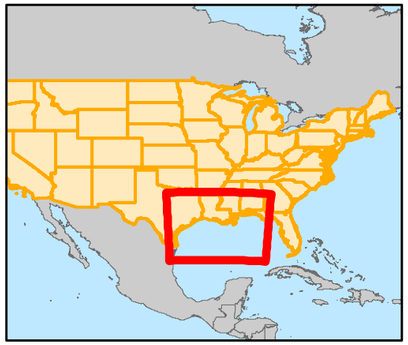
Commercially Used Waterways
GOMEX EIS/OEIS Study Area

Figure 3.14-1

Eastern GOMEX BOMBEX HotBox
Operating Area (OPAREA)
Commercially Used Waterway
State Seaward Extent
TX & FL 9 nm; AL, MS & LA 3 nm
12 nm Territorial Limit

Special Use Airspace

Restricted Area (R-)
Warning Area (W)



N

1:4,130,000

500 250 0 500 1,000 Nautical Miles

2,000 1,000 0 2,000 Kilometers

Projection: UTM Zone 15N
Datum: WGS84

Sources:
Research and Innovative Technology Administration's Bureau of Transportation Statistics (RITA/BTS) National Transportation Atlas Database (NTAD), 2007; NGA DAFIF, Jan 2008; NOAA martime limits, 2005-2006 COMLANTFLT 3120.26E Document, ESRI.

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The Demolition Pond is located on Naval Support Activity (NSA) Panama City, Florida. The NSA Panama City abuts dense residential and commercial development. Most of the installation's operational activities are focused around the waterfront, which has resulted in a crowded industrial area around Alligator Bayou. In the central area of the installation, a variety of community-based activities, such as the administrative facilities, public works, and bachelor housing, are interspersed with vacant land uses. The northernmost section of the installation is dedicated to base housing activities, while the land south of Alligator Bayou is occupied by the Naval Diving and Salvage Training Center, the USCG Station, Florida Fish and Wildlife Conservation Commission, and ordnance storage facilities. The south part of the installation, where the demolition pond is located is almost completely encumbered by Explosive Safety Quantity Distance arcs and/or a non-electromagnetic operations area (DoN, 2006).

County Road 3031, also known as Thomas Drive, is the western boundary of NSA Panama City, Florida. In 2007, the portion of Thomas Drive near U.S. 98 received 22,000 vehicles, computed AADT, two-way reported (FDOT, 2007).

3.14.3 Environmental Consequences

The traffic analysis addresses air, ocean, and land traffic in the GOMEX EIS/OEIS Study Area. The principal issue is the potential for existing or proposed military air, vessel, or vehicular use to affect existing transportation and circulation conditions. Impacts on traffic are considered with respect to the potential for disruption of transportation pattern and systems, and changes in existing levels of transportation safety.

Impacts to air traffic could be shown through a variety of means, including: 1) an increase in the number of flights, such that they could not be accommodated within established operational procedures and flight patterns; 2) a requirement for airspace modification; or 3) an increase in air traffic that might increase collision potential between military and non-participating civilian operations.

Impact to ocean vessel traffic might occur if the extent or degree to which an alternative would seriously disrupt the flow of commercial surface shipping or recreational fishing or boating. A serious disruption occurs when a vessel is unable to proceed to its intended destination due to exclusion from areas in the GOMEX Range Complex. However, the need to use alternative routes during the time of exclusion does not constitute a serious disruption.

3.14.3.1 No Action Alternative

Both military and non-military entities have been sharing the use of the land, airspace and ocean surface that encompasses the GOMEX Study Area for more than 70 years. Military, commercial, and general aviation activities have established an operational co-existence consistent with federal, state, and local plans and policies and compatible with each interest's varying objectives. Military and civilian use of the offshore areas is compatible because naval vessels conducting tactical training are confined to areas away from shipping lanes. Tactical training operations are communicated to all vessels and operators by use of NOTMARs published by the USCG.

The No Action Alternative includes training and testing operations that are and have been routinely conducted in the area for decades. Ongoing, continuing operations identified in this Final EIS/OEIS will continue to use the existing offshore OPAREAs and SUA. Although the nature and intensity of use varies over time and by individual area, the continuing training operations represent precisely the kinds of operations for which these areas were created (*i.e.*, those that present a conflict with other vessels).

The No Action Alternative includes vessel movements which involve transiting to and from port and the training areas as well as vessel movements into, within, and through the range complex. Under the No Action Alternative, the Navy estimates approximately 180 steaming days per year in the GOMEX

Range Complex. Vessel movement was computed as the number of steaming days per year by summing the number of steaming hours proposed in each range complex, dividing by 24 hours per day, and rounding to the nearest 10 days (Table 2.2-7). Military and civilian use of the offshore areas is compatible because naval vessels conducting hazardous operations are confined to areas away from shipping lanes. Hazardous operations are communicated to all vessels and operators by use of NOTMARs published by the USCG.

The No Action Alternative would not modify existing airspace use, and would not change the existing relationship of the Navy's SUA with federal airways, uncharted visual flight routes, and airport related air traffic operations. Under the No Action Alternative, fixed-wing aircraft are estimated to fly approximately 61,657 sorties annually and helicopters are estimated to fly approximately 20 sorties annually (Table 2.2-7).

USFF is the controlling authority for all GOMEX OPAREAs, NRFC for Warning Areas 54 and 92, Houston ARTCC for Warning Area 59, Jacksonville ARTCC for Warning Area 151, and CNATRA is the controlling authority for the remaining SUA (consisting of warning areas, restricted areas, and military operating areas), targets, and land ranges. The scheduling authority promulgates NOTMARs and NOTAMs, as applicable. Through close coordination, controlling authorities ensure that hazardous activities are carefully scheduled to avoid conflicts with civilian activities and safety standards are maintained while allowing the maximum amount of civilian access to airspace and sea space.

The stressors from existing training activities that would likely impact transportation activities stem from vessel movements, aircraft overflights, and military expended materials; however, military activities are either scheduled or announced ahead of execution or take place in an area that is designated for exclusive military use.

Land activities are minimal and are not anticipated to increase or change; therefore, activities associated with the No Action Alternative will have no effect on transportation resources at the McMullen County and Noxubee County Ranges, or at the NSA Panama City Demolition Pond Area.

Implementation of the No Action Alternative would have no impact on transportation resources in U.S. Territory. Furthermore, the No Action Alternative would not cause harm to transportation resources in non-territorial waters.

3.14.3.2 Alternative 1

The Navy can accomplish the proposed activities associated with Alternative 1 without modifications or need for additional designed ocean or airspace. The proposed operations would not require either: (1) a change to an existing or planned instrumented flight rules minimum flight altitude, a published or special instrument procedure, or an instrumented flight rules departure procedures; or (2) a visual flight rules operation to change from a regular flight course or altitude. As such, the increased training operations do not conflict with any airspace use plans, policies, and controls. Military and civilian use of the offshore areas is compatible because naval vessels conducting hazardous operations are confined to areas away from shipping lanes. Hazardous operations are communicated to all vessels and operators by use of NOTMARs published by the USCG.

Under the Alternative 1, the Navy estimates approximately 180 steaming days per year in the GOMEX Range Complex. Through close coordination, controlling authorities ensure that hazardous activities are carefully scheduled to avoid conflicts with civilian activities and safety standards are maintained while allowing the maximum amount of civilian access to airspace and sea space.

Under Alternative 1 fixed-wing aircraft would fly approximately 61,770 sorties annually (this is a less than one percent increase over the levels of the No Action Alternative) and helicopters would no longer

fly in the range complex; a 100 percent decrease (Table 2.2-7). Coordination among agencies is critical for successful operations at the GOMEX Range Complex. Civilian aircraft may use the MOAs and warning areas until a military aircraft is enroute to that area. The scheduling and/or controlling agency is responsible for the coordination of their respective airspace or OPAREA to ensure that civilian air transits do not conflict with military exercises.

Land transportation activities are minimal and are not anticipated to increase or change. Therefore, proposed activities associated with Alternative 1 would have no significant impact on transportation activities at the McMullen County and Noxubee County Ranges, or the NSA Panama City Demolition Pond.

The proposed activities associated with Alternative 1 include modifications in training operations, and enhancements of range complex capabilities, as detailed in Chapter 2. The potential impacts to transportation interests associated with Alternative 1 would be similar to those described for the No Action Alternative. Naval activity in U.S. Territory would have no significant impact on transportation activities under Alternative 1. Naval activity in non-territorial waters would not cause harm to transportation resources under Alternative 1.

3.14.3.3 Alternative 2

The proposed activities associated with Alternative 1 include modifications in training operations, and enhancements of range complex capabilities, as detailed in Chapter 2. The potential impacts to transportation interests associated with Alternative 1 would be similar to those described for the No Action Alternative. Implementation of Alternative 2 would include all the actions proposed for under Alternative 1, and implementation of additional enhancements to enable the range complex to meet foreseeable needs.

Under Alternative 2 steaming days would remain at the No Action and Alternative 1 level of 180 days per year, fixed-wing aircraft sorties would increase to 61,772 (less than one percent increase over Alternative 1), and helicopters would not fly sorties. Military and civilian use of the offshore areas is compatible because naval vessels conducting hazardous operations are confined to areas away from shipping lanes. Hazardous operations are communicated to all vessels and operators by use of NOTMARs published by the USCG.

Land transportation activities are minimal and are not anticipated to increase or change. Therefore, proposed activities associated with Alternative 2 would have no significant impact on transportation activities at the McMullen County and Noxubee County Ranges, or the NSA Panama City Demolition Pond.

Implementation of Alternative 2 would have no significant impact on transportation resources in U.S. Territory, and activities in non-territorial waters would not cause harm to transportation resources under Alternative 2.

3.14.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to transportation resources.

3.14.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.14-2, the environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on transportation would have no impact.

TABLE 3.14-2
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON TRANSPORTATION IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	Military, commercial, and general aviation activities have established an operational co-existence consistent with federal, state, and local plans and policies and compatible with each interest's varying objectives. Activities under the No Action Alternative include activities that are and have been routinely conducted in the area for decades.	Military, commercial, and general aviation activities have established an operational co-existence consistent with federal, state, and local plans and policies and compatible with each interest's varying objectives. Activities under the No Action Alternative include activities that are and have been routinely conducted in the area for decades.
Aircraft Overflights		
Military Expended Materials		
Impact Conclusion	Implementation of the No Action Alternative would have no impact on transportation resources within U.S. Territory.	Implementation of the No Action Alternative would not cause harm to transportation resources in non-territorial waters.
Alternative 1		
Vessel Movements	The Navy can accomplish the proposed activities associated with Alternative 1 without modifications or need for additional designated ocean or airspace. The increased training operations do not conflict with any airspace use plans, policies, and controls.	The Navy can accomplish the proposed activities associated with Alternative 1 without modifications or need for additional designated ocean or airspace. The increased training operations do not conflict with any airspace use plans, policies, and controls.
Aircraft Overflights		
Military Expended Materials		
Impact Conclusion	Implementation of Alternative 1 would have no impact on transportation resources within U.S. Territory.	Implementation of Alternative 1 would not cause harm to transportation resources in non-territorial waters.

TABLE 3.14-2 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON TRANSPORTATION IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel Movements	The Navy can accomplish the proposed activities associated with Alternative 2 without modifications or need for additional designated ocean or airspace. The increased training operations do not conflict with any airspace use plans, policies, and controls.	The Navy can accomplish the proposed activities associated with Alternative 2 without modifications or need for additional designated ocean or airspace. The increased training operations do not conflict with any airspace use plans, policies, and controls.
Aircraft Overflights		
Military Expended Materials		
Impact Conclusion	Implementation of Alternative 2 would have no impact on transportation resources within U.S. Territory.	Implementation of Alternative 2 would not cause harm to transportation resources in non-territorial waters.

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3.15 DEMOGRAPHICS

3.15.1 Introduction and Methods

Demographic statistics are assessed through identification and evaluation of socioeconomic factors such as population characteristics, which may include population growth, distribution, age, education, and race and ethnicity; household characteristics, which may include size, special needs, type, and vacancy; and employment rates and trends. The Study Area for demographics includes the coastal counties of the States of Texas, Louisiana, Mississippi, Alabama, and Florida. It also includes the inland areas around McMullen County, Texas, Noxubee County, Mississippi, and Bay County, Florida. Impacts to demographics related to the 2005 Base Realignment and Closure (BRAC) decision are not evaluated in this Final EIS/OEIS, as those assessments were made during the BRAC process.

3.15.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the U.S. Census Bureau (USCB) and state and local governmental agencies and local organizations as indicated with reference citations; full reference information is provided in References, Chapter 7.

3.15.1.2 Warfare Areas and Associated Demographic Environmental Stressors

Impacts to demographics are assessed in terms of their direct effects on the local economy and related effects on other socioeconomic resources (for example, housing). The level of importance of these impacts can vary depending on the location of the proposed action. If potential stressors would result in substantial shifts in population trends, or adversely affect regional spending and earning patterns, they would be considered an impact.

Aspects of the proposed actions likely to act as stressors to demographics were identified by conducting a detailed analysis of the warfare areas, activities, and specific activities included in the alternatives. There were no potential stressors to demographics identified.

3.15.2 Affected Environment

Population Characteristics

During the period April 1, 2000 to July 1, 2006, the population of Texas increased by 12.7 percent, Louisiana decreased by 4.1 percent, Mississippi increased 2.3 percent, Alabama increased 3.4 percent, and Florida increased by 13.2, while the population of the United States experienced a 6.4 percent increase (USCB, 2007). In the United States, there were 355,866 Navy and Marine Corps personnel in activity duty military installations in 2002 (the latest year reported by the U.S. census). Texas reported 7,800, Louisiana had 1,774, Mississippi reported 5,610, Alabama reported 643, and Florida had 27,570. Civilian personnel affiliated with the Navy and Marine Corps on military installations in 2002 included 177,695 in the United States. There were 1,569 civilian personnel on military installations in Texas, 1,319 in Louisiana, 2,535 in Mississippi, 33 in Alabama, and 1,266 in Florida (USCB, 2003).

Age Structure

The latest year for which age data are available is 2006. During that period, 8.2 percent of Texas' population was under the age of five, 27.6 percent were under the age of 18, and 9.9 percent were over the age of 65. Louisiana had seven percent of the population under the age of five, 25.4 percent were under the age of 18, and 12.2 percent were over the age of 65. Mississippi had 7.2 percent of the population under the age of five, 26.1 percent under the age of 18, and 12.4 percent over the age of 65. Alabama had 6.5 percent under the age of five, 24.2 percent under the age of 18, and 13.4 percent were over the age of 65. Florida had 6.3 percent of the population under the age of five, 22.9 percent under the age of 18, and 16.8 percent over the age of 65. These percentages are consistent with the age

distribution of the United States as a whole: 6.8 percent, 24.8 percent, and 12.4 percent, respectively (USCB, 2008).

Race and Ethnicity

In the year 2000, the percentage of Texas households that spoke a language other than English was 31.2 percent, Louisiana households that spoke a primary language other than English was 9.2 percent, Mississippi was 3.6 percent, Alabama was 3.9 percent, and Florida was 23.1 percent. The percentage of homes in the United States that speak a language other than English as the primary household language was 17.9 percent.

Table 3.15-1 depicts a comparison of the race and ethnicity percentages of the States of Texas, Louisiana, Mississippi, Alabama, and Florida compared to the United States. Percentages exceed 100 due to individuals reporting race and ethnicity in multiple categories (*i.e.*, reporting in both "white" and "white, not Hispanic").

TABLE 3.15-1
RACE AND ETHNICITY COMPARISON

Race/Ethnicity	Texas Percentage	Louisiana Percentage	Mississippi Percentage	Alabama Percentage	Florida Percentage	United States Percentage
White	87.2	65.4	60.9	71.2	80.2	80.1
Black	11.9	31.7	37.1	26.3	15.8	12.8
American Indian & Alaska Native	0.7	0.6	0.5	0.5	0.4	1.0
Asian	3.4	1.4	0.8	0.9	2.2	4.4
Native Hawaiian & Other Pacific Islander	0.1	Z[1]	Z[1]	Z[1]	0.1	0.2
Person Reporting Two Or More Races	1.2	0.9	0.7	0.9	1.3	1.6
Hispanic or Latino Origin	35.7	2.9	1.8	2.5	20.2	14.8
White, Not Hispanic	48.3	62.8	59.3	69	61.3	66.4

Note: All numbers are percentages from 2006
1. Z means the value is greater than zero but less than half unit of measure shown
Source: USCB, 2008

Poverty Level

Texas reported 16.2 percent of the population below the poverty level in 2004, Louisiana reported 19.2, Mississippi reported 19.3, Alabama reported 16.1, and Florida reported 11.9 while the United States reported 12.7 percent (USCB, 2007).

Education

In Texas, 75.7 percent of the population graduated from high school and 23.2 percent of the population achieved a Bachelor's degree or higher. In Louisiana, 74.8 percent of the population graduated from high school and 18.7 percent of the population achieved a Bachelor's degree or higher. In Mississippi, 72.9 percent of the population graduated from high school and 16.9 percent of the population achieved a Bachelor's degree or higher. In Alabama, 75.3 percent of the population graduated from high school and 19 percent of the population achieved a Bachelor's degree or higher. In Florida, 79.9 percent of the population graduated from high school and 22.3 percent of the population achieved a Bachelor's degree

or higher. Comparatively, in the United States, 80.4 percent of the population graduated from high school and 24.4 percent of the population achieved a Bachelor's degree or higher.

3.15.3 Environmental Consequences

Impacts to demographics could occur if the proposed actions resulted in direct impacts to education, ethnicity, and population structure within the Study Area. Demographic impacts could occur if the alternative chosen for implementation resulted in a substantial shift in population trends, spending and earning patterns, or community resources (notably housing and education).

3.15.3.1 No Action Alternative

Implementation of the No Action Alternative would not result in a change in the demographics within the Study Area of the States of Texas, Louisiana, Mississippi, Alabama, and Florida. Therefore, if the No Action Alternative were selected for implementation, there would not be any impacts to demographics.

3.15.3.2 Alternative 1

Although Alternative 1 introduces new training activities and proposes an increase to some existing training, Alternative 1 would not require the basing or relocation of additional personnel within the Study Area. Therefore, implementation of Alternative 1 would not result in impacts to demographics.

3.15.3.3 Alternative 2 (Preferred Alternative)

If Alternative 2 were chosen for implementation, there would be no impacts upon demographics within the Study Area. There are no proposed increases or movement of personnel as a result of the proposed action; therefore, there would be no impacts to demographics.

3.15.4 Unavoidable Significant Environmental Effects

Based on the proceeding analysis, there are no unavoidable significant environmental effects as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.15.5 Summary of Environmental Effects (NEPA and EO 12114)

Table 3.15-2 summarizes the fact that there are no aspects of the proposed action likely to act as stressors to demographics; thus, there are no NEPA impacts on demographics. Proposed actions would have no impact on demographics in U.S. Territory. Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.

TABLE 3.15-2
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON DEMOGRAPHICS IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action Alternative		
No Stressors Identified	The No Action Alternative would not require the basing or relocation of additional personnel within the Study Area.	Non-territorial waters are outside the study area for demographics; therefore, there would be no harm to demographics.
Impact Conclusion	Implementation of the No Action Alternative would have no impact on demographics in U. S. Territorial Waters.	Non-territorial waters are outside the study area for demographics; therefore, there would be no harm to demographics.
Alternative 1		
No Stressors Identified	Alternative 1 would not require the basing or relocation of additional personnel within the Study Area.	Non-territorial waters are outside the study area for demographics; therefore, there would be no harm to demographics.
Impact Conclusion	Implementation of Alternative 1 would have no impact on demographics in U.S. Territorial Waters.	Non-territorial waters are outside the study area for demographics; therefore, there would be no harm to demographics.
Alternative 2		
No Stressors Identified	Alternative 2 would not require the basing or relocation of additional personnel within the Study Area.	Non-territorial waters are outside the study area for demographics; therefore, there would be no harm to demographics.
Impact Conclusion	Implementation of Alternative 2 would have no impact on demographics in U.S. Territorial Waters.	Non-territorial waters are outside the study area for demographics; therefore, there would be no harm to demographics.

3.16 REGIONAL ECONOMY (INCLUDES COMMERCIAL FISHING/TOURISM/SHIPPING)

3.16.1 Introduction and Methods

Regional economy is assessed through the evaluation of economic factors associated with offshore naval activities as indicated in Chapter 2 including industry, commercial fishing, tourism, and recreational fishing. The Study Area for assessment of the regional economy includes the states of Texas, Louisiana, Mississippi, Alabama, and Florida.

3.16.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the U.S. Census Bureau (USCB), National Oceanic Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), state and local governmental agencies, and local organizations as shown in the reference section. Data were collected on commercial fisheries landings, types of fishing gear used, and fishing effort. National Marine Fisheries Service collects data regarding national fisheries, target species, landed tonnage, and gear types by state.

3.16.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to the regional economy are assessed in terms of direct effects of military training in the GOMEX Study Area on the local economy and related effects on other socioeconomic resources (for example, earning and income). Potential impacts might be experienced if commercial or recreational activities were denied access to areas where they previously had occurred.

Stressors to the regional economy would include changes in the intensity or duration of training activities that directly affect the abilities of recreational or commercial fishers to harvest in areas where they have traditionally done so. Table 3.16-1 depicts aspects of the proposed action likely to act as stressors to the regional economy. These stressors were identified by conducting a detailed analysis of the warfare areas, events, and specific activities included in the Alternatives.

3.16.2 Affected Environment

3.16.2.1 Industry

The 2002 U.S. Census indicates that the greatest number of establishments in the U.S. was in the retail trade industry. The states of Texas, Louisiana, Mississippi, Alabama, and Florida reflected that trend with the retail trade industry leading the states with the greatest number of establishments (75,703, 17,613, 12,561, 19,608, and 69,543 respectively). Information services contained the least amount of establishments for all the states with 9,671, 1,426, 1,000, 1,683, and 7,758 respectively (USCB, 2008).

The commercial fishing industry is included in the category of "other services (except public administration)." The fishing industry, which is most likely to be affected by the alternatives analyzed in this Final EIS/OEIS, is not the most productive industry in the Study Area. Of the top ten industries for states in the Study Area, "Other Services" (of which commercial fishing is a sub-section) placed fifth in the top ten industries with 35,282 in Texas, 4,074 in Mississippi, and 28,053 in Florida. "Other Services" placed sixth in the top ten industries with 7,175 in Louisiana and 7,058 in Alabama (USCB, 2008).

TABLE 3.16-1
SUMMARY OF POTENTIAL STRESSORS TO REGIONAL ECONOMY RESOURCES

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Mine Warfare (MIW)					
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox	✓	✓	✓	
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B	✓	✓	✓	
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox	✓	✓	✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Ship)	W-151 A/B; W-155A	✓	✓	✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Panama City OPAREA	✓	✓	✓	
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S] (Boat)	Corpus Christi OPAREA UNDET BOX E3	✓	✓	✓	

TABLE 3.16-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO REGIONAL ECONOMY RESOURCES

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓			
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓		
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓		✓	
Air Warfare (AW)					
Air Intercept Control (AIC)	W-151; W-155		✓		
Strike Warfare (STW)					
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓	✓	
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓	✓	
Amphibious Warfare (AMW)					
Firing Exercises (FIREX) with IMPASS	W-151A/B; W-155A	✓	✓	✓	
Electronic Combat (EC)					
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A		✓	✓	
Chaff Exercises (CHAFFEX)	Brownwood MOA		✓	✓	
Flare Exercises (FLAREX)	W-155A/B		✓	✓	
Flare Exercises (FLAREX)	Brownwood MOA		✓	✓	

TABLE 3.16-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO REGIONAL ECONOMY RESOURCES

		Stressors			
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**	**Towed Mine Warfare Devices**
Mission Area Training[49]					
Mission Area Flight Training	W-92; W-54; Brownwood MOAs				
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312			✓	
Salvage Diver Training	NSA Panama City Demolition Pond			✓	
EOD Tech Training	NSA Panama City Demolition Pond			✓	
Security Force Training	NSA Panama City Demolition Pond			✓	
Diver Training	NSA Panama City Demolition Pond			✓	

The U.S. cruise industry has experienced steady growth in numbers of passengers with an average, annual growth from 2004-2007 of 6.4 percent. The cruise industry contributed $38 billion to the U.S. economy in 2007. The total income realized from the cruise industry in 2007 included purchases of goods and services (air transportation, food and beverage, ship maintenance and refurbishment) and

[49] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

cruise line and port operations. Texas realized a total income of $893 million, Louisiana gained $136 million, Mississippi gained $13 million, Alabama gained $69 million, and Florida gained $5,209 million (CLIA, 2008).

3.16.2.2 Commercial Fishing

The Gulf of Mexico Fishery Management Council manages the fisheries in the Exclusive Economic Zone of the Gulf of Mexico. Fishery Management Plans (FMP) are in effect for several fisheries and regulate both commercial and recreational fishing. The objectives of the plans vary, but are generally geared toward ensuring the long-term sustainability of the subject fish species and meeting specific management goals. FMPs generally utilize geographic and seasonal fishery closures, catch limits and quotas, size and age limits, gear restrictions, and access controls to manage the fishery resources. The Gulf of Mexico Fishery Management Council has developed six FMPs to promote the long-term health and stability of the managed fisheries (GOMFMC, 2008). These FMPs address the following species:

- Reef fish
- Shrimp
- Spiny Lobster
- Stone Crab
- Corals
- Migratory Pelagics
- Red Drum

3.16.2.3 State Landings

NMFS incorporates commercial landing data into NMFS Statistics and Economics Division databases through data collected by comprehensive surveys of all coastal states landings through a system of cooperative state and federal collection systems. The data include landing weighout reports, state-mandated fishery or mollusk trip-tickets from seafood dealers, shipboard and portside interviews, federal logbooks of fishery catch and effort, and biological sampling of catches. The NFMS Statistics and Economics Division collect data and coordinates data collection efforts with state and federal agencies. Data are collected through a multi-survey method that includes telephone surveys of households and for-hire boat operators, shore fishers, and state and federal data collection programs. Collected statistics are then integrated and disseminated through databases that are made available to other agencies and the public. Landing data do not indicate location of harvest, as species may be taken offshore of another state but reported in the state in which the fishermen landed (NMFS, 2008a).

Texas

Over the five year period ending in 2006, Texas commercial landings ranged between a high of 117,131,190 pounds in 2006 and a low of 84,289,291 pounds in 2005 (Table 3.16-2). The five-year average was 95,231,800 pounds. Over the same period, the ten non-shellfish species that generated the most poundage of harvest were approximately five percent of the total annual landings. Landings of these species averaged about 4,996,219 pounds annually. Shellfish comprised almost 95 percent of the total annual average of Texas commercial landings, with an average 89,478,787 annual pounds during the period 2002-2006. The average revenue of all species during the five year period 2002-2006 was $175,498,569 (NMFS, 2008a).

The major ports that report commercial fishery landings for the state of Texas include Brownsville-Port Isabel, Port Arthur, Galveston, Palacios, and Freeport. In 2006 Brownsville-Port Isabel reported 30.5 million pounds of commercial harvest with revenue of $52 million; Port Arthur reported 25 million pounds of commercial harvest with revenue of $42.8 million; Galveston reported 22 million pounds of commercial harvest with a revenue of $40.7 million; Palacios reported 22.3 million pounds of harvest

with a revenue of $32.6 million; and Freeport reported a commercial harvest of 5.9 million pounds with a revenue of $9.2 million (NMFS, 2008b).

TABLE 3.16-2
TEXAS COMMERCIAL
LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS	DOLLARS
2002	93,059,148	173,340,477
2003	96,122,318	168,316,508
2004	85,557,055	166,208,228
2005	84,289,291	172,336,642
2006	117,131,190	197,290,989
TOTAL	476,159,002	877,492,844
FIVE YEAR AVERAGE	95,231,800	175,498,569

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS 2008a

Texas fish harvest in the 0-3-mile zone from shore in 2006 was 2,795,000 pounds ($3,224,000) and the shellfish harvest was 24,391,000 pounds ($49,092,000). The 3-200-mile zone from shore fish harvest was 3,030,000 pounds ($28,135,000) and the shellfish harvest was 86,645,000 pounds ($136,406,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore (NMFS, 2007).

Louisiana

Over the five year period ending in 2006, Louisiana commercial landings ranged between a high of 1,312,138,633 pounds in 2002 and a low of 849,280,372 pounds in 2005 (Table 3.16-3). The five-year average was 1,070,786,427 pounds. Over the same period, the ten non-shellfish species that generated the most poundage of harvest were approximately 70 percent of the total annual landings. Landings of these species averaged about 865,497,464 pounds annually. Shellfish comprised almost 30 percent of the total annual average of Louisiana commercial landings, with an average 190,581,165 annual pounds during the period 2002-2006. The average revenue of all species during the five year period 2002-2006 was $269,467,383 (NMFS, 2008a).

TABLE 3.16-3
LOUISIANA COMMERCIAL
LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS	DOLLARS
2002	1,312,138,633	280,630,404
2003	1,181,606,767	270,408,142
2004	1,095,571,136	274,081,780
2005	849,280,372	251,678,265
2006	915,335,226	270,538,324
TOTAL	5,353,932,134	1,347,336,915
FIVE YEAR AVERAGE	1,070,786,427	269,467,383

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2008a

The major ports that report commercial fishery landings for the state of Louisiana include Empire-Venice, Intracoastal City, Dulac-Chauvin, Lafitte-Barataria, Golden Meadow-Leeville, Cameron, and Morgan City-Berwick. In 2006 Empire-Venice reported 285.7 million pounds of commercial harvest

with revenue of $41.1 million; Intracoastal City reported 400.7 million pounds of commercial harvest with revenue of $38.6 million; Dulac-Chauvin reported 30.8 million pounds of commercial harvest with a revenue of $35.7 million; Lafitte-Barataria reported 25.7 million pounds of harvest with a revenue of $23.1 million; Golden Meadow-Leeville reported a commercial harvest of 17.9 million pounds with a revenue of $20.7 million; Cameron reported a commercial harvest of 8.1 million pounds with a revenue of $9.1 million; and Morgan City-Berwick reported a commercial harvest of 10.2 with a revenue of $3.8 million (NMFS, 2008b).

Louisiana fish harvest in the 0-3-mile zone from shore in 2006 was 257,168,000 pounds ($18,137,000) and the shellfish harvest was 200,756,000 pounds ($214,068,000). The 3-200-mile zone from shore fish harvest was 457,409,000 pounds ($38,329,000) and the shellfish harvest was 2,000 pounds ($4,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore) (NMFS, 2007).

Mississippi

Over the five year period ending in 2006, Mississippi commercial landings ranged between a high of 221,831,766 pounds in 2006 and a low of 183,558,261 pounds in 2004 (Table 3.16-4). The five year average was 200,887,256 pounds. Over the same period, the ten non-shellfish species that generated the most poundage of harvest were approximately 91 percent of the total annual landings. Landings of these species averaged about 183,435,986 pounds annually. Shellfish comprised approximately nine percent of the total annual average of Mississippi commercial landings, with an average 16,681,616 annual pounds during the period 2002-2006. The average revenue of all species during the five year period 2002-2006 was $36,491,766 (NMFS, 2008a).

TABLE 3.16-4
MISSISSIPPI COMMERCIAL LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS	DOLLARS
2002	217,967,609	47,565,219
2003	213,468,811	46,148,637
2004	183,558,261	43,618,143
2005	167,609,834	23,385,725
2006	221,831,766	21,741,108
TOTAL	1,004,436,281	182,458,832
FIVE YEAR AVERAGE	200,887,256	36,491,766

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2008a

The major ports that report commercial fishery landings for the state of Mississippi were Gulfport-Biloxi and Pascagoula-Moss Point. In 2006 Gulfport-Biloxi reported 9.6 million pounds of commercial harvest with revenue of $12.8 million and Pascagoula-Moss Point reported 212.1 million pounds of commercial harvest with revenue of $8.8 million (NMFS, 2008b). Mississippi fish harvest in the 0-3-mile zone from shore in 2006 was 206,910,000 pounds ($8,507,000) and the shellfish harvest was 3,829,000 pounds ($4,081,000). The 3-200-mile zone from shore fish harvest was 5,303,000 pounds ($451,000) and the shellfish harvest was 11,098,000 pounds ($9,163,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore) (NMFS, 2008b).

Mississippi fish harvest in the 0-3-mile zone from shore in 2006 was 206,910,000 pounds ($8,507,000) and the shellfish harvest was 3,829,000 pounds ($4,081,000). The 3-200-mile zone from shore fish harvest was 5,303,000 pounds ($451,000) and the shellfish harvest was 5,795,000 pounds ($8,712,000).

Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore) (NMFS, 2007).

Alabama

Over the five-year period ending in 2006, Alabama commercial landings ranged between a high of 34,151,232 pounds in 2006 and a low of 23,658,021 pounds in 2002 (Table 3.16-5). The five-year average was 26,777,573 pounds. Over the same period, the ten non-shellfish species that generated the most poundage of harvest were approximately 17 percent of the total annual landings. Landings of these species averaged about 4,530,822 pounds annually. Shellfish comprised almost 83 percent of the total annual average of Alabama commercial landings, with an average 20,765,724 annual pounds during the period 2002-2006. The average revenue of all species during the five year period 2002-2006 was $39,743,186 (NMFS, 2008a).

The major ports that report commercial fishery landings for the state of Alabama were Bayou La Batre and Bon Secour-Gulf Shores. In 2006 Bayou La Batre reported 28 million pounds of commercial harvest with revenue of $41 million and Bon Secour-Gulf Shores reported 6 million pounds of commercial harvest with revenue of $8 million (NMFS, 2008b). Alabama fish harvest in the 0-3-mile zone from shore in 2006 was 6,265,000 pounds ($3,848,000) and the shellfish harvest was 11,585,000 pounds ($18,170,000). The 3-200-mile zone from shore fish harvest was 513,000 pounds ($1,249,000) and the shellfish harvest was 15,689,000 pounds ($25,299,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore) (NMFS, 2008b).

TABLE 3.16-5
ALABAMA COMMERCIAL
LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS	DOLLARS
2002	23,658,021	35,925,479
2003	25,534,971	36,843,888
2004	26,558,704	37,035,797
2005	23,984,938	39,725,464
2006	34,151,232	49,185,302
TOTAL	133,887,866	198,715,930
FIVE YEAR AVERAGE	26,777,573	39,743,186

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS 2008a

Alabama fish harvest in the 0-3-mile zone from shore in 2006 was 6,265,000 pounds ($3,848,000) and the shellfish harvest was 11,585,000 pounds ($18,170,000). The 3-200-mile zone from shore fish harvest was 513,000 pounds ($1,249,000) and the shellfish harvest was 15,689,000 pounds ($25,299,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore) (NMFS, 2007).

Florida West Coast

Over the five year period ending in 2006, Florida West Coast commercial landings ranged between a high of 83,893,959 pounds in 2004 and a low of 73,116,376 pounds in 2005 (Table 3.16-6). The five-year average was 78,352,287 pounds. Over the same period, the ten non-shellfish species that generated the most poundage of harvest were approximately 32 percent of the total annual landings. Landings of these species averaged about 25,349,573 pounds annually. Shellfish comprised almost 68 percent of the total annual average of Florida West Coast commercial landings, with an average

38,570,684 annual pounds during the period 2002-2006. The average revenue of all species during the five-year period 2002-2006 was $144,359,135 (NMFS, 2008a).

The major ports that report commercial fishery landings for the state of Florida West Coast were Tampa Bay-St. Petersburg, Fort Myers, and Panama City. In 2006, Tampa Bay-St. Petersburg reported 11.9 million pounds of commercial harvest with revenue of $27.6 million, Fort Myers reported 9.9 million pounds of commercial harvest with revenue of $21 million, and Panama City reported 3 million pounds of commercial harvest with revenue of $7.9 million (NMFS, 2008b). Florida West Coast fish harvest in the 0-3-mile zone from shore in 2006 was 16,004,000 pounds ($11,744,000) and the shellfish harvest was 21,340,000 pounds ($93,105,000). The 3-200-mile zone from shore fish harvest was 18,996,000 pounds ($42,245,000) and the shellfish harvest was 12,574,000 pounds ($46,929,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore) (NMFS, 2008b).

TABLE 3.16-6
FLORIDA WEST COAST COMMERCIAL LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS	DOLLARS
2002	82,075,208	144,184,846
2003	79,162,543	141,185,290
2004	83,893,959	148,057,805
2005	73,116,376	138,054,093
2006	73,513,348	150,313,640
TOTAL	391,761,434	721,795,674
FIVE YEAR AVERAGE	78,352,287	144,359,135

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2008a

Florida West Coast fish harvest in the 0-3-mile zone from shore in 2006 was 16,004,000 pounds ($11,744,000) and the shellfish harvest was 21,340,000 pounds ($93,105,000). The 3-200-mile zone from shore fish harvest was 18,966,000 pounds ($42,245,000) and the shellfish harvest was 12,574,000 pounds ($46,929,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore) (NMFS, 2007).

3.16.2.4 Fishing Gear

Texas

The principal gear used to harvest the fish and shellfish landed on the Texas coast is otter trawl. Between 2002 and 2006, approximately 85 percent of the commercial harvest landed in the state was captured using otter trawl. The total revenue using all reported gear during this period was $877,492,844 (NMFS, 2008c).

Louisiana

The principal gear used to harvest the fish and shellfish landed on the Louisiana coast is otter trawl. Between 2002 and 2006, almost 36 percent of the commercial harvest landed in the state was captured using otter trawl. The total revenue using all reported gear during this period was $1,347,336,915 (NMFS, 2008c).

Mississippi

The principal gear used to harvest the fish and shellfish landed on the Mississippi coast are otter trawl and purse seines. Between 2002 and 2006, approximately 86 percent of the commercial harvest landed in the state was captured using otter trawl and purse seines. The total revenue using all reported gear during this period was $182,458,832 (NMFS, 2008c).

Alabama

The principal gear used to harvest the fish and shellfish landed on the Alabama coast is otter trawl. Between 2002 and 2006, almost 79 percent of the commercial harvest landed in the state was captured using otter trawl. The total revenue using all reported gear during this period was $198,715,930 (NMFS, 2008c).

Florida West Coast

The principal gear used to harvest the fish and shellfish landed on the Florida West Coast are beach haul, purse, and other seines, beam trawls, otter trawl, and pots and traps. Between 2002 and 2006, almost 63 percent of the commercial harvest landed in the state was captured using beach haul, purse, and other seine, beam trawls, otter trawl, pots and traps. The total revenue using all reported gear during this period was $721,795,674 (NMFS, 2008c).

3.16.2.5 Tourism

Texas

In 2006, one half of all visitors' spending in the state was from Texas residents. Total direct travel spending in Texas was $53.8 billion. This spending can be directly attributed to supporting 521,000 jobs that result in $15.5 billion in earnings. Secondary impacts from tourism result in an additional 458,000 jobs and $15.5 billion in earnings. Travel spending directly generates at least 100 jobs in 254 of Texas counties. Eight counties realized more than 10,000 travel-generated jobs whiles 1,000 jobs in 47 counties were related to travel spending. Six of the top ten counties in Texas are non-metropolitan areas and the gulf coast region ranks second in the state for total tourism regional visitor spending in 2006 (Texas Tourism, Office of the Governor, 2007).

Louisiana

In 2006 Louisiana experienced the first full year after Hurricanes Katrina and Rita with a 34.2 percent decline in visitor spending from the last pre-storm year of 2004. Visitor spending in 2006 was just over $6.5 billion. In 2006, over 107,000 residents were directly employed in the tourism industry (6% of the state workforce), which is a decrease of 74,000 over the peak year of 2004. Visitors to Louisiana account for eight percent of the tax revenues for the 2006 budget for the state (Louisiana Department of Culture, Recreation and Tourism, 2007).

Mississippi

Mississippi tourism accounted for 85,300 direct jobs in fiscal year 2007 and 37,295 indirect jobs for a total of 122,595. This employment resulted in earning income of $2.4 billion. Tourism in Mississippi rated sixth in direct employment (based on all employment sectors in the state). An estimated 22 million visitors went to Mississippi in fiscal year 2007, with approximately 72 percent of those visitors coming from outside of the state (Mississippi Development Authority/Tourism Division, Research Unit, 2008).

Alabama

The Alabama Gulf Coast Convention and Visitors Bureau reported that in calendar year 2007 visitors spent $573,314,313. There were 1, 383,100 visitors to Alabama with 49.9 percent visiting the southeast part of the state; 94 percent of those visitors arrived by car and two percent were visiting Alabama to fish. Of the approximate 40 percent of visitors to the coastal region, nine percent stated that the purpose of their trip was to fish (Alabama Gulf Coast Convention and Visitors Bureau, 2009).

Florida

Annual numbers of tourists visiting Florida has increased over several years and with 84.5 million visitors in 2007, Florida is the top travel destination in the world. Tourism is Florida's top revenue grossing industry, contributing $65.5 billion (2007) to Florida's economy and employing nearly a million people. Seasonality of visitation by quarter is relatively consistent. Most domestic and international visitors site leisure as their primary purpose for visiting (Visit Florida Research, 2009).

3.16.2.6 Recreational Fishing

NMFS is required to collect statistics on marine recreational fishing. NMFS 2006 preliminary report on commercial and recreational landings indicates that, in 2006, 3.6 million residents participated in marine recreational fishing in the Gulf of Mexico. These visitors took over 25 million trips and caught a total of almost 193 million fish. The total Gulf catch was the result of 65 percent inland fishing trips and 28 percent was the result of fishing in state territorial waters (NMFS, 2007).

In conjunction with state agencies, the Division of Marine Fisheries, the U.S. Department of Commerce and NOAA began publishing state specific recreational informational brochures in April 2007. Through the state brochures, the following recreational fishing statistics were reported:

- The state of Texas has not developed a state brochure (NMFS, 2008d).
- The state of Louisiana reports that seven percent of the recreational anglers lived outside the state of Louisiana, 67 percent of the saltwater fishing trips were taken via private or rental boat, and 30 percent of the recreational fishing was conducted from the shore. Three percent of the saltwater fishing trips were taken by charter boat. Three percent were in federal waters, seven percent were in state waters, and 90 percent were inland (NMFS, 2008d).
- The state of Mississippi reports that six percent of the recreational anglers lived outside the state of Mississippi, 52 percent of the saltwater fishing trips were taken via private or rental boat, and 47 percent of the recreational fishing was conducted from the shore. One percent of the saltwater fishing trips were taken by charter boat. Approximately five percent were in federal waters, two percent were in state waters, and 93 percent were inland (NMFS, 2008d).
- The state of Alabama reports that 16 percent of the recreational anglers lived outside the state of Alabama, 55 percent of the saltwater fishing trips were taken via private or rental boat, and 40 percent of the recreational fishing was conducted from the shore. Three percent of the saltwater fishing trips were taken by charter boat. Eighteen percent were in federal waters, 45 percent were in state waters, and 37 percent were inland (NMFS, 2008d).
- The state of Florida (Gulf Coast) reports that 14 percent of the recreational anglers lived outside the state of Florida, 53 percent of the saltwater fishing trips were taken via private or rental boat, and 42 percent of the recreational fishing was conducted from the shore. Three percent of the saltwater fishing trips were taken by charter boat. Nine percent were in federal waters, 38 percent were in state waters, and 53 percent were inland (NMFS, 2008d).

Favored fishing areas change over time with changes in fish populations and communities, changes in preferred target species, or changes in fishing modes and styles. Popular fishing sites are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fishes. Fishermen focusing on areas of bottom relief not only catch reef-associated fishes but also coastal pelagic species that may be attracted to the habitat. A detailed discussion of fish habitat can be found in Section 3.9.

3.16.3 Environmental Consequences

3.16.3.1 No Action Alternative

The No Action Alternative would maintain baseline training at current levels. Implementation of the No Action Alternative would not result in a change in the local regional economy. Under this alternative, the Study Area would not accommodate an increase in training activities due to proposed force structure changes, and it would not implement enhancements identified in the Range Complex Management Plan. Implementation of the No Action Alternative would not result in a substantial shift in regional employment or spending and earning patterns; therefore, there would be no impacts. The environmental effects of the No Action Alternative in U.S. Territory on regional economy would have no impact. In non-territorial waters, the environmental effects of the No Action Alternative would not cause harm to regional economy resources.

Industry – The industries assessed for regional economy were primarily land based. According to the USCB, the fishing industry is included in the category of "Other Services (except Public Administration)." Of the 537,576 industries in this category in the U.S., 195,028 (36%) are found in the Study Area for the GOMEX Range Complex EIS/OEIS. The leading industry in the Study Area is retail trade. Given the fact that the land based industries are not directly related to any of the alternatives or possible associated impacts, there would be no impacts to these industries if the No Action Alternative were implemented.

State Landings – The possible occurrence of potential impacts can vary greatly depending on the location of a proposed action. Given the size of the Study Area and the limited number of activities within this area, the likelihood of possible contact with a non-Navy vessel or impact to commercial fishing practices would be negligible. The training areas are not proposed to change with implementation of any of the alternatives; therefore, the areas that traditionally produce state landings are not expected to be affected.

Fishing Gear – Fishing activities have the potential to interact with equipment used during the proposed Navy training activities. Commercial bottom fishing activities have the greatest potential for negative effects. Interaction with bottom-fishing gear could result in the loss of or damage to both commercial and naval hardware and fishing gear. Given the size of the Study Area in which the Navy has proposed to introduce or increase training activities, and the fact that the area is substantially the same as it has been for many years, it is unlikely that fishing gear interaction with naval equipment in the OPAREAs would realize an impact since the existing areas that are productive for recreational or commercial fishing are unlikely to change or experience any impact. Naval activities that would have the greatest potential of conflict with fishing gear (Mine Warfare activities) occur in areas designed for those activities where fishing is not likely to occur.

Tourism – Tourism in the Study Area encompasses many activities that do not involve boating or sailing. Tourism is an important economic activity in the Study Area. Tourism would not be impacted by Navy training in the Study Area as training events occur in areas specifically designed and designated for such training where tourism would not occur.

Recreational Fishing - As indicated in the Essential Fish Habitat Section 3.9, popular fishing sites are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fishes. For all states in the Study Area, at least 30 percent (and up to 90%) of recreational fishing occurs inland, 45 percent in State waters, and 18 percent or less of recreational fishing occurs in federal waters or beyond. Given the size of the Study Area, the opportunities for Navy activities to interfere with recreational fishing are avoidable due to the issuance of NOTMARs and NOTAMs.

3.16.3.2 Alternative 1

Alternative 1 includes accommodating training operations currently conducted (i.e., those described in the No Action Alternative), adjustment of training operations (increases and decreases as shown in Tables 2.2-3 and 2.2-4), adjustment of range complex capabilities to the minimum extent possible to meet the components of the proposed action, and adjustment of research, development, testing, and evaluation (RDT&E) as identified in Tables 2.2-3 and 2.2-4. The environmental impacts of Alternative 1 on the regional economy in U.S. Territory would have no impact. In non-territorial waters, the environmental effects of Alternative 1 would not cause harm to regional economy resources.

3.16.3.3 Alternative 2 (Preferred Alternative)

The assessment of impacts to industry, commercial fishing, fishing gear, or recreational fishing with implementation of Alternative 2 is the same as those described in the No Action Alternative, described in Section 3.16.3.1. Alternative 2, the Preferred Alternative, includes implementation of many of the elements of Alternative 1, and an increase in post-BRAC gulf-based (F-18 and E-2) operations and transient Navy participation in Navy or joint training opportunities as well as a reduction in BOMBEX (A-S) training with high explosive (HE) ordnance. The environmental impacts of Alternative 2 in U.S. Territory on regional economy would have no impact. In non-territorial waters, the environmental effects of Alternative 2 would not cause harm to regional economy resources.

3.16.4 Unavoidable Significant Environmental Effects

Based on the proceeding analysis, there are no unavoidable significant environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.16.5 Summary of Environmental Effects (NEPA and EO 12114)

Table 3.16-7 shows a summary of the environmental impacts of the alternatives on the regional economy. The environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 in U.S. Territory on regional economy would have no impact. In non-territorial waters, the environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 would not cause harm to the regional economy.

TABLE 3.16-7
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE REGIONAL ECONOMY IN THE GOMEX RANGE COMPLEX

Alternatives and Stressors	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	The No Action Alternative would continue current Navy practices; it would not result in any impacts to the regional economy. Implementation of the No Action Alternative would not result in a substantial shift in regional employment or spending and earning patterns.	The No Action Alternative would continue current Navy practices; it would not result in any impacts to the regional economy. Implementation of the No Action Alternative would not result in a substantial shift in regional employment or spending and earning patterns.
Aircraft Overflights		
Military Expended Materials		
Towed Mine Warfare Devices		
Impact Conclusion	The environmental effects of the No ActionAlternative in U.S. Territorial Waters on regional economy would have no impact.	In Non-Territorial Waters, the environmental effects of the No Action Alternative would not cause harm to regional economy resources.
Alternative 1		
Vessel Movements	Alternative would not result in any impacts to the regional economy. Implementation of Alternative 1 would not result in a substantial shift in regional employment or spending and earning patterns.	Alternative would not result in any impacts to the regional economy. Implementation of Alternative 1 would not result in a substantial shift in regional employment or spending and earning patterns.
Aircraft Overflights		
Military Expended Materials		
Towed Mine Warfare Devices	Not applicable; Towed Mine Warfare Devices would not be utilized under Alternative 1.	Not applicable; Towed Mine Warfare Devices would not be utilized under Alternative 1.
Impact Conclusion	Implementation of the Alternative 2 would have no impact on the regional economy in U.S. Territorial Waters.	Implementation of the Alternative 2 would not cause harm to the regional economy in non-territorial waters.

TABLE 3.16-7 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE REGIONAL ECONOMY IN THE GOMEX RANGE COMPLEX

Alternatives and Stressors	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel Movements	Implementation of Alternative 2 would not result in any impacts to the regional economy. Implementation of Alternative 3 would not result in a substantial shift in regional employment or spending and earning patterns.	Implementation of Alternative 2 would not result in any impacts to the regional economy. Implementation of Alternative 3 would not result in a substantial shift in regional employment or spending and earning patterns.
Aircraft Overflights		
Military Expended Materials		
Towed Mine Warfare Devices	Not applicable; Towed Mine Warfare Devices would not be utilized under Alternative 2.	Not applicable; Towed Mine Warfare Devices would not be utilized under Alternative 2.
Impact Conclusion	The environmental effects of Alternative 2 in U.S. Territorial Waters on regional economy would have no impact.	In Non-Territorial Waters, the environmental effects of Alternative 2 would not cause harm to regional economy resources.

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3.17 RECREATION

3.17.1 Introduction and Methods

Recreation refers to non-commercial activities that occur in the GOMEX Range Complex EIS/OEIS Study Area. Commercial recreation activities are addressed in the regional economy section of this Final EIS/OEIS. Offshore areas of the Gulf of Mexico are in use by both military and civilian interests. These activities are compatible with Navy ships. Navy ships, acounting for 3 percent of the total ship presence out to 200 nautical miles (CNA, 2001). Where naval vessels and aircraft are conducting activities that are not compatible (*e.g.*, hazardous weapons firing), they are conducted away from shipping lanes and inside Special Use Airspace (SUA). Hazardous activities are communicated to all vessels and operators by use of Notices to Mariners (NOTMAR), issued by the U.S. Coast Guard (USCG), and Notices to Airmen (NOTAM), issued by the Federal Aviation Administration (FAA). NOTMARs can be found on the internet at www.nga.mil/portal/site/maritime and NOTAMs are available on the internet at www.notams.jcs.mil.

Advance notice of schedule operation times are made available to the public via NOTMARs. These provide recreational boaters and other users notice that the military will be operating in a specific area, and allow them to plan their own activities accordingly. Schedules are updated when changes occur up until the date of the operation. If activities are cancelled at any time, this information is posted and the area is again identified as clear for public use. NOTMARs advise the public, fishermen, and divers in advance of ongoing military activities that may temporarily relocate civilian/recreational activities.

3.17.1.1 Assessment Methods and Data Used

Information regarding personal watercraft (PWC) was obtained in part from the USCG. Statistical data from the National Marine Manufacturers Association (NMMA) were also consulted with regard to recreational boating. State divisions of tourism, parks, and recreation provided state-specific PWC and recreational boating data.

The sport diving industry does not maintain statistics on numbers of individuals diving in specific regions of the country or on commonly used sites (Davison, 2007; DEMA, 2006). Dive locations identified in this document were established through the use of:

- The NOAA Office of Coast Survey's Automated Wreck and Obstruction Information System;
- A survey of state dive charter company websites;
- Veridian Corporation's 2001 Global Maritime Wrecks Database; and
- State tourism and parks and recreation information.

National Marine Fisheries Service (NMFS) collects statistics on marine recreational fishing. The information is obtained through recreational fishing participant telephone surveys, access site angler intercept surveys, a sampling of angler trips, and voluntary sampling of angler trips by participants. Through surveys, the number of boat trips and catch per trip are determined and total catch is estimated.

Favored fishing hotspots change over time with changes in fish populations and communities, preferred target species, or fishing modes and styles. Popular fishing sites are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fish. Anglers focusing on areas of bottom relief habitat not only catch reef-associated fish but also coastal pelagic species that may be attracted to the habitat. A more extensive discussion of fishing habitat is found in Appendix F.

3.17.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to recreation are assessed in terms of anticipated levels of disruption of or improvement to recreational areas. Table 3.17-1 identifies stressors that would likely impact recreational activities

These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the Alternatives.

TABLE 3.17-1
SUMMARY OF POTENTIAL STRESSORS TO RECREATION RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Mine Warfare (MIW)				
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Mine Neutralization –Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓	✓	✓
Surface Warfare (SUW)				
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox	✓	✓	✓
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B	✓	✓	✓
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox		✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓	✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Panama City OPAREA	✓	✓	✓
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Corpus Christi OPAREA UNDET BOX E3	✓	✓	✓

TABLE 3.17-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO RECREATION RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓		
MSO to include VBSS/MIO- Helo	W-151/W-155	✓	✓	
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓		✓
Air Warfare (AW)				
Air Intercept Control (AIC)	W-151; W-155		✓	
Strike Warfare (STW)				
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓	✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓	✓
Amphibious Warfare (AMW)				
Firing Exercise (FIREX) with IMPASS	W-151A/B; W-155A	✓		✓
Electronic Combat (EC)				
Chaff Exercises (CHAFFEX)	W-155A/B; W-155A		✓	✓
Chaff Exercises (CHAFFEX)	Brownwood MOA		✓	✓
Flare Exercises (FLAREX)	W-155A/B		✓	✓
Flare Exercises (FLAREX)	Brownwood MOA		✓	✓
Mission Area Training[50]				
Mission Area Flight Training	W-92; W-54; Brownwood MOAs		✓	

[50] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

TABLE 3.17-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO RECREATION RESOURCES

		Stressors		
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Military Expended Materials**
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-6312		✓	
Salvage Diver Training	NSA Panama City Demolition Pond			✓
EOD Tech Trainings	NSA Panama City Demolition Pond			✓
Security Force Training	NSA Panama City Demolition Pond			✓
Diver Training	NSA Panama City Demolition Pond			✓

3.17.2 Affected Environment

Popular sport diving sites within the Study Area consist of natural and artificial reefs as well as shipwrecks. In 1999 an estimated 83,780 dive trips occurred offshore between Texas and Alabama (MMS, 2001). The 5,000 offshore oil and gas structures in the Gulf (located primarily in Louisiana and Texas waters and on the adjoining outer continental shelf), provide shelter and are an indirect contributor of food for benthic, demersal, and pelagic fish. Of dives conducted offshore between Texas and Alabama, 93.6 percent of them occurred within 300 feet of an oil or gas structure. A popular diving destination in the Gulf of Mexico is the Flower Garden Banks National Marine Sanctuary, which consists of the East and West Flower Gardens and Stetson Bank (NOAA, 2008a, b, c).

Favored fishing hotspots change over time with changes in fish populations and communities, preferred target species, or fishing modes and styles. Popular fishing sites are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fish. Anglers focusing on areas of bottom relief habitat not only catch reef-associated fish but also coastal pelagic species that may be attracted to the habitat. A more extensive discussion of fishing habitat is found in Appendix F.

In 2006, 3.6 million residents participated in marine recreational fishing in the Gulf of Mexico (NMFS, 2007a). These visitors took more than 25 million trips and caught a total of approximately 193 million fish. Almost 28 percent of the total Gulf of Mexico catch came on saltwater trips that fished primarily in the state territorial seas, and 64 percent came on trips that fished primarily in inland waters (NMFS, 2007b). Assuming the distribution between saltwater and inland waters, Table 3.17-2 shows the 2006

number of trips (not the number of fisherman actually participating) and percentage calculated for inland and saltwater trips for the states in the GOMEX EIS/OEIS Study Area.

TABLE 3.17-2
RECREATIONAL LANDINGS & TRIP ESTIMATES

State	Number of Trips	Percentage of Inland Trips (64%)	Percentage of Saltwater Trips (28%)
Florida	29,345,260	17,607,156	8,803,578
Alabama	16,230425	9,738,255	4,869,128
Mississippi	997,911	598,747	229,373
Louisiana	4,491,280	2,694,768	1,347,384
Texas	1,063,000	637,800	318,900

Source: NMFS, 2007c.

Florida

Recreational Boating and Diving

Recreational activities in Florida waters are primarily comprised of game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, whale watching, and other recreational boating activities. Florida ranks first in the nation for the number of recreational boats registered in the state (USCG, 2005), with 973,859 registered in 2005 (NMMA, 2007). Recreational boats transit throughout the Florida coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations along the coast of Florida includes recreational vessels traversing Navy OPAREAs. Some recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

Diving and swimming account for 32 percent of all boating activities in the state (USCG, 2003). Florida's Panhandle and Gulf coast offer divers wrecks, towers, and ledges, all supporting marine life and of interest to divers. Off the Panhandle's coast hundreds of ships and artificial reef structures are located on the ocean floor.

Recreational Fishing

Recreational fishing is an important industry along the coast of Florida. Roughly half of the saltwater fishing trips are taken on private, rental, charter, and party/head boats, with the remainder taken from shore. Table 3.17-3 provides Florida fish catch (both saltwater and inland waters) recreational landings for years 2002-2006. About 1,285,000 fishing trips were taken in 2006 by individual marine recreational anglers fishing in the federal waters along the west coast of Florida (NMFS, 2007c). The estimated number of participants in recreational fishing in marine fishing areas, including the state territorial sea and federal waters, was over 4 million persons (NMFS, 2007d).

TABLE 3.17-3
FLORIDA (WEST COAST) RECREATIONAL LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS
2002	14,651,337
2003	14,662,960
2004	17,000,087
2005	11,389,676
2006	10,161,881
TOTAL	67,865,941

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007b.

Unlike the other states, Florida shows substantial activity during the winter months and generally stable recreational fishing effort throughout the year. Measured in terms of trips to federal waters, efforts peak during the 4-month period from May through August, when almost half the annual trips are taken.

Many sites known as fishing hotspots also attract divers. Fishing hotspots and other dive sites, including artificial reefs, coral patches, and shipwrecks, are utilized throughout the year by recreational vessels and commercial chartered boats, but use is highest during the summer (see Section 3.9 for additional information).

Alabama

Recreational Boating and Diving

In 2004, 727,000 residents inhabited coastal Alabama (USCB, 2005). Recreational activities offshore primarily comprise game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, and other recreational boating activities. Alabama ranks 18th in the nation for the number of recreational boats registered in the state (USCG, 2005). Recreational boats range throughout the Alabama coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations along the Alabama coast does not require traversing Navy OPAREAs. However, larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

The Gulf coast of Alabama offers plenty of opportunities for recreational diving. Approximately 1,200 square miles of offshore waters are included in the artificial reef general permit areas of Alabama, making it the largest artificial reef program in the U.S. (ADCNR, 2008). Artificial reefs can be constructed outside of the general permit areas after obtaining a special permit. In addition to artificial reefs, shipwrecks off the coast are popular diving sites.

Recreational Fishing

Table 3.17-4 provides Alabama fish catch (both saltwater and inland waters) recreational landings for years 2002-2006. About 247,000 fishing trips were taken in 2006 by individual marine recreational anglers fishing in the federal waters along the coast of Alabama (NMFS, 2007c). The estimated number of participants in recreational fishing in marine fishing areas, including the state territorial sea and federal waters, was over 736,000 persons (NMFS, 2007d).

TABLE 3.17-4
ALABAMA RECREATIONAL LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS
2002	4,029,533
2003	4,167,924
2004	3,982,771
2005	3,230,561
2006	2,602,025
TOTAL	18,012,814

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007b.

Mississippi

Recreational Boating and Diving

The pre-Hurricane Katrina population of coastal Mississippi was 608,000 (USCB, 2005). Recreational activities offshore primarily comprise game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, and other recreational boating activities. Mississippi ranks 23rd in the nation for the number of recreational boats registered in the state (USCG, 2005). Recreational boats range throughout the Mississippi coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations along the Mississippi coast does not require traversing Navy OPAREAs. However, larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

The 26 miles of beaches along Mississippi's coast offer plenty of opportunities for tourists seeking water recreation (Harrison County Tourism, 2005). A chain of barrier islands paralleling the coast result in calm coastal waters ideal for recreation. These islands make up part of the Gulf Islands National Seashore, which extends from Mississippi to Florida (NPS, 2007). Popular activities include boating, fishing, snorkeling and scuba diving.

Recreational Fishing

Table 3.17-5 provides Mississippi fish catch (both saltwater and inland waters) recreational landings for years 2002-2006. About 30,000 fishing trips were taken in 2006 by individual marine recreational anglers fishing in the federal waters along the coast of Mississippi (NMFS, 2007c). The estimated

number of participants in recreational fishing in marine fishing areas, including the state territorial sea and federal waters, was over 193,000 persons (NMFS, 2007d).

TABLE 3.17-5
MISSISSIPPI RECREATIONAL LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS
2002	471,985
2003	403,448
2004	264,702
2005	93,874
2006	175,383
TOTAL	1,409,392

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007b.

Louisiana

Recreational Boating and Diving

Recreational activities offshore primarily comprise game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, and other recreational boating activities. Louisiana ranks 15th in the nation for the number of recreational boats registered in the state (USCG, 2005). Recreational boats range throughout the Louisiana coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations along the Louisiana coast does not require traversing Navy OPAREAs. However, larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

Louisiana has had an artificial reef program since 1986 to take advantage of unused oil and gas platforms that provide habitats for coastal fish (LDFW, 2005a). In 2005 the Louisiana Department of Fish and Wildlife (LDFW) reported the locations of 231 artificial reef sites (LDFW, 2005b). Reefs are generally found between 30 and 70 miles off Louisiana's continental slope.

Recreational Fishing

Table 3.17-6 provides Louisiana fish catch (both saltwater and inland waters) recreational landings for years 2002-2006. About 176,000 fishing trips were taken in 2006 by individual marine recreational anglers fishing in the federal waters along the coast of Louisiana (NMFS, 2007c). The estimated number of participants in recreational fishing in marine fishing areas, including the state territorial sea and federal waters, was almost 1.2 million persons (NMFS, 2007d).

TABLE 3.17-6
LOUISIANA RECREATIONAL LANDINGS (2002-2006), ALL SPECIES

YEAR	POUNDS
2002	2,263,333
2003	2,902,870
2004	3,094,765
2005	3,904,424
2006	4,232,534
TOTAL	16,397,926

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007b.

Texas

Recreational Boating and Diving

Recreational activities offshore primarily comprise game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, and other recreational boating activities. Texas ranks 6th in the nation for the number of recreational boats registered in the state (USCG, 2005). Recreational boats range throughout the Texas coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations along the Texas coast does not require traversing Navy OPAREAs. However, larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

Artificial and natural reefs exist off of the Texas coast (TPWD, 2007). Artificial reefs have been created offshore from oil structures and sunken ships. Near-shore/shallow reefs also being constructed along the coast within nine nautical miles of shore. Water depths of the reefs will range from 60 to 100 feet.

Recreational Fishing

Texas only estimates harvest numbers and does not collect weight or release data. The Texas Gulf Coast is one of the most biologically rich and ecologically diverse regions in North America (TGLO, 2008). The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, conducted by the U.S. Department of Interior (USDOI), U.S. Fish and Wildlife Service, and U.S. Census Bureau, reported 2.4 million Texas residents participated in fishing related recreation and spent a total of around $2 billion on trips (USDOI, 2001).

Cruise Industry

The United States ports handle 73 percent of all global cruise embarkations. More than nine million cruise passengers (estimated 9.2 million) began their cruises from United States ports in 2007, an increase of 2.0 percent from 2006. Galveston is one of the top ten United States ports in the United States (CLIA, 2008). In 2007, 54.3 percent of the North American cruise passengers lived in Florida,

California, Texas, New York, Massachusetts, and Pennsylvania. Florida ranked 1st in the nation for annual passengers which were 35.7 percent of the national total. Texas ranked 5th, Louisiana ranked 20th, Alabama ranked 25th, and Mississippi ranked 38th for annual passengers. States in the Study Area claim a total of 39.9 percent of the national total (CLIA, 2008).

Inland Ranges

Land Areas of the GOMEX Range Complex (included in this Final EIS/OEIS) are McMullen County Range, consisting of Dixie Target and Yankee Target, and the Noxubee County Range, consisting of the SEARAY Target. Another inland area included in this Final EIS/OEIS is the NSA Panama City Demolition Pond.

The McMullen County Range is located approximately 75 miles northwest of NAS Kingsville in south-central Texas. The Escondido Ranch is a parcel of land surrounding three sides of the Dixie Target and is maintained as a hunting preserve by the Navy. The ranch is not open for public access; however outdoor recreation is available for military personnel. The remainder of the McMullen County Range is surrounded by ranch land interspersed with small lakes. The Nueces River flows in a northeastern direction between Dixie and Yankee Targets. The river holds a variety of fish and is popular for fly fishing (seesouthtexas.net, 2007). The Range Air Installations Compatible Use Zones Study (RAICUZ) for the McMullen County Range determined that the Weapons Safety Footprints are completely contained within the Impact Area to ensure safe recreation use in the adjacent areas of the McMullen County Range (DoN, 2006). Figure 2.1-4 depicts the location of the McMullen County Range.

The Noxubee County Range is located in a rural portion of eastern-central Mississippi approximately 30 nautical miles northwest of NAS Meridian. Pine forests and clear cut flatlands surround the range. Development in the area mainly consists of low density single family residences, and is limited to SR 14 and 21, rural roads, and the nearby rural towns of Macedonia, Mashulaville, and New Salem. The RAICUZ Study for the Noxubee County Range determined that the Weapons Safety Footprints are completely contained within the Impact Area to ensure safe recreation use in the adjacent areas of the Noxubee County Range (DoN, 2005). Figure 2.1-5 depicts the location of the Noxubee County Range.

The GOMEX Range Complex also includes another interior training area at NSA Panama City referred to as the Demolition Pond Area. The Demolition Pond Area is a circular water body approximately 95 yards in diameter. Figure 2.1-6 depicts the Demolition Pond Area. The Demolition Pond is contained within the installation boundary and is not accessible to the public. The Demolition Pond opens into St. Andrew Bay, but the shoreline is considered a naval restricted area and is not open to public access (NOAA, 2005).

3.17.3 Environmental Consequences

This analysis addresses potential impacts to recreational activities in the GOMEX Study Area. The principal issue is the potential for existing or proposed Navy training to affect existing recreational activities. Impacts on recreational activities are assessed with respect to the potential for disruption or degradation of recreational activities. A factor used to assess the impact on recreational activities includes an alternative's potential to result in an increase in military restricted activities, such that non-participating civilian recreational activities would be excluded from use of the area. A serious disruption occurs when civilian recreational activities are excluded from areas in the GOMEX Study Area; however, the need to use alternative recreational areas during the time of the temporary exclusion does not constitute a serious disruption.

3.17.3.1 No Action Alternative

Civilian recreational activities conducted in the GOMEX Study Area include sport fishing/diving, sailing, and other tourist related activities. These activities contribute to the overall economy of the states within the Study Area. Land operations by the military are conducted on existing training areas that do not impact civilian recreational uses of fly-fishing and hunting. Temporary clearance procedures for safety purposes do not adversely affect these recreational activities because displacement is temporary. The Navy has performed military training in this region in the past and has not precluded fishing or recreational use in the area, even during peak fishing seasons. When safety clearance of the OPAREAs is required, a NOTMAR is provided in advance, which allows boats to select an alternate destination without substantially affecting their activities. Sixty-four percent (31,276,726 angler trips; a combination of all states within the Study Area of the GOMEX EIS/OEIS) of recreational fishing occurs within a few miles of shore (state territorial waters), and approximately 28 percent (15,568,363 angler trips; a combination of all states within the Study Area of the GOMEX EIS/OEIS) in the vicinity of the GOMEX OPAREAs (non-territorial waters). Recreational boaters and divers' activities tend to occur closer to the shore although larger vessels do travel in the vicinity of the GOMEX OPAREAs. These activities are compatible.

Potential stressors of increased ship and aircraft operations and their associated training activities and military expended materials are confined to existing training areas. Hazardous activities are communicated to all vessels and operators by use of NOTMARs, issued by the USCG, and NOTAMs, issued by the FAA. Operational activities are required to avoid recreational boaters in the range. The No Action Alternative does not have a significant impact on recreational activities as they are now executed due to the Navy's policy of avoidance. Naval activity in U.S. Territory would have no significant impact on recreational activities under the No Action Alternative. Naval activity in non-territorial waters would not cause harm to recreational activities under the No Action Alternative.

3.17.3.2 Alternative 1

The proposed activities associated with Alternative 1 includes accommodating training operations currently conducted (*i.e.,* those described in the No Action Alternative), adjustment of training operations (increases and decreases as shown in Tables 2.2-3 and 2.2-4), adjustment of range complex capabilities to the minimum extent possible to meet the components of the proposed action, and adjustment of research, development, testing, and evaluation (RDT&E) as identified in Tables 2.2-3 and 2.2-4. Recreational vessels that do traverse the OPAREA would be temporarily excluded from the area during these training events. Such seldom temporary exclusions would not be considered significant. Naval activity on land is performed on existing training areas. Naval activity in U.S. Territory would have no significant impact on recreational activities under Alternative 1. Naval activity in non-territorial waters would not cause harm to recreational activities under Alternative 1.

3.17.3.3 Alternative 2 (Preferred Alternative)

The potential impacts to recreational interests associated with Alternative 2 would be similar to those described for the No Action Alternative and Alternative 1. Alternative 2, the Preferred Alternative, includes implementation of many of the elements of Alternative 1, and an increase in post-BRAC gulf-based (F-18 and E-2) operations and transient Navy participation in Navy or joint training opportunities as well as a reduction in BOMBEX (A-S) training with high explosive (HE) ordnance. Naval activity on land is performed on existing training areas. Naval activity in U.S. Territory would have no significant impact on recreational activities under Alternative 2. For the same reasons stated under Alternative 1, naval activity in non-territorial waters would not cause harm to recreational activities under Alternative 2.

3.17.4 Unavoidable Significant Environmental Effects

There would be no unavoidable significant environmental effects as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.17.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.17-7 the environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on recreation would have no significant impact and would not cause harm. Navy activities in U.S. Territory would have no significant impact on recreational interests under the No Action Alternative, Alternative 1, or Alternative 2. Navy activities in non-territorial waters would not cause harm to recreational interests under the No Action Alternative, Alternative 1, or Alternative 2.

TABLE 3.17-7
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON RECREATION IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	The Navy has performed military operations in this region in the past and has not precluded fishing or recreational use in the GOMEX Range Complex, even during peak fishing seasons. Training operations are communicated to all vessels and operators by use of NOTMARs and NOTAMs that allows boats and aircraft to select an alternate destination without substantially affecting their activities is provided in advance.	The Navy has performed military operations in this region in the past and has not precluded fishing or recreational use in the GOMEX Range Complex, even during peak fishing seasons. Training operations are communicated to all vessels and operators by use of NOTMARs and NOTAMs that allows boats and aircraft to select an alternate destination without substantially affecting their activities is provided in advance.
Aircraft Overflights		
Military Expended Materials		
Impact Conclusion	Implementation of the No Action Alternative would have no impact on recreation in U.S. Territory.	Implementation of the No Action Alternative would not cause harm to recreation in non-territorial waters

TABLE 3.17-7 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON RECREATION IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 1		
Vessel Movements **Aircraft Overflights** **Military Expended Materials**	The proposed increase in training operations, force structure changes, and enhanced range capabilities are all proposed to occur in existing training areas. Impacts to recreational activities would be kept to a minimum due to the Navy's policy of avoidance of recreational activities. Potential stressors of increased ship and aircraft operations and their associated training activities are confined to the GOMEX Range Complex.	The proposed increase in training operations, force structure changes, and enhanced range capabilities are all proposed to occur in existing training areas. Impacts to recreational activities would be kept to a minimum due to the Navy's policy of avoidance of recreational activities. Potential stressors of increased ship and aircraft operations and their associated training activities are confined to the GOMEX Range Complex.
Impact Conclusion	Implementation of Alternative 1 would have no impact on recreation in U.S. Territory.	Implementation of Alternative 1 would not cause harm to recreation in non-territorial waters
Alternative 2		
Vessel Movements **Aircraft Overflights** **Military Expended Materials**	The proposed increase in training operations, force structure changes, and enhanced range capabilities are all proposed to occur in existing training areas. Impacts to recreational activities would be kept to a minimum due to the Navy's policy of avoidance of recreational activities. Potential stressors of increased ship and aircraft operations and their associated training activities are confined to the GOMEX Range Complex.	The proposed increase in training operations, force structure changes, and enhanced range capabilities are all proposed to occur in existing training areas. Impacts to recreational activities would be kept to a minimum due to the Navy's policy of avoidance of recreational activities. Potential stressors of increased ship and aircraft operations and their associated training activities are confined to the GOMEX Range Complex.
Impact Conclusion	Implementation of Alternative 2 would have no impact on recreation in U.S. Territory.	Implementation of Alternative 2 would not cause harm to recreation in non-territorial waters

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3.18 ENVIRONMENTAL JUSTICE

3.18.1 Introduction and Methods

Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was issued on February 11, 1994. This EO requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental impacts of its programs, policies, and activities on minority and low-income populations. The U.S. Environmental Protection Agency (USEPA) and Council on Environmenal Quality (CEQ) emphasize the importance of incorporating an environmental justice review in the analyses conducted by federal agencies under National Environmental Policy Act (NEPA) and of developing protective measures that avoid disproportionate environmental impacts on minority and low-income populations. Objectives of this EO as it pertains to this Final EIS/OEIS include development of federal agency implementation strategies, identification of minority and low-income populations where proposed federal actions have disproportionately high and adverse human health and environmental impacts, and participation of minority and low-income populations in the public participation process.

Protection of Children

The President issued EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, in 1997. This order requires each federal agency to "…make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and shall...ensure that its policies, programs, activities, and standards address disproportionate risks to children…." This order was issued because a growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health risks and safety risks.

Navy Supplemental Environmental Planning Policy

Both EO 12898 and EO 13045 require each federal agency to identify and address impacts of their programs, policies, and activities. The Navy chose to ensure compliance with both EO 12898 and EO 13045 through implementation of the Chief of Naval Operations (CNO) Supplemental Environmental Planning Policy (September 23, 2004). This policy provides instructions for naval personnel to identify and assess stressors to and disproportionately high and adverse impacts on minorities, low-income populations, and children. A component of this policy institutes processes that result in consistent and efficient consideration of environmental impacts on Navy decision-making.

3.18.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the USBC and state and local governmental agencies and local organizations, as shown in Chapter 7, which outlines the references used to develop the socioeconomic (regional economy, demographics, transportation, and recreation) and public health and safety sections. A review of the resources discussed in this chapter was conducted to identify stressors on individual resources and whether the identified stressors could result in disproportionately high and adverse impacts for the purposes of the environmental justice analysis. An evaluation was then conducted to determine if further analysis was needed to determine if impacts could disproportionately fall on minorities, low-income populations, or children.

3.18.1.2 Warfare Areas and Associated Environmental Stressors

The CEQ's Environmental Justice Guidance under NEPA identifies factors to be considered to the extent practicable when determining whether environmental impacts to minority populations and low-

income populations are disproportionately high and adverse. These factors include whether there is or would be an effect on the natural or physical environment that adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social effects when those effects are interrelated to impacts to the natural or physical environment. Other factors to be considered if adverse effects are projected include: (1) whether they would appreciably exceed those same impacts to the general population or other appropriate comparison group, and (2) whether these populations would be affected by cumulative or multiple exposures from environmental hazards.

The methods to conduct the impacts analysis for environmental justice included a review of conclusions for resources discussed in Chapter 3 to determine if such stressors exist. Stressors are Navy activities that could potentially cause or create stress to the resources evaluated in this Final EIS/OEIS. If impacts were identified, or if the identified impacts considered were disproportionately high and adverse for the purposes of environmental justice analysis, an evaluation would have been conducted to determine if further analysis was needed to determine if impacts could disproportionately fall on minority populations or low-income populations. A review of the conclusions for the resources in Chapter 3 revealed that there were no major environmental impacts that would require additional analysis. The lack of major impacts means that there are no disproportionately high or adverse impacts to minority populations or low-income populations.

3.18.2 Affected Environment

The affected environment is primarily open water in the Gulf of Mexico, and the States of Texas, Louisiana, Mississippi, Alabama, and Florida. Populations that could be impacted would be fishermen and recreational users of the open water areas who are most likely to live in the coastal areas adjacent to the proposed action. The latest year for which data are available is 2006. During that period, 8.2 percent of Texas' population was under the age of five, Louisiana had seven percent of the population under the age of five, Mississippi had 7.2 percent of the population under the age of five, Alabama had 6.5 percent under the age of five, and Florida had 6.3 percent of the population under the age of five. These percentages are consistent as the number of children under the age of five in the United States is 6.8 percent (USCB, 2008).

The Texas poverty level is 16.2 percent, Louisiana is 19.2 percent, Mississippi is 19.3 percent, Alabama is 16.1, and Florida is 11.9 percent, which is slightly higher than the U.S. rate of 12.7 percent. The percentage of the non-white race population (which includes Black, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Hispanic or Latino Origin, and persons reporting two or more races) is 53 percent of the Texas total population, 37.5 percent of the Louisiana population, 40.9 percent of the Mississippi total population, 31.1 percent of the Alabama total population, and 39.9 percent of the Florida total population, which is consistent with the U.S. total of 34.8 percent.

Texas, Louisiana, Mississippi, Alabama, and Florida were all within eight percent of the U.S. total of the population that had attained high school and bachelor degrees. The 2002 U.S. census indicates that the greatest number of establishments in the United States was in the retail trade industry. The States of Texas, Louisiana, Mississippi, Alabama, and Florida reflected that trend with the retail trade industry leading the states with the greatest number of establishments (75,703, 17,613, 12,561, 19,608, and 69,543 respectively) (USCB, 2002). The fishing industry, consistently placed fifth in the top ten industries with 35,282 in Texas, 4,074 in Mississippi, and 28,053 in Florida; and placed sixth in the top ten industries with 7,175 in Louisiana and 7,058 in Alabama (USCB, 2008).

3.18.3 Environmental Consequences

Environmental impacts related to Environmental Justice or Protection of Children would occur if they would disproportionately affect minorities, low-income populations, or children.

3.18.3.1 No Action Alternative

The No Action Alternative would comprise the continuation of current Navy training. Because current operations would occur in open water or established military training areas with no permanent populations, no disproportionate impacts would occur to land-based populations unless they obtained a living from fishing or other uses of open water areas. The fishing industry ranks fifth or sixth of all reporting industries for all States in the Study Area, and is unlikely to be impacted based on the analysis in this chapter for the No Action Alternative and the continuation of current training activities. With unlikely impacts to open water-related industries, the proposed action would not result in a finding of any disproportional impacts to minorities, low-income populations, or children. Navy activities in U.S. Territory would have no impact on environmental justice under the No Action Alternative. Likewise, Navy activities in non-territorial waters would not cause harm to environmental justice.

3.18.3.2 Alternative 1

Alternative 1 is composed of incremental tempo changes of activities that occur in the No Action Alternative. There are no anticipated disproportional impacts to minorities, low-income populations, or children. Navy activities in U.S. Territory would have no impact upon environmental justice under Alternative 1. Likewise, Navy activities in non-territorial waters would not cause harm to environmental justice under Alternative 1.

3.18.3.3 Alternative 2 (Preferred Alternative)

Alternative 2 is composed of incremental tempo changes of activities that occur in the No Action Alternative. There are no anticipated disproportional impacts to minorities, low-income populations, or children. Navy activities in U.S. Territory would have no impact upon environmental justice under Alternative 2. Likewise, Navy activities in non-territorial waters would not cause harm to environmental justice under Alternative 2.

3.18.4 Unavoidable Significant Environmental Impacts

There were no unavoidable environmental impacts reported as part of the analysis of the resources in Chapter 3. Air Quality reported “minor, short-term” effects could be expected as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2; but all other resources reported that there are no unavoidable significant adverse impacts anticipated as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2.

3.18.5 Summary of Environmental Impacts (NEPA and EO 12114)

Table 3.18-1 shows a summary of the environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 on environmental justice. There are no aspects of the proposed action likely to act as stressors to minorities, low-income, and children populations; thus, there are no NEPA or EO 12114 impacts on environmental justice. Implementation of the proposed action in the No Action Alternative, Alternative 1, or Alternative 2 would not pose disproportionate high or adverse impacts to minority or low-income populations, or environmental health and safety risks to children.

TABLE 3.18-1
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON ENVIRONMENTAL JUSTICE IN THE GOMEX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
No Stressors Identified	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.
Impact Conclusion	Implementation of the No Action Alternative would have no impact on environmental justice or protection of children within the Study Area.	Implementation of the No Action Alternative would not cause harm to environmental justice or protection of children within the Study Area.
Alternative 1		
No Stressors Identified	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.
Impact Conclusion	Implementation of Alternative 1 would have no impact on environmental justice or protection of children within the Study Area.	Implementation of Alternative 1 would not cause harm to environmental justice or protection of children within the Study Area.
Alternative 2		
No Stressors Identified	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.
Impact Conclusion	Implementation of Alternative 2 would have no impact on environmental justice or protection of children within the Study Area.	Implementation of Alternative 2 would not cause harm to environmental justice or protection of children within the Study Area.

3.19 PUBLIC HEALTH AND SAFETY

3.19.1 Introduction and Methods

Public health and safety issues within the GOMEX Range Complex include potential hazards inherent in flight operations, vessel movements, and detonation of explosives. It is the policy of the Navy to observe every possible precaution in the planning and execution of all activities that occur onshore or offshore to prevent injury to people or damage to property.

3.19.1.1 Assessment Methods and Data Used

All current and proposed training operations were examined for the possibility of civilians entering a hazardous training environment that could cause personal injury. Current Navy safety procedures, according to existing Navy Instructions were assessed for their protection of the general public and whether the procedures would protect the public from hazardous training operations proposed in the Alternatives presented.

3.19.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to public health and safety are assessed in terms of the potential of Navy training operations to injure or compromise civilians in any way. Impacts may arise from physical injury directly from hazardous operations or as an indirect result of hazardous materials expended from a training event. Stressors that would likely impact public health and safety include surface and subsurface ship movements, aircraft overflights, use of explosives, and various ordnance, lasers, expended materials, radio frequencies, and aircraft noise. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the Alternatives. Table 3.19-1 identifies these stressors by warfare area. Table 3.19-1 also lists the training events and the location within the complex where the events are conducted. Issues regarding public safety and hazardous materials and hazardous waste are addressed in Section 3.2, water quality in Section 3.3; air quality in Section 3.4; and noise in Section 3.5. Additional safety and health issues are addressed in this section.

3.19.2 Affected Environment

The Affected Environment in terms of public health and safety includes the entire GOMEX Study Area (See Figure 1.5-1). These areas are described in detail in Chapter 2. Military, commercial, institutional, and recreational activities take place in the GOMEX Range Complex. The Federal Aviation Administration (FAA) established Warning Areas for military aircraft operations; however, most of the airspace and seaspace is available for co-use most of the time. Only hazardous activities require exclusive use of an area, and these periods are scheduled by the Navy and broadcast as Notices to Airmen (NOTAM) and Notices to Mariners (NOTMAR) by the FAA and USCG, respectively.

The public typically accesses the offshore ocean areas for recreational purposes such as sport fishing, sailing, boating, sight seeing, eco-tourism, diving, and swimming. Public access to offshore marine areas is a safety concern for the Navy because its activities occur primarily in international waters. Commercial and recreational vessels generally are allowed to operate in the GOMEX OPAREA. During training events or exercises in these areas, weapons delivery events are delayed or cancelled if range areas are not clear. Prior to issuing a “Green Range” stating the range is clear safe, Navy personnel must ensure that the hazard footprint of the ordnance being fired is clear of non-participating surface vessels, divers, and aircraft.

TABLE 3.19-1
SUMMARY OF POTENTIAL STRESSORS TO PUBLIC HEALTH AND SAFETY

		Stressors									
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Airborne Noise**	**Underwater Noise**	**Air Emissions**	**Non-Explosive Practice Munitions**	**High Explosive Ordnance**	**Military Expended Materials**	**Towed Mine Warfare Devices**	**Water Quality**
Mine Warfare (MIW)											
Mine Countermeasures (MCM) – Airborne	Corpus Christi OPAREA and Panama City OPAREA		✓	✓	✓	✓		✓	✓	✓	
MCM-Surface	Corpus Christi OPAREA and Panama City OPAREA	✓		✓	✓	✓		✓	✓	✓	
Mine Neutralization – Remotely Operated Vehicle (ROV)	Corpus Christi OPAREA and Panama City OPAREA	✓		✓	✓	✓		✓	✓	✓	
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Corpus Christi OPAREA and Panama City OPAREA	✓		✓	✓	✓		✓	✓	✓	✓
Surface Warfare (SUW)											
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-155 Hotbox		✓	✓	✓	✓	✓	✓	✓		
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	W-151 A/C; W-155B		✓	✓	✓	✓		✓	✓		
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	W-155 Hotbox	✓	✓	✓	✓	✓	✓	✓	✓		
Gunnery Exercise (Surface-to-Surface) (GUNEX[S-S]) (Ship)	W-151 A/B; W-155A	✓		✓	✓	✓	✓		✓		
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Panama City OPAREA	✓		✓	✓	✓	✓		✓		

TABLE 3.19-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO PUBLIC HEALTH AND SAFETY

		Stressors									
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Airborne Noise**	**Underwater Noise**	**Air Emissions**	**Non-Explosive Practice Munitions**	**High Explosive Ordnance**	**Military Expended Materials**	**Towed Mine Warfare Devices**	**Water Quality**
Gunnery Exercise (Surface-to-Surface) (GUNEX [S-S]) (Boat)	Corpus Christi UNDET BOX E3	✓		✓	✓	✓	✓	✓	✓		
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	W-151/W-155	✓				✓					
MSO to include VBSS/MIO-Helo	W-151/W-155	✓	✓	✓		✓					
Small Arms Training – Explosive Hand Grenades	UNDET Area E3	✓			✓			✓	✓		
Air Warfare (AW)											
Air Intercept Control (AIC)	W-151; W-155		✓	✓		✓					
Strike Warfare (STW)											
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	SEARAY Target; Dixie Target; Yankee Target		✓	✓		✓	✓		✓		✓
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Yankee Target		✓	✓		✓	✓		✓		✓
Amphibious Warfare (AMW)											
Firing Exercise (FIREX) with IMPASS (no live 5")	W-151A/B; W-155A	✓		✓	✓	✓	✓		✓		
Electronic Combat (EC)											
Chaff Exercises (CHAFFEX)	W-151A/B; W-155A	✓	✓	✓		✓	✓		✓		
Chaff Exercises (CHAFFEX)	Brownwood MOA's		✓	✓		✓	✓		✓		
Flare Exercises (FLAREX)	W-155A/B		✓	✓		✓	✓		✓		
Flare Exercises (FLAREX)	Brownwood MOA's		✓	✓		✓	✓		✓		

TABLE 3.19-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO PUBLIC HEALTH AND SAFETY

		Stressors									
Primary Warfare Area (Shaded) Range Operation	**Training Area(s)**	**Vessel Movements**	**Aircraft Overflights**	**Airborne Noise**	**Underwater Noise**	**Air Emissions**	**Non-Explosive Practice Munitions**	**High Explosive Ordnance**	**Military Expended Materials**	**Towed Mine Warfare Devices**	**Water Quality**
Mission Area Training[51]											
Mission Area Flight Training	W-92; W-54 Brownwood MOAs		✓	✓		✓					
Basic Flight Instruction	W-228; R-4404; Meridian MOAs; Pine Hill MOAs; Pensacola MOAs; Kingsville MOAs; R-2908; R-5=6312		✓	✓		✓					
Salvage Diver Training	NSA Panama City Demolition Pond			✓	✓	✓		✓	✓		✓
Underwater Demolitions	NSA Panama City Demolition Pond			✓	✓	✓		✓	✓		✓
Security Force Training	NSA Panama City Demolition Pond			✓	✓	✓		✓	✓		✓
Diver Training	NSA Panama City Demolition Pond			✓	✓	✓		✓	✓		✓

[51] Mission Area Training is not considered a Primary Warfare Area, but is displayed for organizational purposes.

3.19.2.1 Current Mitigation Measures

Munitions Safety

In all cases where munitions are expended within the GOMEX Range Complex (both land and sea training areas), a qualified Range Safety Officer (RSO) is on duty. Safety of participants is the primary consideration for all activities on weapons ranges within the training range complex. The fundamental guidance adhered to by units operating within the land and sea training areas is that the range must be able to contain the hazard footprints of the weapons employed. The locations of firing points, impact areas, and surface danger zones form a footprint on land ranges, as well as sea ranges. RSOs ensure that these areas are clear of personnel during activities. After every live-fire event, each participating unit ensures that all weapons are safe and cleared of rounds. The RSOs are also responsible for the emergency medical evacuation of people from the range in case of mishap.

Laser Safety

Lasers are used in training operations for precision range finding and by target designation systems for guided munitions. Due to the nature of laser light and the potential hazards associated with laser usage, protective measures and procedures have been established to protect individuals from injury. As outlined in OPNAVINST 5100.27B/Marine Corps Order (MCO) 5104.1C, the completion of a laser safety course, protective goggles, a medical surveillance program, and mishap reporting procedures are required by all units conducting laser training. Laser safety requirements for aircraft include a dry run to ensure that target areas are clear. In addition, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where personnel may be present.

Lasers are used occasionally on the nearshore and onshore ranges for both precision distance range finding and target designation for guided munitions. These precautions and written instructions are in place and observed by laser users to ensure no personnel suffer eye injury due to the light energy.

Electromagnetic Radiation Safety

Communications and electronic devices such as radar, electronic jammers, and other radio transmitters produce Electromagnetic Radiation (EMR). Equipment that produces an electromagnetic field has the potential to generate hazardous levels of EMR. An EMR hazard exists when transmitting equipment generates electromagnetic fields that induce currents or voltages great enough to trigger electro-explosive devices in ordnance, harm people or wildlife, or create sparks that can ignite flammable substances in the area. This radiation can cause health hazards to people or cause explosive hazards to ordnance or fuels. Hazards are reduced or eliminated by establishing minimum distances from EMR emitters for people, ordnance, and fuels.

EMR is expressed in milliwatts per square centimeter. Its effects are directly proportional to the frequency of the source of EMR. For example, the lower the frequency of the EMR source, the lower the acceptable power density threshold before a potential hazard to human health exists. Likewise, the higher the frequency of the EMR source, the higher the acceptable power density threshold before health effects occur.

OPNAVINST 5100.23 sets fourth a list of engineering, administrative, and personal protection controls to ensure personnel and the public are protected from EMR sources. These controls include, but are not limited to:

- properly designing and shielding RF energy sources;
- rotating antennas to make it less likely that sufficient energy will be transmitted to cause an adverse effect to personnel, ordnance, and fuel;
- using physical barriers to keep people a safe distance away from EMR sources;
- providing RF/EMR safety and health training to all ship personnel;

- tuning equipment electronically to minimize the stray power emitted; and
- operating transmitters at reduced power whenever possible.

Because of programmed improvements in both communications and radar tracking systems and the increased use of the Electronic Combat platforms, the electronic emissions environment on within the GOMEX Range Complex is periodically reviewed. Navy personnel typically use low-power communications equipment (*e.g.*, two-way radios, cellular telephones) during training.

Airspace Controlling Procedures

Air traffic control facilities within the GOMEX Range Complex are required to provide air traffic separation consistent with FAA guidelines to ensure the safe and efficient flow of air traffic. Radar surveillance and radio communications facilitate air traffic control separation between high-performance military aircraft and the high volume of commercial aircraft transiting along the Gulf Coast.

Fort Worth, Houston, Jacksonville, and Memphis Air Route Traffic Control Centers (ARTCC) control the airspace within the GOMEX Range Complex when it is not being used for military purposes. Each Naval entity wishing to conduct training posing a hazard to non-participating aircraft requests the use of the Warning areas from the scheduling authority who coordinates its use with the appropriate FAA center.

Surface and Subsurface Controlling Procedures

Clearance for a surface area does not include the airspace above or the subsurface below. Units are required to obtain clearances for all hazardous or exclusive operations within the OPAREAs.

Subsurface/surface mutual use is from the surface to a depth of 98 feet. Submerged operations cover the area from a depth of 98 feet to the sea floor.

Units are required to obtain clearance for all hazardous operations within the OPAREA. Any operations involving the use of live or inert ordnance must be authorized by the appropriate controlling authority. To insure maximum safety, all inert and live ordnance expenditures require the issuance of a NOTMAR. Weapons firings, including small arms and chaff use by surface units, require coordination with airspace controlling procedures.

3.19.2.2 Range Safety Procedures

All range safety procedures within the GOMEX Range Complex are consistent with those outlined in Section 8, Chapter 1 of CINCLANTFLTINST 3120.26E. Some of these practices are outlined below.

Fleet training would continue to occur in the GOMEX OPAREAs. Most offshore activities expend ordnance and targets from ships and aircraft. Both high-explosive (HE) and non-explosive practice munitions (NEPM) are used in offshore activities. While activities are in progress, an RSO is always on duty. The RSO can halt an activity if a potentially unsafe condition arises.

Range Safety officials ensure that weapons platforms (*e.g.*, ships and aircraft), targets, and weapons (*e.g.*, naval guns, missiles, and bombs) are operated safely, and that air operations and other hazardous fleet training activities are safely executed in controlled areas.

The Navy's standard range safety procedures are designed to avoid risks to the public and to Navy activities. When aircraft or surface vessels fire ordnance, range procedures and safety practices ensure there are no vessels or aircraft in the intended path or impact area of the ordnance. Before any training event is allowed to proceed, the target area is determined to be clear using ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data.

The hazard footprint of the ordnance to be used is based on the range of the weapon, and includes a large safety buffer to account for the item going off-target or functioning prematurely. For activities with a large hazard footprint, special sea and air surveillance measures are taken to search for, detect, and clear the area of intended activities. Aircraft are required to make a preliminary pass over the intended target area to ensure that it is clear of boats, divers, or other non-participants. Aircraft carrying ordnance are not allowed to fly over surface vessels.

Target areas would be cleared of personnel prior to conducting training, so the only public health and safety issue would be if an activity exceeded the safety area boundaries. Risks to public health and safety are reduced, in part, by providing termination systems on some of the missiles. In those cases where a weapon system does not have a flight termination capability, the target area would be determined to be clear of unauthorized vessels and aircraft, based on the flight distance the vehicle can travel, plus a 5-mile area beyond the system performance parameters.

3.19.2.3 Range Inspection Procedures

Range inspection procedures within the GOMEX Range Complex are consistent with those outlined in Section 8, Chapter 1 of CINCLANTFLTINST 3120.26E and all Fleet Exercise Publications (FXP). The scheduling authority promulgates NOTMARs and NOTAMs as applicable. Ranges are inspected by several different methods, which are generally determined by the type of training activity taking place. Inspection methods include aircraft overflights, visual scanning of sea targets from ships and land targets from vehicles and observation towers, and radar scanning for non-participants within the target area and/or safety buffer zone.

3.19.2.4 Scheduling and Coordination Procedures

Coordination between agencies is critical for successful operations at the GOMEX Range Complex. Civilian aircraft not under center control (operating VFR) may enter SUA despite it being scheduled and coordinated for use by the Navy, but do so at their own risk. The controlling agency is responsible for the coordination of their respective airspace or OPAREA to ensure civilian air transits do not conflict with military exercises. Scheduling and controlling agencies for each range complex component are shown in Table 3.19-2 (FAA, 2009).

TABLE 3.19-2
SCHEDULING AND CONTROLLING AUTHORITIES WITHIN THE GOMEX RANGE COMPLEX

Range Complex Component	Scheduling Agency	Controlling Agency
Oceanic OPAREAS		
Panama City OPAREA	NSA Panama City	n/a
Pensacola OPAREA	NAS Pensacola Operations	n/a
Warning Area 155 (W-155)	NAS Pensacola Operations	JAX ARTCC
New Orleans OPAREA	NAS JRB New Orleans	n/a
Warning Area 92 (W-92)	159th FW Louisiana Air National Guard	Houston ARTCC
Warning Area 59 (W-59)	159th Fighter Wing Louisiana Air National Guard (LAANG)	Houston ARTCC
Corpus Christi OPAREA	Chief of Naval Air Training (CNATRA)	n/a
Warning Area 228 (W-288)	NAS Corpus Christi	Houston ARTCC

TABLE 3.19-2 (Continued)
SCHEDULING AND CONTROLLING AUTHORITIES WITHIN THE GOMEX RANGE COMPLEX

Range Complex Component	Scheduling Agency	Controlling Agency
Airspace		
Noxubee County Range	NAS Meridian	CNATRA
Restricted Area 4404 (R-4404)	TRAWING 1	Memphis ARTCC
Meridian 1 East and West MOAs	TRAWING 1	Memphis ARTCC
Pine Hill East and West MOAs	TRAWING 1	Atlanta ARTCC
Pensacola North MOA	TRAWING 5, NAS Whiting Field, FL	JAX ARTCC
Pensacola South MOA	TRAWING 6	Pensacola ATC Tower
Restricted Area 2908 (R-2908)	Navy Flight Demonstration Squadron	Pensacola TRACON
Kingsville 1-5 MOAs	TRAWING 2	Houston ARTCC
McMullen Target Range	NAS Kingsville	CNATRA
Restricted Area 6312 (R-6312)	TRAWING 2	Houston ARTCC
Dixie/Yankee Targets	NAS Kingsville	CNATRA

Other coordination procedures within the GOMEX Range Complex include the following:

- Coordination is required between NSA Panama City and Eglin AFB for scheduling of W-151 airspace.
- NAS Pensacola is the liaison for Navy units requesting use of W-453.

Public Health and Safety at the McMullen County Range and Associated Special Use Airspace

Activities within the McMullen County Range and Associated Special Use Airspace are consistent with the safety procedures outlined in Section 8, Chapter 1 of CINCLANTFLTINST 3120.26E. The range is also governed by its own set of Standard Operating Procedures (SOP). These elements combine to ensure the range operates in a manner that upholds public health and safety at all times. They include:

- Range Safety Officers on duty during all exercises;
- restricted range access;
- range clearance procedures and overflights;
- posted safety lookouts during exercises;
- preparing NOTAMS before exercises; and
- observing the appropriate hazard footprint for each ordnance type.

Public Health and Safety at the Noxubee County Range and Associated Special Use Airspace

Activities within the Noxubee County Range and Associated Special Use Airspace are consistent with the safety procedures outlined in Section 8, Chapter 1 of CINCLANTFLTINST 3120.26E. The range is also governed by its own set of SOPs. These elements combine to ensure the range operates in a manner that upholds public health and safety at all times. They include:

- Range Safety Officers on duty during all exercises;
- restricted range access;
- range clearance procedures and overflights;

- posted safety lookouts during exercises;
- preparing NOTAMS before exercises; and
- observing the appropriate hazard footprint for each ordnance type.

Public Health and Safety at the NSA Panama City Demolition Pond

Activities within the NSA Panama City Demolition Pond are governed by SOPs outlined in NAVDIVESALVTRACENINST 8020.1E. These procedures include, but are not limited to:

- Range Safety Officers on duty during all exercises;
- safety briefings before each demolition exercise;
- restricted range access;
- no demolition until range inspected and the RSO declares a "Green Range;"
- safety lookouts will also be posted during all demolition exercises; and
- notification of NSA Armory three days prior to demolition operations.

In summary, there are many different guidelines and mitigation measures in already in place that work hand-in-hand to ensure the protection of public health and safety. These procedures, combined with the Navy's extensive personnel safety training programs, allow for the safe co-use of the GOMEX OPAREA by both military and non-military interests.

3.19.3 Environmental Consequences

Public safety impacts are significant if the general public is substantially endangered as a result of Navy activities within the GOMEX Range Complex. For each training activity or group of similar activities, an estimate of risk to the general public was formulated, based on the Navy's current set of safety procedures for inland and sea range activities.

Activities in the GOMEX Range Complex would be conducted in accordance with guidance provided in CINCLANTFLTINST 3120.26E. The instruction provides operational and safety procedures for all normal range events. Its emphasis is on providing the necessary information to range users so they can operate safely and avoid affecting non-military activities such as shipping, recreational boaters, divers, and commercial or recreational fishermen.

Several factors were considered in evaluating the effects of the Navy's activities on public safety. These factors include proximity to the public, access control, scheduling, public notification of events, frequency of events, duration of events, range safety procedures, operational control of training events, and safety history.

3.19.3.1 No Action Alternative

Under the No Action Alternative, Fleet training activities would continue to be conducted in the GOMEX OPAREA. Offshore operations would continue to expend ordnance and other materials, including bombs, missiles, NEPM, shells, bullets, marine markers (smoke floats), and targets from vessels and aircraft. The ordnance used in offshore operations would include HE, wholly inert, and NEPM.

As under current conditions, a range safety officer (RSO) would always be on duty while activities were in progress. The RSO would halt any activity if a potentially unsafe condition arose. The continued use of RSOs under the No Action Alternative would ensure that projectiles, targets, and missiles were operated safely, and that air operations and other hazardous Fleet training activities were safely executed in controlled areas.

The Navy would continue to implement its standard range safety procedures, which are proven effective in avoiding risks to the public and to Navy activities. When aircraft or surface vessels fire ordnance,

range procedures and safety practices would ensure there were no vessels or aircraft in the intended path or impact area of the ordnance. Before any training event would be allowed to proceed, the target area would be determined to be clear using ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data.

The hazard footprint for the ordnance to be used is based on the range of the weapon, and includes a large safety buffer to account for the item going off-target or functioning prematurely. For activities with a large hazard footprint, special sea and air surveillance measures would be taken to search for, detect, and clear the area of intended activities. Aircraft would continue to be required to make a preliminary pass over the intended target area to ensure that it was clear of boats, divers, or other non-participants. Aircraft carrying ordnance would not be allowed to fly over surface vessels.

Target areas would be cleared of personnel prior to conducting training, so the only public health and safety issue would be in the very rare occasion when an activity exceeded the safety area boundaries. Risks to public health and safety would be further reduced by providing termination systems on some missiles. In cases where a weapon system did not have a flight termination capability, the target area would be determined to be clear of unauthorized vessels and aircraft, based on the flight distance the vehicle can travel, plus a 5-mile area beyond the system performance parameters.

There would be about 20 helicopter sorties annually within the GOMEX Study Area that would involve towing MK-103 mechanical mine-sweeping system in the water (see Table 2.2-4). MH-53 helicopters would tow the equipment in the water while flying at 75 to 100 feet above water level. If the aircraft encountered a commercial or recreational vessel, the aircrew either would stop forward progress or maneuver the aircraft safely around the vessel before continuing the mission.

All training activities would continue to comply with DoD Directive 4540.01, "*Use of International Airspace by U.S. Military Aircraft and for Missile/Projectile Firings*" (DoD, 2007). These documents specify procedures for conducting aircraft operations and firing missiles and projectiles. The missile and projectile firing areas would continue to "be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity" (DoD, 2007).

Recreational diving activities within the GOMEX OPAREA takes place primarily at known diving sites, including shipwrecks and artificial reefs. The locations of these popular dive sites are well-documented, dive boats are typically well-marked, and diver-down flags would be visible from and avoided by ships conducting training under the No Action Alternative. As a result, interactions between training activities within the offshore areas and scuba diving would be minimized. Similar knowledge and avoidance of popular fishing areas would help reduce interactions with recreational anglers.

Most naval training conducted under the No Action Alternative would occur well out to sea, while most civilian activity, other than shipping and some commercial fishing, is conducted within a few miles of land. This separation would help prevent interferences among military and civilian activities and reduce the potential for incidents that would threaten the safety of civilians.

The Navy would continue to recover many of the targets that were used in training so that they would not pose a collision risk. Unrecoverable pieces of Military Expended Material (MEM) are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intended sink to the bottom after their useful function was completed (such as expended 55-gallon steel drums), so that they would not represent a collision risk to civilian vessels. Additional information on the fate of these materials is provided in Section 3.2, Hazardous Materials and Hazardous Waste.

The Navy would continue to temporarily limit public access to areas where there was a risk of injury or property damage through the use of NOTAMs and NOTMARs. Public safety would continue to be

enhanced by providing the public with information that would let them take an active role in avoiding interactions with naval training and ensuring their own safety.

All of these public safety measures were developed over a long period of time of public interaction. They are all proven effective, and are currently employed on a routine basis in the GOMEX Range Complex. Their continued implementation under the No Action Alternative would ensure that no changes in, and no adverse effects to, public safety would occur.

Public Health

Management of MEM in conjunction with Navy training exercises in the GOMEX Study Area is addressed in Section 3.2, Hazardous Materials and Hazardous Waste. While continued releases of hazardous materials, such as metals, hydraulic fluid, fuel and other hydrocarbons, propellants, and unconsumed explosives would occur, the liquid and soluble constituents of concern would quickly disperse in the water column. Solid constituents of concern would rapidly settle to the ocean floor and soon become buried in sediment, coated by corrosion, or encrusted by benthic organisms. Because of the very small quantities of these materials relative to the extent of the sea ranges, the effective dilution volume provided by the ocean, and the remoteness of the sea ranges relative to human populations, their effect on human health would not be detectable. Details regarding the fate and transport of MEM constituents are provided in Section 3.2.

Sources of EMR include radar, navigational aids, and electronic warfare (EW) systems. These systems are the same as, or similar to, civilian navigational aids and radars at local airports and television weather stations throughout the U.S. EW systems emit EMR similar to that from cell phones, hand-held radios, commercial radio stations, and television stations. SOPs are in place to protect Navy personnel and the public from EMR hazards. These include setting the heights and angles of EMR transmissions to avoid direct exposure, posting warning signs, establishing safe operating levels, and activating warning lights when radar systems are operational. Measures also are in place to avoid excessive exposure from EMR emitted by military aircraft. The No Action Alternative would not result in any change in EMR types or use, and would not result in any change in impacts on public health.

Laser hazards also exist within the GOMEX Study Area, where these high-energy light sources are used for precision range finding and by target-designation systems for guided munitions. A comprehensive safety program exists for the use of lasers. SOPs protect individuals from the hazard of severe eye injury caused by the nature of the laser light. The completion of a laser safety course, use of protective goggles, maintenance of a medical surveillance program, and implementation of mishap reporting procedures are required by all units conducting laser training. Laser safety requirements for aircraft require a dry run to ensure that target areas are clear. In addition, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where personnel may be present. Continued use of these procedures would ensure that changes in public health relating to the use of lasers would not occur with the implementation of the No Action Alternative.

In accordance with NEPA, naval activity in U.S. Territory under the No Action Alternative would have no significant impact on public health and safety. In accordance with EO 12114, naval activity in non-territorial waters would not cause harm to public safety.

3.19.3.2 Alternative 1

Under Alternative 1, training and RDT&E operations numbers would be adjusted (increased or decreased as the case may be) in order to meet Navy and DoD current and near-term operational training and RDT&E requirements. Under this alternative, force structure changes would be accommodated and range complex capabilities would be enhanced to the minimum extent possible to meet the components of the proposed action.

In addition to maintaining current levels of operations (the No Action Alternative baseline), Alternative 1 at the GOMEX Range Complex would support the FRTP.

As detailed in Table 2.2-4, the changes in training tempo would result in a minimal increase in sorties flown by fixed-wing aircraft, more use of explosive munitions and NEPM, more underwater detonations, and more deployment of expendable materials. All of these activities have the potential to pose a risk to public health and safety. However, the Navy would continue to apply the risk reduction measures that were described for the No Action Alternative. These measures would be effective in protecting the public so that no measurable changes in accidents, injuries, or illnesses would be expected with the implementation of Alternative 1. In addition, the elimination of MIW training exercises and the associated helicopter sorties further decreases the risks to public health and safety.

The use of the F/A-18 for unit level BOMBEX (A-S) and GUNNEX (A-S) training would pose many of the same types of risks that were described for the No Action Alternative, and the measures described for that alternative would be effective in protecting public health and safety. Additional risks posed by these activities would be associated with increased aircraft overflights and ordnance. Safety measures that would be implemented for exercises in support of BOMBEX (A-S) and GUNNEX (A-S) would include:

- Avoiding shipping lanes, popular dive sites, shipwrecks, and recreational fishing areas when selecting training area locations;
- If a training area was fouled by recreational pursuits, cancelling or delaying training until the training area was clear; and
- Using live fire ordnance for this type of training (MK-82, MK-83, and MK-84) only in the proposed BOMBEX Hotbox (W-155) located within the Pensacola OPAREA.

Under Alternative 1, the Navy proposes to increase the annual net explosive weight (NEW) associated with some NSA Panama City Demolition Pond underwater demolition training. The charges used in training are typically very small charges. Training with detonations takes place during daylight hours only. The proposed NEW for two of the four groups that train at the Demolition Pond would increase, while the NEW used by the other two groups would decrease. The proposed overall NEW for the Demolition Pond training will actually decrease slightly. However, the Navy would continue to apply the risk reduction measures that were described for the No Action Alternative so that no measurable changes in accidents, injuries, or illnesses would be expected with the implementation of Alternative 1.

In accordance with NEPA, naval activity in U.S. Territory under Alternative 1 would have no significant impact on public health and safety. In accordance with EO 12114, naval activity in non-territorial waters would not cause harm to public safety.

3.19.3.3 Alternative 2 (Preferred Alternative)

Training events proposed under Alternative 2 includes implementation of many of the elements of Alternative 1, and an increase in post-BRAC gulf-based (F-18 and E-2) operations and transient Navy participation in Navy or joint training opportunities afforded by proximity to the Army's Joint Readiness Training Center (JRTC) and its JNTC infrastructure. However, the Navy would continue to apply the risk reduction measures that were described for the No Action Alternative. These measures would be effective in protecting the public so that no measurable changes in accidents, injuries, or illnesses would be expected with the implementation of Alternative 1.

Alternative 2 also includes a reduction in BOMBEX (A-S) training with HE ordnance, as summarized in Tables 2.2-4 and 2.2-7. This alternative would eliminate the use of MK-84 (HE) bombs (944.8 pounds NEW), MK-82 (HE) bombs (192.2 pounds NEW), and would reduce the numbers of MK-83 (HE) bombs (415.8 pounds NEW) used in bombing exercises by 84 percent. However, these changes would

not result in any reductions in risk to public health and safety. BOMBEX (A-S) training would still occur under Alternative 2, but most of the ordnance used would be non-explosive practice munitions (NEPM). Because of the Navy's strict implementation of safety measures, current use of these HE bombs has not resulted in any civilian deaths or injuries, and their reduced use under Alternative 2 would not change this safety record.

In accordance with NEPA, naval activity in U.S. Territory under Alternative 2 would have no significant impact on public health and safety. In accordance with EO 12114, naval activity in non-territorial waters would not cause harm to public safety.

3.19.4 Unavoidable Significant Environmental Effects

There would not be any unavoidable significant environmental effects on public health and safety as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.19.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.19-3, No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on public health and safety. Furthermore, the No Action Alternative, Alternative 1, and Alternative 2 would not cause harm to public health and safety in non-territorial waters.

TABLE 3.19-3
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action Alternative		
Vessel Movements	SOPs are in place to avoid civilian craft. Use of NOTMARs would provide the public with information that would enable them to avoid interactions with naval training and help ensure their own safety.	SOPs are in place to avoid civilian craft. Use of NOTMARs would provide the public with information that would enable them to avoid interactions with naval training and help ensure their own safety.
Aircraft Overflights	Aircraft control in SUAs is outlined in Table 3.19-2; Use of NOTAMs would provide commercial and civilian aviators with information that would enable them to avoid interactions with naval training and help ensure their own safety; SOPs exist for proper handoff of Air Traffic Control.	Aircraft control in SUAs is outlined in Table 3.19-2; Use of NOTAMs would provide commercial and civilian aviators with information that would enable them to avoid interactions with naval training and help ensure their own safety; SOPs exist for proper handoff of Air Traffic Control.

TABLE 3.19-3 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Aircraft and Ordnance Noise	Noise from aircraft would be below levels that cause even temporary impacts to hearing; ordnance detonations occur in areas where civilians would not likely be impacted by the noise.	Noise from aircraft would be below levels that cause even temporary harm to hearing; ordnance detonations occur in areas where civilians would not likely be harmed by the noise.
Aircraft Emissions	SOPs and maintenance practices are in place to ensure that aircraft emissions are minimal and below levels that would impact the public.	SOPs and maintenance practices are in place to ensure that aircraft emissions are minimal and below levels that would harm the public.
Non-explosive practice munitions	SOPs are in place to exclude civilian activities from areas of NEPM use.	SOPs are in place to exclude civilian activities from areas of NEPM use.
High Explosive Ordnance	SOPs in place to ensure range is clear before ordnance deliveries and detonations.	SOPs in place to ensure range is clear before ordnance deliveries and detonations.
Military Expended Materials	Most large pieces would be recovered. Most other pieces would be small or soft, or would sink to the bottom after use. Hazardous materials or hazardous waste would only be released into the water in small volumes and quickly would be diluted.	Most large pieces would be recovered. Most other pieces would be small or soft, or would sink to the bottom after use. Hazardous materials or hazardous waste would only be released into the water in small volumes and quickly would be diluted.
Towed Mine Warfare Devices	SOPs are in place to avoid civilian interactions during mine countermeasure and mine neutralization activities.	SOPs are in place to avoid civilian interactions during mine countermeasure and mine neutralization activities.
Electromagnetic Radiation (EMR) and Lasers	SOPs are in place to protect Navy personnel and the public from hazards resulting from the use of EMR and lasers.	SOPs are in place to protect Navy personnel and the public from hazards resulting from the use of EMR and lasers.
Water Quality	Quantities of hazardous materials or hazardous waste expended in the water, intentionally or unintentionally released into the water are small and quickly diluted.	Quantities of hazardous materials or hazardous waste expended in the water, intentionally or unintentionally released into the water are small and quickly diluted.
Impact Conclusion	Less than significant impacts to the general public.	Less than significant harm to the general public.

TABLE 3.19-3 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Alternative 1		
Vessel Movements	SOPs are in place to avoid civilian craft. Use of NOTMARs would provide the public with information that would enable them to avoid interactions with naval training and help ensure their own safety.	SOPs are in place to avoid civilian craft. Use of NOTMARs would provide the public with information that would enable them to avoid interactions with naval training and help ensure their own safety.
Aircraft Overflights	Aircraft control in SUAs is outlined in Table 3.19-2; Use of NOTAMs would provide commercial and civilian aviators with information that would enable them to avoid interactions with naval training and help ensure their own safety; SOPs exist for proper handoff of Air Traffic Control.	Aircraft control in SUAs is outlined in Table 3.19-2; Use of NOTAMs would provide commercial and civilian aviators with information that would enable them to avoid interactions with naval training and help ensure their own safety; SOPs exist for proper handoff of Air Traffic Control.
Aircraft and Ordnance Noise	Noise from aircraft would be below levels that cause even temporary impacts to hearing; ordnance detonations occur in areas where civilians would not likely be impacted by the noise.	Noise from aircraft would be below levels that cause even temporary harm to hearing; ordnance detonations occur in areas where civilians would not likely be harmed by the noise.
Aircraft Emissions	SOPs and maintenance practices are in place to ensure that aircraft emissions are minimal and below levels that would impact the public.	SOPs and maintenance practices are in place to ensure that aircraft emissions are minimal and below levels that would harm the public.
Non-explosive practice munitions	SOPs are in place to exclude civilian activities from areas of NEPM use.	SOPs are in place to exclude civilian activities from areas of NEPM use.
High Explosive Ordnance	SOPs in place to ensure range is clear before ordnance deliveries and detonations.	SOPs in place to ensure range is clear before ordnance deliveries and detonations.
Military Expended Materials	Most large pieces would be recovered. Most other pieces would be small or soft, or would sink to the bottom after use. Hazardous materials or hazardous waste would only be released into the water in small volumes and quickly would be diluted.	Most large pieces would be recovered. Most other pieces would be small or soft, or would sink to the bottom after use. Hazardous materials or hazardous waste would only be released into the water in small volumes and quickly would be diluted.

TABLE 3.19-3 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Towed Mine Warfare Devices	Not applicable.	Not applicable.
Electromagnetic Radiation (EMR) and Lasers	SOPs are in place to protect Navy personnel and the public from hazards resulting from the use of EMR and lasers.	SOPs are in place to protect Navy personnel and the public from hazards resulting from the use of EMR and lasers.
Water Quality	Quantities of hazardous materials or hazardous waste expended in the water, intentionally or unintentionally released into the water are small and quickly diluted.	Quantities of hazardous materials or hazardous waste expended in the water, intentionally or unintentionally released into the water are small and quickly diluted.
Impact Conclusion	Less than significant impacts to the general public.	Less than significant harm to the general public.
Alternative 2		
Vessel Movements	SOPs are in place to avoid civilian craft. Use of NOTMARs would provide the public with information that would enable them to avoid interactions with naval training and help ensure their own safety.	SOPs are in place to avoid civilian craft. Use of NOTMARs would provide the public with information that would enable them to avoid interactions with naval training and help ensure their own safety.
Aircraft Overflights	Aircraft control in SUAs is outlined in Table 3.19-2; Use of NOTAMs would provide commercial and civilian aviators with information that would enable them to avoid interactions with naval training and help ensure their own safety; SOPs exist for proper handoff of Air Traffic Control.	Aircraft control in SUAs is outlined in Table 3.19-2; Use of NOTAMs would provide commercial and civilian aviators with information that would enable them to avoid interactions with naval training and help ensure their own safety; SOPs exist for proper handoff of Air Traffic Control.
Aircraft and Ordnance Noise	Noise from aircraft would be below levels that cause even temporary impacts to hearing; ordnance detonations occur in areas where civilians would not likely be impacted by the noise.	Noise from aircraft would be below levels that cause even temporary harm to hearing; ordnance detonations occur in areas where civilians would not likely be harmed by the noise.
Aircraft Emissions	SOPs and maintenance practices are in place to ensure that aircraft emissions are minimal and below levels that would impact the public.	SOPs and maintenance practices are in place to ensure that aircraft emissions are minimal and below levels that would harm the public.
Non-explosive practice munitions	SOPs are in place to exclude civilian activities from areas of NEPM use.	SOPs are in place to exclude civilian activities from areas of NEPM use.
High Explosive Ordnance	SOPs in place to ensure range is clear before ordnance deliveries and detonations.	SOPs in place to ensure range is clear before ordnance deliveries and detonations.

TABLE 3.19-3 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (U.S. Territory)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Military Expended Materials	Most large pieces would be recovered. Most other pieces would be small or soft, or would sink to the bottom after use. Hazardous materials or hazardous waste would only be released into the water in small volumes and quickly would be diluted.	Most large pieces would be recovered. Most other pieces would be small or soft, or would sink to the bottom after use. Hazardous materials or hazardous waste would only be released into the water in small volumes and quickly would be diluted.
Towed Mine Warfare Devices	Not applicable.	Not applicable.
Electromagnetic Radiation (EMR) and Lasers	SOPs are in place to protect Navy personnel and the public from hazards resulting from the use of EMR and lasers.	SOPs are in place to protect Navy personnel and the public from hazards resulting from the use of EMR and lasers.
Water Quality	Quantities of hazardous materials or hazardous waste expended in the water, intentionally or unintentionally released into the water are small and quickly diluted.	Quantities of hazardous materials or hazardous waste expended in the water, intentionally or unintentionally released into the water are small and quickly diluted.
Impact Conclusion	Less than significant impacts to the general public.	Less than significant harm to the general public.

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3.20 SUMMARY OF ATLANTIC FLEET ACTIVE SONAR TRAINING AND AGGREGATE IMPACTS IN THE GOMEX RANGE COMPLEX

The GOMEX Range Complex EIS/OEIS incorporates by reference the Final Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS (DoN, 2008). Because sonar use and sonar effects cross and go beyond Range Complex boundaries, the Navy comprehensively analyzed all Atlantic Fleet sonar training in a separate EIS/OEIS. Active sonar training, however, is an integral component of fleet readiness training within each range complex; therefore, the Final AFAST EIS/OEIS analysis and conclusions are summarized herein so the direct and indirect impacts of all components of fleet training in the GOMEX Range Complex can be comprehensively evaluated under NEPA and EO 12114. The reader should refer to the AFAST EIS/OEIS (available at http://afasteis.gcsaic.com) for the full description and analysis of active sonar activities along the East Coast and within the Gulf of Mexico. The Final AFAST EIS/OEIS was released to the public on December 12, 2008 (73 FR 75715). The Navy's consultation with NMFS, under the MMPA, concluded when the Final Rule was filed for public inspection with the Office of the Federal Register (74 FR 4844) on January 22, 2009 and the annual Letter of Authorization was subsequently issued. The Navy's consultation with NMFS, in accordance with Section 7 of the ESA, concluded when the Biological Opinion was signed on January 21, 2009 and the annual Incidental Take Statement was subsequently issued.

The AFAST EIS/OEIS analyzes the potential environmental effects associated with the designation of sonar use areas and the use of mid- and high-frequency active sonar technology and the improved extended echo ranging (IEER) system during Atlantic Fleet training exercises. The IEER system consists of an explosive source sonobuoy (AN/SSQ-110A) and an air deployable active receiver (ADAR) sonobuoy (AN/SSQ-101). The Navy is developing the Advanced Extended Echo Ranging (AEER) system as a replacement to the IEER system. The AEER system would use a new active sonobuoy (AN/SSQ-125) that utilizes a tonal (or a ping) versus an impulsive (or explosive) sound source as a replacement for the AN/SSQ-110A. The AEER system will still use the ADAR sonobuoy as the systems receiver. In addition, the Final AFAST EIS/OEIS incorporates research, development, test, and evaluation (RDT&E) active sonar activities similar, and coincident with, Atlantic Fleet training. For the purposes of the Final AFAST EIS/OEIS, "active sonar activities" refers to training, maintenance, and RDT&E activities involving mid- and high-frequency active sonar and explosive source sonobuoy (AN/SSQ-110A). During active sonar activities, surface ships, submarines, helicopters, and marine patrol aircraft use active sonar during ASW, MIW, object detection/navigation, and maintenance events. The activities involving active sonar described in the AFAST EIS/OEIS are not new and do not involve significant changes in systems, tempo, or intensity from past activities.

The Navy analyzed four alternatives in the AFAST EIS/OEIS. Under Alternative 1, active sonar areas would be designated using an environmental analysis to determine locations that would minimize environmental effects to biological resources while still meeting operational requirements. Under Alternative 2, active sonar training areas would be designated using the same environmental analysis conducted under Alternative 1; however, these areas would be adjusted seasonally to minimize effects to marine resources. Under Alternative 3, sonar training would not occur within certain environmentally sensitive areas, which would be designated areas of increased awareness. The No Action Alternative can be regarded as continuing with the present course of action. Under the No Action Alternative, the Navy would continue conducting active sonar activities within and adjacent to existing OPAREAs rather than designate active sonar areas or areas of increased awareness.

The Deputy Assistant Secretary of the Navy (Environment), considered the following factors: the Congressional mandates in 10 U.S.C. § 5062; the Navy, DoD, and other federal agencies' operational, testing, and training requirements; environmental impacts; and comments received during the EIS/OEIS process in determining whether and how to designate areas where active sonar activities would occur within and adjacent to existing OPAREAs located along the East Coast of the U.S. and in the Gulf of Mexico. After carefully weighing all of these factors and analyzing the data presented in the EIS/OEIS, the DASN (E) determined that the Preferred Alternative, the No-Action Alternative, best meets the requirements for the proposed AFAST active sonar activities. The DASN (E) signed the Navy's Record of Decision (74 FR 5650) on January 23, 2009.

3.20.1 Summary of Sonar Activities in the GOMEX Range Complex

3.20.1.1 Description of Sonar Systems

There are two basic types of sonar: passive and active.

- ***Passive sonars*** are only used to listen to incoming sounds. Passive sonars do not emit sound energy into the water and cannot acoustically affect the environment.
- ***Active sonars*** emit acoustic energy to obtain information concerning a distant object from the reflected sound energy. Active sonars are the most effective detection systems against modern ultra-quiet submarines and sea mines.

Table 3.20-1 identifies the active acoustic systems acoustically modeled in the AFAST EIS/OEIS. The systems that were not acoustically modeled include systems typically operated at frequencies greater than 200 kHz, such as the AN/AQS-14 or AN/AQS-20. Since active sonar sources operating at 200 kHz or higher attenuate rapidly and are at or outside the upper frequency limit of marine mammals with ultrasonic hearing, further consideration and modeling of these higher frequency acoustic sources were not warranted. Refer to Section 2.3 and Appendix C in the Final AFAST EIS/OEIS for more information on sonar systems used during Atlantic Fleet training.

TABLE 3.20-1
ACOUSTIC SYSTEMS ANALYZED IN THE FINAL AFAST EIS/OEIS

Systems Analyzed			
System	***Frequency***	***Associated Platform***	***System Description***
AN/SQS-53	3.5 kHz	DDG and CG hull-mounted sonar	ASW search, detection, and localization; utilized 70% in search mode and 30% track mode
AN/AQS-13[52]	10.0 kHz	Helicopter dipping sonar	ASW sonar lowered from hovering helicopter (approximately 10 pings/dip, 30 seconds between pings)
AN/AQS-22	4.1 kHz	Helicopter dipping sonar	ASW sonar lowered from hovering helicopter (approximately 10 pings/dip, 30 seconds between pings)

[52] AN/AQS-22 was used to model the AN/AQS-13

TABLE 3.20-1 (Continued)
ACOUSTIC SYSTEMS ANALYZED IN THE FINAL AFAST EIS/OEIS

Systems Analyzed			
System	***Frequency***	***Associated Platform***	***System Description***
Improved Extended Echo Ranging (IEER) system (AN/SSQ-110A explosive source sonobuoy)	Impulsive broadband	MPA deployed	ASW system consists of explosive acoustic source buoy (contains two 4.1 lb charges) and expendable passive receiver sonobuoy
AN/SSQ-125	MF	MPA Deployed	ASW system consists of explosive acoustic source sonobuoys and expendable passive receiver sonobuoy
AN/SQQ-32	HF	MCM over the side system	Detect, classify, and localize bottom and moored mines
AN/BQS-15	HF	Submarine navigational sonar	Only used when entering and leaving port
AN/SQS-56	7.5 kHz	FFG hull-mounted sonar	ASW search, detection, & localization; Utilized 70% in search mode and 30% track mode
MK-48 Torpedo	HF	Submarine fired exercise torpedo	Recoverable and non-explosive exercise torpedo; sonar is active approximately 15 min per torpedo run
MK-46 and MK-54 Torpedo	HF	Surface ship and aircraft fired exercise torpedo	Recoverable and non-explosive exercise torpedo; sonar is active approximately 15 min per torpedo run
AN/SLQ-25 (NIXIE)	MF	DDG, CG, and FFG towed array	Towed countermeasure to avert localization and torpedo attacks (approximately 20 mins per use)
AN/SQS-53 and AN/SQS-56 (Kingfisher)	MF	DDG, CG, and FFG hull-mounted sonar (object detection)	Only used when entering and leaving port
AN/BQQ-10 and AN/BQQ-5	MF	Submarine hull-mounted sonar	ASW search and attack (approximately one ping per two hours when in use)
Tonal sonobuoy (DICASS) (AN/SSQ-62)	8 kHz	Helicopter and MPA deployed	Remotely commanded expendable sonar-equipped buoy (approximately 12 pings per use, 30 secs between pings)
ADC MK-1, MK-2, MK-3, and MK-4	MF	Submarine deployed countermeasure	Expendable acoustic countermeasure (approximately 20 mins per use)
Submarine deployed countermeasure (NAE)	MF	Submarine deployed countermeasure	Expendable acoustic countermeasure (20 mins per use)

3.20.1.2 Description of Active Sonar Activities

Because the Navy conducts many different types of Independent ULT, Coordinated ULT, Strike Group training, maintenance, and RDT&E active sonar activities, it grouped similar events to form representative scenarios for analysis in the AFAST EIS/OEIS. Specific active sonar events are described in more detail in Appendix C of the AFAST EIS/OEIS. Note that specific exercise names and other details occasionally change as required to meet the current operational needs. Table 3.20-2 summarizes the active sonar scenarios that typically occur in the GOMEX Range Complex and seaward. Refer to Section 2.3 and Appendix C in the AFAST EIS/OEIS for more detail on Atlantic Fleet sonar training events.

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TABLE 3.20-2
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
ULT- Surface Ship ASW	One or two surface ships (CG, DDG, and FFG) conducting ASW localization and tracking training.	5	2 to 6 hours	5 nm x 10 nm to 30 nm x 40 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	One to two ships (CG, DDG, or FFG) pinging 1 to 2 hours each	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-1, MK-2, MK-3, MK-4, or Noise Acoustic Emitter)	Two hours per NIXIE, 20 minutes per ADC and Noise Acoustic Emitter	MFA sonar exposure and expended material
					MK-46 or MK-54 Torpedo	Exercise torpedoes could be used for RDT&E	HFA sonar exposure, direct strike, and expended material
					MK-39 EMATT or MK-30 target	One EMATT or MK-30 (recoverable) per exercise may be used as a target	Direct strike and expended material
					Vessel movement	1 to 2 ships maneuvering	Vessel strike

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
ULT- Submarine ASW	One submarine conducting ASW and SUW training using passive and active sonar.	1	2 to 3 days	30 nm x 40 nm	Submarine MFA sonar (AN/BQQ-10)	One submarine pinging once per two hours (average 36 pings per event)	MFA sonar exposure
					MK-48 Torpedo	Number of exercise torpedoes could be used in a single event could vary; not used in most events	HFA sonar exposure, direct strike, and expended material
					Vessel movement	One submarine maneuvering	Vessel strike
					MK-39 EMATT or MK-30 target	One EMATT or MK-30 (recoverable) per exercise may be used as a target	Direct strike and expended material
					Tactical page buoy	One tactical page buoy may be deployed	Expended materials
ULT- MPA ASW (tonal sonobuoy)	One MPA conducting ASW submarine localization and tracking training using tonal sonobuoys.	7	2 to 8 hours	30 nm x 30 nm to 60 nm x 60 nm	Tonal sonobuoy (DICASS) (AN/SSQ-62)	Up to 10 tonal sonobuoys (DICASS)	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended materials and Direct strike
					MK-46 or MK-54 Torpedo	Exercise torpedoes could be used for RDT&E	MFA sonar exposure, direct strike, and expended material
					MK-39 EMATT (repeater) and or MK-30 Target	One EMATT or MK-30 (recoverable) per exercise may be used as a target	direct strike and expended material

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
ULT- MPA ASW (explosive source sonobuoy	One MPA conducting ASW submarine localization and tracking training using explosive source sonobuoy (AN/SSQ-110A).	34	2 to 8 hours	60 nm x 60 nm	Explosive source Sonobuoy (AN/SSQ-110A)	Up to 14 AN/SQ-110A sonobuoys	Explosive byproducts, pressure wave exposure, impulsive sound exposure, direct strike, and expended material
					Receiver (ADAR) Sonobuoy (AN/SSQ-101)	Up to five AN/SSQ-101 sonobuoys	Direct strike and expended materials
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended materials and direct strike
Surface Ship MIW ULT	One ship (MCM) conducting mine localization training	266	Less than 24 hours	1 nm x 2 nm	Surface ship HFA MIW sonar (AN/SQQ-32)	One ship (MCM) pinging for 1-15 hours	HFA sonar exposure
					Vessel Movement	One or two ships maneuvering	Vessel strike
Coordinated ULT- Integrated ASW Course (IAC)	An exercise with three DDGs, one CG, one FFG, two to three helicopters, one to two submarines, and one MPA	1	2 to 5 days	120 nm X 60 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	Five ships pinging for up to 10 hours	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopter dipping up to one hour (10 pings per five-minute dip)	MFA sonar exposure
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One - two submarines pinging up to six times each	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per ADC and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	Helicopters and/or MPA dropping up to 36 sonobuoys	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended materials and direct strike
					Vessel movement	Three ships maneuvering	Vessel strike
RONEX and GOMEX MIW Exercises	One to five MCM ships conducting mine localization training	8	10 to 15 days	20 nm x 20 nm	Surface ship HFA MIW sonar (AN/SQQ-32 and AN/SLQ-48)	One to five ships for 60-90 hours each	HFA sonar exposure
					Vessel Movement	One to five ships maneuvering	Vessel strike
Strike Group Training- ESG COMPTUEX and CSG COMPTUEX and	Intermediate level battle group exercise designed to create a cohesive CSG/ ESG prior to deployment or JTFEX. Three DDGs, one FFG, helicopters, one MPA, and two submarines.	1	21 days	60 nm x 120 nm	Surface ship MFA ASW sonar (AN/SQS-53 and AN/SQS-56)	Four ships (CG, DDG, or FFG) pinging approximately 60 hours each over 10 days	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One to four helicopters (10 pings per five-minute dip) during CSG COMPTUEX	MFA sonar exposure
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	Two submarines pinging up to 16 times each	MFA sonar exposure

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
					Acoustic countermeasures (AN/SLQ-25 NIXIE, ADCs, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per ADC and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended materials
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	MPA and/or helicopter dropping three to 10 sonobuoys for a total of up to 218 sonobuoys over duration of event	MFA sonar exposure, direct strike, and expended materials
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended materials and direct strike
					Explosive source sonobuoy (AN/SSQ-110A)	Two MPA dropping up to 14 AN/SQ-110A sonobuoys	Explosive byproducts, pressure wave exposure, impulsive sound exposure, direct strike, and expended material
					Receiver (ADAR) sonobuoy (AN/SSQ-101)	Up to five AN/SSQ-101 sonobuoys	Direct Strike and expended material
					Vessel movement	Six ships (CG, DDG, FFG, or submarine) maneuvering	Vessel strike
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopters dipping for up to one hour (10 pings per five-minute dip)	MFA sonar exposure

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
Surface Ship Sonar Maintenance	Pier side and at-sea maintenance to sonar system.	4	0.2 to 4 hours		Surface ship MFA ASW sonar (AN/SQS-53 OR AN/SQS-56)	One ship (CG, DDG, or FFG) pinging	MFA sonar exposure
Submarine Sonar Maintenance	Pier side and at-sea maintenance to sonar system.	1	1 hour		Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One submarine pinging for up to one hour (60 pings per hour)	MFA sonar exposure

** Events per year is an estimate of the average number Atlantic Fleet sonar activities or sonar portion of other activities that occur annually within the GOMEX Range Complex and seaward of the GOMEX Range Complex. Some Coordinated ULT exercises and Strike Group Training are shown as less than one event; this indicates that only a portion of that event is expected to occur in the GOMEX Range Complex.*
ADC – Acoustic Device Countermeasure; CG – Guided Missile Cruiser; COMPTUEX – Composite Training Unit Exercise; DDG – Guided Missile Destroyer; DICASS – Directional Command-Activated Sonobuoy System; EMATT – Expendable Mobile Acoustic Training Target; FFG – Fast Frigate; HFA – High-Frequency Active; IEER – Improved Extended Echo Ranging; kHz – Kilohertz; JTFEX – Joint Task Force Exercise; MFA – Mid-Frequency Active; MPA – Maritime Patrol Aircraft; nm – Nautical Mile; TORPEX – Torpedo Exercise

In the GOMEX Range Complex, all ASW training would occur beyond 12 nm from shore.

3.20.2 Summary of Environmental Consequences

In the following sections, a summary of the environmental consequences due to sonar activities in the GOMEX Range Complex is provided by resource area. This is followed by a discussion of the aggregate environmental consequences by resource area due to the combined effects of:

- Sonar activities occurring in GOMEX Range Complex under the preferred alternative presented in the Final AFAST EIS/OEIS; and
- The other training events, RDT&E activities, and range enhancements proposed for each alternative in this Final EIS/OEIS.

Only the resource areas potentially impacted by sonar activities are presented below. Other resources potentially impacted by range complex activities, but not affected by sonar activities, are discussed previously in this chapter.

For each resource area potentially affected by sonar activities, the relevant section of the Final AFAST EIS/OEIS is referenced. The reader should refer to the Final AFAST EIS/OEIS for the full discussion and analysis of environmental consequences resulting from sonar activities.

3.20.2.1 Bathymetry and Sediments

Summary of Environmental Consequences Due to AFAST

Potential effects to bathymetry and sediments are discussed in Section 4.3 of the Final AFAST EIS/OEIS. Any potential effects are due to material expended during sonar activities and not recovered. Material expended during sonar activities is summarized in Table 3.20-3.

Because a limited quantity of material would be expended over a large operational area, there would be no significant accumulation of expended material. Material on the sea floor would eventually be covered by sediments or overgrown by marine life. Under the AFAST selected alternative, therefore, there would be no significant impact to bathymetry or sediments in territorial waters due to expended material or sediment displacement. In addition, there would be no significant harm to bathymetry or sediments in non-territorial waters due to expended material or sediment displacement.

Aggregate Environmental Consequences

The potential impacts to bathymetry and sediments due to range complex activities (other than sonar activities) are presented in Section 3.1 of this Final EIS/OEIS. Under all alternatives presented in this Final EIS/OEIS, when the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, there would be no significant impact to bathymetry or sediments in territorial waters due to expended material or sediment displacement. In addition, there would be no significant harm to bathymetry or sediments in non-territorial waters due to expended material or sediment displacement.

TABLE 3.20-3
MATERIAL EXPENDED DURING SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX

Device	Description	Expended Material	Number Expended per Year*
Sonobuoys	A sonobuoy is an expendable bathythermograph (XBT) used for detection of underwater acoustic energy and conducting vertical water column temperature measurements. Following deployment, sonobuoys descend to specified depths and transmit data measurements to a surface unit via an electrical suspension cable or radio frequency signal. Sonobuoys are cylindrical devices about 12.5 cm (4.9 in) in diameter and 91 cm (36 in) long, weighing from 6 to 18 kg (14 to 39 lbs). At water impact, a seawater battery activates and deployment initiates. The parachute assembly (aircraft only) is jettisoned and sinks away from the unit, while a float containing an antenna is inflated. The subsurface assembly descends to a selected depth, and the sonobuoy case falls away and sea anchors deploy to stabilize the hydrophone (underwater microphone). The operating life of the seawater battery is eight hours, after which the sonobuoy scuttles itself and sinks to the ocean bottom.	• Parachute assembly (12-18 inch diameter nylon chute) and nylon cord • Fabric floatation unit • Lead chloride, cuprous thiocyanate, or silver chloride batteries, Lithium batteries, or Lithium iron disulfide thermal batteries (XBT does not contain a battery) • Plastic casing • Metal clips • Nylon strap • Electrical wiring (90-400 ft of copper wiring, depending on type of sonobuoy) • Drogue (fabric and frame; on some sonobuoys) • Hydrophone/transducer assembly (configuration and amount of material varies depending on type of sonobuoy- sonobuoys may contain up to 38 lbs of material)	• Listening sonobuoys: 1073 • Tonal sonobuoys: 228 • Explosive source sonobuoys: 164 • Receiver sonobuoys: 58
Acoustic Device Countermeasure (ADC)	Typically cylinder-shaped about 40 to 110 inches long, 3 to 6 inches in diameter, and weighing between 7 and 125 lbs.	• Lithium sulfur dioxide battery • Metal casing • Wires	• 10 ADCs
EMATT	Approximate shape of 5 by 36 inches with a weight of 21 lbs.	• Parachute assembly (12-18 inch diameter nylon chute) and nylon cord • Lithium sulfur dioxide battery • Metal casing • Metal clips • Nylon strap • Electrical wiring	• 13 EMATTs

TABLE 3.20-3 (Continued)
MATERIAL EXPENDED DURING SONAR ACTIVITIES IN THE GOMEX RANGE COMPLEX

Device	Description	Expended Material	Number Expended per Year*
K-46/54 Lightweight Torpedo	MK-46 is a deep diving, high-speed lightweight torpedo that is launched from helicopters, fixed-wing aircraft, and surface ships. It has an OTTO II fuel propulsion system and uses active acoustic homing. The MK-54 is launched similar to the MK-46. An exercise torpedo that actually "runs" is referred to as an "EXTORP." Only about 10% of the lightweight shots would be "runners." All MK-54 shots are "runners." The remaining shots are non-running "dummy" torpedo shapes called "REXTORPs." All torpedoes are recovered. A parachute assembly for aircraft-launched torpedoes is jettisoned and sinks.	• Protective nose cover • Suspension bands • Air Stabilizer • Release wire • Propeller baffle • Steel-jacketed lead ballast weights • OTTO Fuel II • Parachute (4-9 ft².; only on air dropped torpedoes)	• 3 MK-46
MK-48 Torpedo	Heavy weight exercise torpedo about 580 cm (19 ft) in length and 53 cm (21 in) in diameter. All MK-48 torpedos are recovered	• Guidance wire (maximum if 0.1 cm [0,04 in] in diameter and composed of a very fine thin-gauge copper-cadmium core with a polyolefin coating); Up to 15 mi of wire is deployed during a run • Flex hose (250 ft long) • OTTO Fuel II	• 3 MK-48

**The quantity shown is an estimate of the portion of overall AFAST expended material anticipated to be used in the GOMEX Range Complex or seaward of the GOMEX Range Complex.*

3.20.2.2 Hazardous Material and Hazardous Waste

Summary of Environmental Consequences Due to AFAST

Potential effects due to both hazardous and non-hazardous constituents of material expended during sonar activities are discussed in Section 4.3 of the Final AFAST EIS/OEIS. The components of material expended during sonar activities are provided in Table 3.20-3. Most of these components are non-hazardous and non-reactive and, therefore, would have no significant effect. The potential effects due to battery constituents were also examined and found to be minimal.

Because a limited quantity of material would be expended, and the constituents of the expended material would have no or minimal effects, under the AFAST selected alternative, there would be no significant impact in territorial waters due to hazardous material. In addition, there would be no significant harm in non-territorial waters due to hazardous material.

Aggregate Environmental Consequences

The potential impacts of hazardous material and hazardous waste due to range complex activities (other than sonar activities) are presented in Section 3.2 of the EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS, there would be less than significant impacts in territorial waters due to hazardous material. In addition, there would be less than significant harm in non-territorial waters due to hazardous material.

3.20.2.3 Water Resources

Summary of Environmental Consequences Due to AFAST

Potential effects due to water quality due to constituents of expended material and byproducts formed during sonar activities are discussed in Section 4.3.3 of the Final AFAST EIS/OEIS. The following sources were examined for potential impacts to water quality:

- Sonobuoy, ADC, and EMATT battery constituents
- Explosion byproducts from explosive-source sonobuoys

The constituents of concern for each of these sources are identified and analyzed in detail in the Final AFAST EIS/OEIS; overall, negligible impacts were found. Under the AFAST selected alternative, therefore, there would be no significant impacts to water quality in territorial waters. In addition, there would be no significant harm to water quality in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to water quality due to range complex activities (other than sonar activities) are presented in Section 3.3 of this Final EIS/OEIS. When potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be no significant impact to water quality in territorial waters. In addition, there would be no significant harm to water quality in non-territorial waters.

3.20.2.4 Marine Communities

Summary of Environmental Consequences Due to AFAST

The potential effects to marine invertebrates, including shell fish and corals, are discussed in Section 4.9 of the Final AFAST EIS/OEIS. There is very little information available regarding the hearing capability of marine invertebrates. However, no effects to marine invertebrates are anticipated from active sonar since acoustic transmissions are brief in nature. Any small level of mortality caused by the explosive source sonobuoy would not be significant to the population as a whole. In addition, the explosions would occur within the water column. Based on the small net explosive weight of the explosive, it is not likely the pressure wave associated with the detonation would reach the bottom, where the majority of invertebrates live.

The potential effects to marine plants and algae are discussed in Section 4.10 of the Final AFAST EIS/OEIS. No effects to marine plants and algae are anticipated from active sonar because plants and algae are acoustically transparent. Moreover, ships and submarines would not be operating in the shallow waters where sea grasses are present. In addition, *Sargassum* mats are easily identified and avoided wherever possible.

Under the AFAST selected alternative, therefore, there would be no significant impacts to marine communities in territorial waters. In addition, there would be no significant harm to marine communities in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to marine communities due to range complex activities (other than sonar activities) are presented in Section 3.6 of this EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there will be no significant impact to marine communities in territorial waters. In addition, there would be no significant harm to marine communities in non-territorial waters.

3.20.2.5 Marine Mammals

Summary of Environmental Consequences Due to AFAST

The Final AFAST EIS/OEIS evaluates potential direct and indirect effects to marine mammals as a result of exposure to in-water sound and non-acoustic interactions during sonar activities in Section 4.4.

Acoustic Effects

Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those marine mammals. The Final AFAST EIS/OEIS analyzed potential effects to marine mammals using the regulatory framework of the MMPA.

- Level A harassment: potential injury (biological tissue is damaged or lost as a result of the action)
- Level B harassment: disruption of natural behavior patterns to the a point where they are abandoned or significantly altered

Although exposure to sound may cause a variety of physiological effects in mammals, the tissues of the ear are most susceptible. Threshold shift (TS), or loss of hearing sensitivity over a subsection of an animal's hearing range, therefore, is used as an indicator of physiological effects. TSs can be either permanent (PTS) or temporary (TTS), depending on the duration and intensity of the sound exposure. For the purpose of estimating physiological effects to marine mammals due to sound exposure, the Navy and NMFS concur on use of the energy flux density level (EFD) method, which takes into account the total sound energy received. Under this method, harassment is correlated to EFD as follows:

- Marine mammals predicted to receive a sound exposure with EFD of 215 dB re 1 μPa^2-s or greater are assumed to experience PTS and are counted as Level A harassment exposures.
- Marine mammals predicted to receive a sound exposure with EFD greater than or equal to 195 dB re 1 μPa^2-s but less than 215 dB re 1 μPa^2-s are assumed to experience TTS and are counted as Level B harassment exposures.

In addition to TTS exposures, Level B harassment includes behavioral responses, such as fleeing and interruption of social or foraging activity. A behavioral response is dependent on many factors, including the species, an individual's characteristics, and the context of the exposure. Because a range of behavioral responses may occur to a particular sound exposure, the Navy, in cooperation with NMFS, has implemented a risk function approach to estimate the number of behavioral responses that NMFS would classify as behavioral harassment. The risk function is a mathematical function that estimates the probability of behavioral response based on the maximum sound pressure level (SPL) to which the animal is exposed. Figure 3.20-1 is the curve resulting from the risk function inputs for odontocetes (except harbor porpoises) and pinnipeds. Figure 3.20-2 is the curve resulting from the risk function inputs for mysticetes. Due to information that suggests harbor porpoises exhibit a very low threshold

for response, a single exposure threshold of 120 dB SPL is used to estimate behavioral harassment for this species.

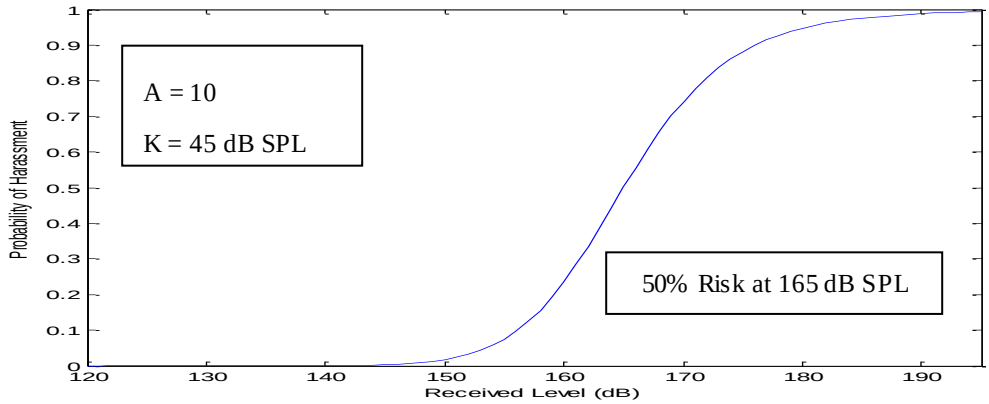

Figure 3.20-1. Risk Function Curve for Odontocetes (except harbor porpoises) (toothed whales) and Pinnipeds

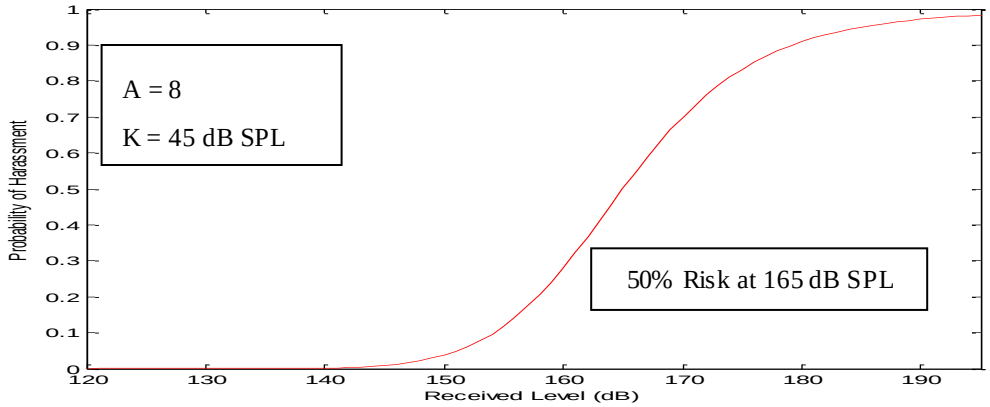

Figure 3.20-2 Risk Function Curve for Mysticetes (Baleen Whales)

Although immediate behavioral effects may occur at a receive level above the physiological thresholds, for purposes of this analysis, behavioral responses to sonar are counted as those occurring beyond the range to physiological effects. Figure 3.20-3 depicts shows the ranges of effects that correspond to MMPA harassment levels.

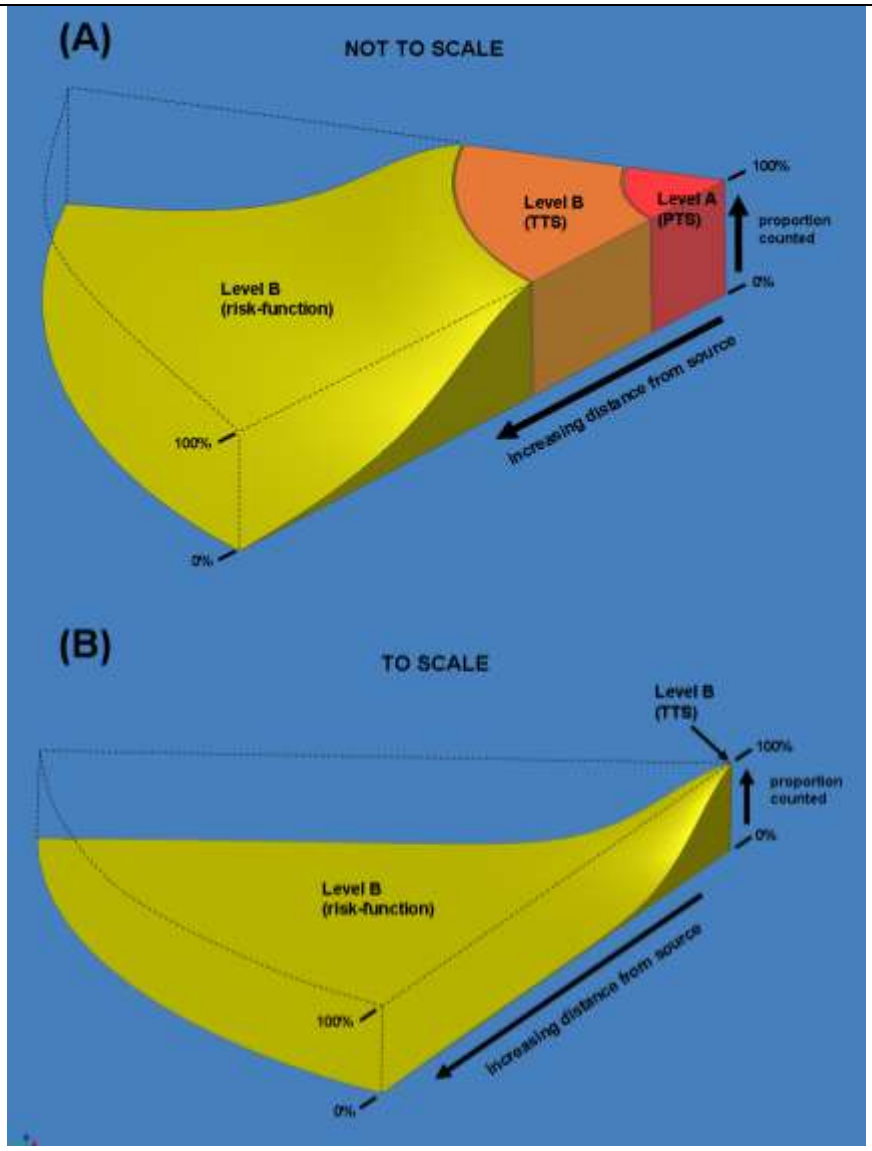

Figure 3.20-3 Range to Effects for the Most Powerful Active Sonar, AN/SQS-53

(A) General relationships between PTS, TTS, and risk function harassment zones. Image is not scaled, which allows each zone to be visible. (B) Scaled representation of harassment zone areas. Scaled distances were based on a single, 1-second ping with source level of 235 dB re 1 µPa.

The Final AFAST EIS/OEIS also analyzed the effects to marine mammals due to exposure to small explosives during deployment of the AN/SSQ-110A IEER sonobuoy. The Final AFAST EIS/OEIS used the same small explosives criteria (for single explosions) presented in Section 3.7.3.1 of this DEIS/OEIS.

To estimate the number of exposures of marine mammals to sound that would result in regulatory levels of harassment, sonar activities were acoustically modeled for the GOMEX Study Area. By analyzing both the acoustic propagation of each source and the estimates of marine mammal presence, annual marine mammal exposures were calculated (Table 3.20-4). When interpreting the modeling results, it is

important to recognize the limitations of the model. The model does not reflect implementation of protective measures (such as reducing power levels or ceasing sonar use in the presence of marine mammals) and it assumes the acoustic footprint extends to the seafloor regardless of the operating environment (in reality the zone of influence for physiological effects is shaped like a bubble in deeper waters). Sonar power reduction would reduce the likelihood of hearing impairment due to close aboard exposure, but some animals could be missed or could surface within the safety zone. Others could receive multiple pings that cause TTS due to added energy of multiple exposures over a short time period.

In addition, the exposure estimates rely on the best available information from marine mammal surveys. Marine species density models rely on limited survey data, and for some species data are insufficient to estimate densities (blue whale, white-beaked dolphin, hooded seal, and harp seal throughout the AFAST Study Area; harbor porpoise, gray seal, harbor seal, sei whale in the GOMEX Range Complex.

Due to the above reasons, quantitative exposure estimates should be used in conjunction with a qualitative analysis to assess potential impacts.

TABLE 3.20-4
ESTIMATED ANNUAL TAKES OF MARINE MAMMALS UNDER THE AFAST SELECTED ALTERNATIVE

Species	Mortality	PTS	TTS	Risk-Function (Behavioral)
Bryde's whale	0	0	0	25
Sperm whale*	0	0	5	370
Kogia spp.	0	0	5	330
Beaked whale	0	0	2	161
Rough-toothed dolphin	0	0	10	974
Bottlenose dolphin	0	2	225	24014
Pantropical spotted dolphin	0	5	695	49445
Atlantic spotted dolphin	0	3	124	14583
Spinner dolphin	0	2	289	20624
Clymene dolphin	0	1	114	8145
Striped dolphin	0	0	58	4133
Fraser's dolphin	0	0	5	341
Risso's dolphin	0	0	21	1465
Melon-headed whale	0	0	23	1620
Pygmy killer whale	0	0	3	233
False killer whale	0	0	7	487
Killer whale	0	0	1	62
Short-finned pilot whale	0	0	16	1121

**Denotes species listed in accordance with the Endangered Species Act.*

Potential acoustic effects to individual marine mammal species, including those for which density data are not available to quantify potential exposures, are discussed in sections 4.4.10.3 (ESA-listed species) and 4.4.10.4 (non-ESA-listed species) of the Final AFAST EIS/OEIS. Most exposures would cause short-term recoverable behavioral effects, and protective measures, such as sonar power reduction and shutdown as an animal approaches a vessel, would reduce the likelihood of physiological effects.

The quantified physiological and behavioral effects above account solely for exposures to levels of sound associated with the effects thresholds discussed previously. Other potential acoustic effects are also

discussed in the Final AFAST EIS/OEIS. Currently, evidence of acoustically mediated bubble growth and decompression sickness is limited and inconclusive; therefore, these phenomena are discussed but not considered as potential effects. Investigations of air cavity resonance predict it would occur at frequencies lower than those analyzed in the Final AFAST EIS/OEIS. The potential for masking, in which sounds interfere with an animal's ability to hear other sounds, exists; however, due to the intermittent use and narrow-frequency band of sonars, masking effects are considered negligible. The reader should refer to Section 4.4.10.2.4 of the Final AFAST EIS/OEIS for a discussion of what is known about the possibility of these phenomena.

The reader should refer to the Final AFAST EIS/OEIS for full discussion and explanation of the following topics:

- *Conceptual Biological Framework* (Section 4.4.3)- an explanation of the pathways to potential physiological and behavioral effects, including stress responses, due to sound exposure
- *The Regulatory Frameworks* (Section 4.4.4)- an explanation of MMPA Level A and Level B harassment and the corresponding biological indicators and exposure zones
- *Criteria and Thresholds for MMPA Harrassment* (Section 4.4.5)- an explanation of the development of PTS and TTS EFD criteria for physiological effects *and* an explanation of the risk function approach used to estimate behavioral responses to sonar exposure
- *Criteria and Thresholds for Small Explosives* (Section 4.4.6)- an explanation of small explosives criteria
- *Acoustic Effects Results for Marine Mammals* (Section 4.4.9)- an overview of the acoustic analysis approach and modeling (for more detail on the modeling and assumptions, refer to Final AFAST EIS/OEIS Appendix H)
- *Summary of Potential Acoustic Effects by Marine Mammal Species* (Section 4.4.10)- analysis of acoustic impacts by individual species

Non-acoustic Effects

The Final AFAST EIS/OEIS also examined the potential non-acoustic effects to marine mammals during sonar activities, including interactions with vessels (Section 4.4.12.1) and interactions with other components of sonar activities, such as entanglement in expended material (Section 4.4.12.2) and direct animal strike by a deployed item, such as torpedoes, sonobuoys, or training targets (Section 4.4.12.3). As discussed in Section 3.7.3.3 of the GOMEX Range Complex Final EIS/OEIS, the Navy employs protective measures to reduce the likelihood of vessel strikes. The characteristics of material expended during sonar activities make them unlikely to be a source of entanglement or ingestion for marine mammals. Due to the large area over which sonar training material could be deployed from the air, the likelihood of striking an animal that may be near the surface is negligible. In addition, there are no known instances in which an animal has been struck by an exercise torpedo, as torpedoes are designed to home on mechanical signatures or active sonar returns from vessel hulls.

Potential for Strandings

The history of Navy activities in the AFAST Study Area and analysis in the Final AFAST EIS/OEIS indicate that military readiness activities are not expected to result in any sonar – induced mortalities to marine mammals. Natural and manmade sources of mortality other than sonar and UNDETs that may contribute to stranding events are discussed in the Final AFAST EIS/OEIS (Section 3.6.3 and described in detail in Appendix E, Cetacean Stranding Report). The actual cause of a particular stranding may not be immediately apparent when there is little evidence of physical trauma, especially in the case of disease or age-related mortalities. These events require careful scientific investigation by a collaborative team of subject matter experts to determine actual cause of death.

Evidence from five beaked whale strandings that occurred over approximately a decade suggests that exposure of beaked whales to mid-frequency sonar in the presence of certain conditions (*e.g.*, multiple units using tactical sonar, steep bathymetry, constricted channels, strong surface ducts, *etc*.) may result in strandings, potentially leading to mortality. Although these physical factors believed to contribute to the likelihood of beaked whale strandings are not present, in their aggregate, in the AFAST Study Area, scientific uncertainty exists regarding what other factors, or combination of factors, may contribute to beaked whale strandings.

Summary of Effects to Marine Mammals

In conclusion, under the AFAST selected alternative, no significant impacts are predicted to marine mammals in territorial waters due to sonar activities. In addition, there would be no significant harm in non-territorial waters to marine mammals due to sonar activities. The Navy consulted with NMFS in accordance with Section 7 of the ESA for ESA-listed marine mammals (with the exception of manatees) located in the AFAST Study Area concluding in the Biological Opinion dated Jan 21, 2009. The Navy consulted with NMFS in accordance with the MMPA for marine mammals located in the AFAST Study Area resulting in an Incidental Take Permit.

Aggregate Environmental Consequences

The potential impacts to marine mammals due to range complex activities (other than sonar activities) are presented in Section 3.7 of this Final EIS/OEIS. Although it is possible a single animal may be significantly affected when considering all events in the training complex, no significant effects are predicted by the analysis and no significant impacts to populations of marine mammals are anticipated when the potential impacts due to sonar activities are included with the potential impacts due to range complex activities. Therefore, under all alternatives presented in this Final EIS/OEIS there would be no significant impact to marine mammals in territorial waters. In addition, there would be no significant harm to marine mammal populations in non-territorial waters.

3.20.2.6 Sea Turtles

Summary of Environmental Consequences Due to AFAST

The Final AFAST EIS/OEIS evaluates potential direct and indirect effects to sea turtles as a result of exposure to in-water sound and non-acoustic interactions during sonar activities in Section 4.5.

Acoustic Effects

Assessing whether a sound may disturb or injure a sea turtle involves understanding the characteristics of the acoustic sources, the presence of sea turtles in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those animals. Little is known about the role of sound and hearing in sea turtles; however, their greatest sensitivity appears to be at frequencies below the frequencies used by sonar systems during Atlantic fleet sonar activities. Use of these systems, therefore, is not expected to acoustically affect sea turtles. Sea turtles are, however, expected to be physiologically or behaviorally affected by use of explosive source sonobuoys. Effects to sea turtles were analyzed in the Final AFAST EIS/OEIS using the same methods and criteria presented for small explosive impacts (single explosions) to sea turtles in the GOMEX Range Complex Final EIS/OEIS (Section 3.8). Table 3.20-5 shows that no acoustic exposures resulting in a physiological effect are anticipated in the GOMEX Study Area. In the case of single explosions, behavioral effects are expected to be limited to short-term startle effects.

TABLE 3.20-5
ESTIMATED SEA TURTLE ACOUSTIC EXPOSURES FROM EXPLOSIVE SOURCE SONOBUOYS

Species	Mortality	PTS	TTS
Loggerhead sea turtle	0	0*	1
Kemp's ridley sea turtle **	0	0	0
Leatherback sea turtle	0	0	0*
Hardshell sea turtle ***	0	0*	1

** Indicates an exposure greater than or equal to 0.05, therefore is considered a "may effect" for ESA listed species.*
*** This category does not include Kemp's ridley sea turtles in the Gulf of Mexico. They are included in the hardshell sea turtle class.*
**** This category includes green, hawksbill, and unidentified hardshell species for all regions. It also includes Kemp's ridley sea turtles in the Gulf of Mexico, and may include extralimital occurrences of olive ridley turtles along the Atlantic coast.*

Non-acoustic Effects

The Final AFAST EIS/OEIS also examined the potential non-acoustic effects to sea turtles during sonar activities, including interactions with vessels (Section 4.5.3.1) and interactions with other components of sonar activities, such as entanglement in expended material (Section 4.5.3.2) and direct animal strike by a deployed item, such as torpedoes, sonobuoys, or training targets (Section 4.5.3.3). As discussed in Section 3.8.3.2 of the GOMEX Range Complex Final EIS/OEIS, although the potential for vessel strikes exist, the Navy employs protective measures to reduce the likelihood of vessel strikes. The characteristics of material expended during sonar activities make them unlikely to be a source of entanglement or ingestion for sea turtles. Due to the large area over which sonar training material could be deployed from the air, the likelihood of striking an animal that may be near the surface is negligible. In addition, there are no known instances in which an animal has been struck by an exercise torpedo, as torpedoes are designed to home on mechanical signatures or active sonar returns from vessel hulls.

Summary of Effects to Sea Turtles

In conclusion, under the AFAST selected alternative, although there could be potential impacts to individuals, there would be no significant impact to sea turtles in territorial waters due to sonar activities. In addition, there would be no significant harm in non-territorial waters to sea turtles due to sonar activities. The Navy has completed consultation with NMFS in accordance with Section 7 of the ESA for ESA listed sea turtles due to sonar activities in the AFAST Study Area.

Aggregate Environmental Consequences

The potential impacts to sea turtles due to range complex activities (other than sonar activities) are presented in Section 3.8 of this Final EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be no significant impact to sea turtles in territorial waters. In addition, there will be no significant harm to sea turtles in non-territorial waters.

3.20.2.7 Fish and Essential Fish Habitat

Summary of Environmental Consequences Due to AFAST

Effects to Essential Fish Habitat

Potential effects to EFH are analyzed in Section 4.6 of the Final AFAST EIS/OEIS. The potential stressors examined were effects of expended material or byproducts and the effects due to small explosive forces. As previously discussed in Bathymetry and Sediments (Section 3.20.2.1), Hazardous Material and Hazardous Waste (Section 3.20.2.2), and Water Resources (Section 3.20.2.3), under the AFAST selected alternative, there would be no significant impact to the physical environment due to expended material and byproducts of sonar activities. Detonation of explosive sonobuoys would occur in relatively deeper waters where the sea bottom habitat structure would not be affected.

Effects to Fish: Sonar Exposure

Potential effects to fish due to exposure to active sonar are discussed in Section 4.7.1 of the Final AFAST EIS/OEIS.

Studies indicate that acoustic communication and orientation of fish may be restricted by sound regimes in their environment. However, most marine fish species are not expected to able to detect sounds in the mid-frequency range of the operational sonars used during Atlantic fleet sonar activities and, therefore, the sound sources do not have the potential to mask key environmental sounds. The few fish species shown to be able to detect mid-frequencies do not have their best sensitivities in the range of the operational sonars. Additionally, vocal marine fish largely communicate below the range of mid-frequency sonars.

There is no information available that suggests that exposure to non-impulsive acoustic sources results in significant fish mortality on a population level. Mortality has been shown to occur in the larval stage of one species; however, the level of mortality was considered insignificant in light of natural daily mortality rates. Experiments show that exposure to loud sound can result in significant threshold shifts in certain fish classified as hearing specialists (but not those classified as hearing generalists). Threshold shifts are temporary, and considering the best available data, no data exist that demonstrate any long-term negative effects on marine fish from underwater sound associated with sonar activities. Further, while fish may respond behaviorally to mid-frequency sources, this behavioral modification is only expected to be brief and not biologically significant.

Effects to Fish: Exposure to Small Explosives (Explosive Source Sonobuoy)

Potential effects to fish due to exposure to detonation of the explosive source sonobuoy are discussed in Section 4.7.2 of the Final AFAST EIS/OEIS.

Fish located in the water column in proximity to the source of detonation could be injured, killed, or disturbed by the impulsive sound of a sonobuoy detonation or possibly temporarily leave the area. The potential for injury depends on proximity, fish anatomy (presence of a swim bladder), fish size, fish shape, and orientation of the fish to the explosive source. The huge variations in the fish population, including numbers, species, sizes, and orientation and range from the detonation point, make it very difficult to accurately predict mortalities at any specific site of detonation.

Summary of Effects to EFH and Fish

Sonar activities will not reduce the quality or quantity of EFH, introduce significant contamination to the water column or bottom habitats, or result in physical disruption of EFH. The likelihood of significant effects to individual fish from active sonar is low. Most fish species experience large

number of natural mortalities especially during early life-stages and, therefore, any small level of mortality caused by sonar activities involving the explosive source sonobuoy would most likely be insignificant to the population as a whole. Therefore, under the AFAST selected alternative, there would be no significant impact to EFH or fish populations as a result of active sonar activities in territorial waters. In addition, there would be no significant harm to EFH or fish populations from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

Potential impacts to EFH and fish due to range complex activities (other than sonar activities) are presented in Section 3.9 of this Final EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be no impact to EFH and fish in territorial waters. In addition, there would be no significant harm to EFH and fish in non-territorial waters.

3.20.2.8 Seabirds and Migratory Birds

Summary of Environmental Consequences Due to AFAST

Potential effects to seabirds due to exposure to sonar or explosive source sonobuoy detonations are discussed in Section 4.8 of the Final AFAST EIS/OEIS. Little is known about the general hearing or underwater hearing capabilities of sea birds. It was concluded effects were unlikely even if some diving birds were able to hear a signal for the following reasons:

- There is no evidence seabirds use underwater sound.
- Seabirds spend a small fraction of time submerged.
- Seabirds could rapidly fly away from the area and disperse to other areas if disturbed.

Since sonobuoys are only detonated more than 12 nm from shore, only birds traveling far from shore have the potential to be exposed to a detonation; however, the likelihood of a seabird diving near a sonobuoy at the time of detonation is negligible. Therefore, under the AFAST selected alternative, there would be no significant impact to sea birds as a result of active sonar activities in territorial waters. In addition, there would be no significant harm to sea birds from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

Potential impacts to sea birds due to range complex activities (other than sonar activities) are presented in Section 3.10 of this Final EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be no significant impact to sea birds in territorial waters. In addition, there would be no significant harm to sea birds in non-territorial waters.

3.20.2.9 Cultural Resources

Summary of Environmental Consequences Due to AFAST

Potential impacts to cultural resources due to sonar activities are discussed in Section 4.19 of the Final AFAST EIS/OEIS. Sound in the water is not expected to affect cultural resources, and the explosions associated with the explosive source sonobuoy will occur within the water column and will not reach the ocean floor. Although shipwrecks are located in multiple locations throughout the AFAST Study Area, the likelihood of expended material causing a disturbance is low. Therefore, under the AFAST selected alternative, there would be no significant impact to cultural resources as a result of active sonar

activities in territorial waters. In addition, there would be no significant harm to cultural resources from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

Potential impacts to cultural resources due to range complex activities (other than sonar activities) are presented in Section 3.13. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be less than significant impact to cultural resources in territorial waters. In addition, there would be less than significant harm to cultural resources in non-territorial waters.

3.20.2.10 Transportation

Summary of Environmental Consequences Due to AFAST

Potential impacts to airspace management are discussed in Section 4.12 of the Final AFAST EIS/OEIS. Because no new or modified activities are proposed within the airspace of the AFAST Study Area, there would be no effects to airspace management due to sonar activities.

The potential impacts to commercial shipping are discussed in Section 4.16 of the Final AFAST EIS/OEIS. No significant effects to commercial shipping have been reported in the past due to sonar activities.

Therefore, under the AFAST selected alternative, there would be no significant impact to transportation as a result of active sonar activities in territorial waters. In addition, there would be no significant harm to transportation from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

Potential impacts to transportation due to range complex activities (other than sonar activities) are presented in Section 3.14 of this Final EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be no significant impact to transportation in territorial waters. In addition, there would be no significant harm to transportation in non-territorial waters.

3.20.2.11 Regional Economy

Summary of Environmental Consequences Due to AFAST

Potential impacts to commercial fishing are discussed in Section 4.15 of the Final AFAST EIS/OEIS. The Navy does not routinely close areas for active sonar activities. In addition, the largest portion commercial fishing occurs in state waters, where active sonar activities would not occur, with the exception of limited maintenance, navigation, and helicopter dipping sonar use. Furthermore, no significant impacts to fish are anticipated due to sonar activities. Therefore, under the AFAST selected alternative, no significant impact to commercial fishing is anticipated due to sonar activities.

Aggregate Environmental Consequences

Potential impacts to regional economy due to range complex activities (other than sonar activities) are presented in Section 3.16 of this Final EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be no significant impact to the regional economy in territorial waters. In addition, there would be no significant harm to the regional economy in non-territorial waters.

3.20.2.12 Recreation

Summary of Environmental Consequences Due to AFAST

Potential effects to recreational boating are discussed in Section 4.14 of the Final AFAST EIS/OEIS. The potential effects to recreational fishing are discussed in Section 4.15 of the Final AFAST EIS/OEIS. The Navy does not routinely close areas for active sonar activities; therefore, under the AFAST selected alternative, there would be no effect to recreational boating or fishing. Furthermore, as previously discussed, no potential impacts to fish are anticipated due to active sonar activities.

The potential effects to scuba diving are discussed in Section 4.17 of the Final AFAST EIS/OEIS. Under the AFAST selected alternative, no significant impacts to diving are anticipated due to sonar activities.

The potential effects to marine mammal watching are discussed in Section 4.18 of the Final AFAST EIS/OEIS. Because these activities typically occur near-shore, and the navy does not routinely close areas for sonar activities, under the AFAST selected alternative, there would be no significant impact to marine mammal watching due to sonar activities.

Aggregate Environmental Consequences

Potential impacts to recreation due to range complex activities (other than sonar activities) are presented in Section 3.17 of this Final EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this Final EIS/OEIS there would be no significant impact to recreation in territorial waters. In addition, there would be no significant harm to recreation in non-territorial waters.

3.20.3 Mitigation Measures for Atlantic Fleet Active Sonar Activities

The AFAST Final EIS/OEIS and Record of Decision (ROD) provides a detailed discussion of mitigation measures employed during sonar activities, specifically during: active sonar activities (AFAST EIS/OEIS Section 5.1), use of explosive source sonobuoys (AFAST EIS/OEIS Section 5.2), and vessel transit (AFAST EIS/OEIS Section 5.3). In addition, the AFAST Final EIS/OEIS and ROD presents a discussion of other measures that have been considered and rejected after consideration of: known science; likely effectiveness; personnel safety; practicality of implementation; and impact on the effectiveness of the military readiness activity. All mitigation measures incorporated into this Final EIS/OEIS, including those from AFAST, are discussed in chapter 5. Specifically, AFAST mitigations related to active sonar and the use of explosive source sonobouys are presented below.

3.20.3.1 AFAST Mitigation Measures Related to Acoustic Effects

As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST ROD, the Navy would implement various mitigation measures to maximize the ability of operators to recognize instances when marine mammals are in the vicinity. These measures include the following:

1. Training personnel in lookout/watchstander duties;
2. Stationing at least three people on watch with binoculars at all times;
3. Stationing at least two additional people on watch during ASW exercises when MFA sonar is being used;
4. Requiring all personnel engaged in passive acoustic sonar operation to monitor for marine mammal vocalizations;

5. Using all available sensor and optical systems, such as night vision goggles during MFA and HFA active sonar activities;
6. Using only passive capability of sonobuoys when marine mammals are detected within 183 meters (200 yards);
7. Limiting ship or submarine active transmission levels to at least 6 dB below normal operating levels when marine mammals are detected by any means within 914 meters (1,000 yards) of the sonar dome (the bow);
8. Limiting ship or submarine active transmission levels to at least 10 dB below normal operating levels when marine mammals are detected by any means within 457 meters (500 yards) of the sonar dome, or ceasing ship or submarine active transmissions when a marine mammal is detected by any means within 183 meters (200 yards) of the sonar dome;
9. If the need for such power-down arises, following power-down requirements as though the system is operating at 235 dB, the normal operating level (i.e., power-down would be to 229 dB);
10. Operating sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives;
11. Requiring helicopters to observe or survey the vicinity of an ASW activity for ten minutes before first deployment of active (dipping) sonar in the water; prohibiting dipping sonar within 183 meters (200 yd) of a marine mammal and ceasing pinging if a marine mammal closes to within 183 meters (200 yd) after pinging has begun;
12. Coordinating with the local NMFS Stranding Coordinator; and submitting a report containing a discussion of the nature of any observed effects based on both modeled results of real-time events and sightings of marine mammals.

Special Conditions Applicable for Bow-Riding Dolphins

If, after conducting an initial maneuver to avoid close quarters with dolphins, the ship concludes that dolphins are deliberately closing in on the ship to ride the vessel's bow wave, no further mitigation actions would be necessary because dolphins are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

The Navy and NMFS worked together to identify additional practicable and effective mitigation measures to address the following three issues of concern:

(1) general minimization of marine mammal impacts;

(2) minimization of impacts within the southeastern North Atlantic right whales critical habitat; and

(3) the potential relationship between the operation of mid and/or high-frequency active sonar and marine mammal strandings.

Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the following general goals:

- avoidance or minimization of injury or death of marine mammals wherever possible;
- a reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of mid- or high-frequency active sonar, underwater

detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal above, or by reducing harassment takes only);

- a reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of mid- or high-frequency active sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal listed above or by reducing harassment takes only);
- a reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of MFA or HFA sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to (1), above, or to reducing the severity of harassment takes only);
- a reduction in adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time;
- and for monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

NMFS and the Navy had extensive discussions regarding mitigation as part of consultation on the proposed and final rules, in which several mitigation options and their respective practicability were explored. Ultimately, NMFS and the Navy developed the following measures which the Navy and NMFS believe supports (or contributes) to the goals mentioned above:

Planning Awareness Areas (PAAs): The Navy has designated several Planning Awareness Areas (PAAs) based on areas of high productivity that have been correlated with high concentrations of marine mammals (such as persistent oceanographic features like upwellings associated with the Gulf Stream front where it is deflected off the east coast near the Outer Banks), and areas of steep bathymetric contours that are frequented by deep diving marine mammals such as beaked whales and sperm whales. In developing the PAAs, USFF was able to consider these factors because of geographic flexibility in conducting ASW training. USFF is not tied to a specific range support structure for the majority of the training for AFAST.

Additionally, the topography and bathymetry along the East Coast and in the Gulf of Mexico is unique in that there is a wide continental shelf leading to the shelf break, affording a wider range of training opportunities. The Navy will avoid planning major exercises in the specified PAAs where feasible. Should national security require the conduct of more than four major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) in these areas (meaning all or a portion of the exercise) per year, the Navy will provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. To the extent operationally feasible, the Navy plans to conduct no more than one of the four major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) per year in the Gulf of Mexico. Based on operational requirements, the exercise area for this one exercise may include the De Soto Canyon. If national security needs require more than one major exercise to be conducted in the PAAs, which includes portions of the DeSoto Canyon, the Navy would provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. The PAAs will be included in the Navy's Protective Measures Assessment Protocol (PMAP) (implemented by the Navy for use in the protection of the marine environment) for unit level situational awareness (i.e., exercises other than COMPTUEX, JTFEX, or SEASWITI). The goal of PMAP is to raise awareness in the fleet and ensure common sense and informed oversight is injected into planning processes for testing and training evolutions.

Helicopter Dipping Sonar in North Atlantic right whale Critical Habitat: Helicopter Dipping Sonar is one of the two activity types that have been identified as planned to occur in the southern North Atlantic right whale critical habitat. Historically, only maintenance of helicopter dipping sonars occurs within a portion of the North Atlantic right whale critical habitat. Tactical training with helicopter dipping sonar does not typically occur in the North Atlantic right whale critical habitat area at any time of the year. The critical habitat area is used on occasion for post maintenance operational checks and equipment testing due to its proximity to shore. Unless otherwise dictated by national security needs, the Navy will minimize helicopter dipping sonar maintenance within the southeast North Atlantic right whale critical habitat from November 15 to April 15.

Object Detection Exercises in North Atlantic Right Whale Critical Habitat: Object detection training requirements are another type of activity that has been identified as planned to occur in the southern North Atlantic right whale critical habitat. The Navy recognizes the significance of the North Atlantic right whale calving area and has explored ways of affecting the least practicable impact (which includes a consideration of practicality of implementation and impacts to training fidelity) to right whales. Navy units will incorporate data from the Early Warning System (EWS) into exercise pre-planning efforts. USFF contributes more than $150,000 annually for aerial surveys that support the EWS, a communication network that assists afloat commands to avoid interactions with right whales. Fleet Air Control Surveillance Facility (FACSFAC) JAX houses the Whale Fusion Center, which disseminates the latest right whale sighting information to Navy ships, submarines, and aircraft. Through the Fusion Center, FACSFAC JAX coordinates ship and aircraft movement into the right whale critical habitat and the surrounding operating areas based on season, water temperature, weather conditions, and frequency of whale sightings and provides right whale reports to ships, submarines and aircraft, including coast guard vessels and civilian shipping. The Navy proposes:

- To reduce the time spent conducting object detection exercises in the North Atlantic right whale critical habitat during the time of November 15 to April 15; and
- Prior to conducting surface ship object detection exercises in the southeast North Atlantic right whale critical habitat during the time of November 15 to April 15, ships will contact the FACSFAC JAX to obtain the latest right whale sighting information. FACSFAC JAX will advise ships of all reported whale sightings in the vicinity of the critical habitat and Associated Area of Concern. To the extent operationally feasible, ships will avoid conducting training in the vicinity of recently sighted right whales. Ships will maneuver to maintain at least 457 meters (500 yards) separation from any observed whale, consistent with the safety of the ship.

3.20.3.2 Mitigation Measures Related to Explosive Source Sonobuoys (AN/SSQ-110A)

As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST Record of Decision dated 23 Jan 2009, the Navy would implement the following mitigation measures for explosive source sonobuoys (AN/SSQ-110A) as well as for the follow on Advanced Extended Echo Ranging (AEER) system:

1. Crews will conduct visual reconnaissance of the drop area prior to laying their intended sonobuoy pattern;
2. Crews will conduct a minimum of 30 minutes of visual and aural monitoring of the search area prior to commanding the first post (source/receiver sonobuoy pair) detonation;

3. If a post (source/receiver sonobuoy pair) will be deployed within 914 meters (1,000 yards) of observed marine mammal activity, crews will deploy the receiver only and monitor while conducting a visual search;
4. When operationally feasible, crews will conduct continuous visual and aural monitoring of marine mammal activity, including monitoring of their aircraft sensors from first sensor placement to checking off-station and of radio frequency range of these sensors; aural detection of marine mammal cues the aircrew to increase the diligence of their visual surveillance;
5. If marine mammals are visually detected within 914 meter (1,000 yards) of the explosive source sonobuoy (AN/SSQ-110A) intended for use, then that payload shall not be detonated;
6. Aircrews will ensure a 914-meter (1,000-yard) safety zone, visually clear of marine mammals, is maintained;
7. Aircrews shall only leave posts with unexploded charges in the event of a sonobuoy malfunction, an aircraft system malfunction, or when an aircraft must immediately depart the area due to issues such as fuel constraints, inclement weather, and in-flight emergencies;
8. Aircrews will ensure all payloads are accounted for;
9. Marine mammal monitoring shall continue until out of their aircraft sensor range.

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CHAPTER 4 OTHER CONSIDERATIONS

4.1 CONSISTENCY WITH OTHER FEDERAL, STATE, AND LOCAL PLANS, POLICIES, AND REGULATIONS

Based on evaluation with respect to consistency and statutory obligations, the Department of the Navy's alternatives including the proposed action for the GOMEX Range Complex EIS/OEIS does not conflict with the objectives or requirements of federal, state, regional, or local plans, policies, or legal requirements. Table 4.1-1 provides a summary of environmental compliance requirements that may apply.

TABLE 4.1-1
SUMMARY OF ENVIRONMENTAL COMPLIANCE FOR THE PROPOSED ACTION

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
National Environmental Policy Act (NEPA) of 1969 (42 USC §§ 4321, *et seq*.) Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR §§ 1500-1508) DoN Procedures for Implementing NEPA (32 CFR § 775)	DoN	This EIS/OEIS has been prepared in accordance with NEPA, CEQ regulations and Navy NEPA procedures. Public participation and review is being conducted in compliance with NEPA. The proposed action would not result in significant impacts.
Executive Order (EO) 12114, Environmental Effects Abroad of Major Federal Actions	DoN	EO 12114 requires environmental consideration for actions that may affect the environment outside of U.S. territorial waters. The proposed action would not result in significant harm to the environment.
Clean Water Act (CWA) (33 USC §§ 1344, *et seq*.)	USEPA	No permit under the CWA, Section 401, 402, or 404 (b) (1), is required.
Coastal Zone Management Act (CZMA) (16 CFR §§ 1451, *et seq*.)	Texas, Coastal Coordination Council Louisiana, Office of Coastal Restoration and Management Mississippi, Department of Marine Resources Alabama, The State Lands Division, Coastal Section Florida, Florida Coastal Management Program	The Navy has determined that the proposed action is consistent to the maximum extent practicable with the Texas, Louisiana, Mississippi, Alabama, and Florida Coastal Management Plans, and is preparing a Federal Consistency Determination (FCD) in accordance with the CZMA.
Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§ 1801-1802)	National Marine Fisheries Service (NMFS)	The proposed action would not adversely affect Essential Fish Habitat (EFH) and would not decrease the available area or quality of EFH.

TABLE 4.1-1 (Continued)
SUMMARY OF ENVIRONMENTAL COMPLIANCE FOR THE PROPOSED ACTION

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
Endangered Species Act (ESA) (16 USC §§ 1531, *et seq*.)	DoN U.S. Fish and Wildlife Service (USFWS) NMFS	The EIS/OEIS analyzes potential effects to species listed under the ESA. The Navy completed consultation under Section 7 of the ESA with NMFS and USFWS on the potential that the proposed action may affect listed species.
Marine Mammal Protection Act (MMPA) (16 USC §§ 1431, *et seq*.)	NMFS	This EIS/OEIS analyzes potential effects to marine mammals, some of which are species-listed under the ESA. As noted, potential effects on listed species are the subject of consultations with NMFS. The Navy has prepared a Request for a Letter of Authorization for Incidental Harassment on Marine Mammals from the NMFS.
Act to Prevent Pollution from Ships (APPS) (33 U.S.C. §§ 1901, *et seq*.)	DoN	The Navy complies with the discharge regulations set fourth under the requirements of the APPS.
The National Marine Sanctuaries Act (16 USC §§ 1431, *et. seq*.)	National Oceanic and Atmospheric Administration	The proposed action would have no effect on sanctuary resources in the off-shore environment of Flower Garden Banks (Texas/Louisiana). Review of agency actions under Section 304 is not required.
National Historic Preservation Act (NHPA) (16 USC §§ 470, *et seq*.)	DoN	The Navy complies with the consultation and other requirements of the NHPA. The proposed action would not have a significant impact on protected resources.
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	DoN	The proposed action would not result in disproportionately high and adverse human health or environmental effects on minority or low income populations.
EO 13045, Protection of Children from Environmental Health Risks and Safety Risks	DoN	The proposed action would not result in disproportionate risks to children from environmental health risks or safety risks.
EO 13112, Invasive Species	DoN	EO 13112 requires Agencies to identify actions that may affect the status of invasive species and take measures to avoid introduction and spread of those species. This EIS/OEIS satisfies the requirement of EO 13112 with regard to the proposed action.

TABLE 4.1-1 (Continued)
SUMMARY OF ENVIRONMENTAL COMPLIANCE FOR THE PROPOSED ACTION

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
EO 11990, Protection of Wetlands	DoN	The proposed action would not have a significant impact on wetlands.
EO 12962, Recreational Fisheries	DoN	EO 12962 requires Agencies to fulfill certain duties with regard to promoting the health and access of the public to recreational fishing areas. The proposed action complies with these duties.
EO 13158, Marine Protected Areas	DoN	EO 13158 requires agencies to identify any actions that affect natural or cultural resources protected by an MPA. Agencies shall avoid harm to the natural and cultural resources protected by an MPA. This EIS/OEIS satisfies the requirement of EO 13158 with regard to the proposed action.
Migratory Bird Treaty Act (MBTA) (16 USC §§703-712)	USFWS	The proposed action would not have a significant impact on migratory birds, and would comply with applicable requirements of the MBTA.
The Sikes Act of 1960 (16 USC §§670a-670o, as amended by the Sikes Act Improvement Act of 1997, Public Law No. 105-85) requires military installations with significant natural resources, to prepare and implement Integrated Natural Resource Management Plans (INRMP).	DoN	The proposed action would be implemented in accordance with the management and conservation criteria set forth in INRMPs for installations within the GOMEX Range Complex.
EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance	DoN	EO 13514 requires agencies to set goals for reducing greenhouse gas emissions. Even though this EO was recently signed, many of the Navy's procedures described in this EIS/OEIS support this requirement.

4.2 REQUIRED PERMITS AND APPROVALS

All required permits and approvals will be or are in the process of being obtained.

4.2.1 COASTAL ZONE MANAGEMENT ACT COMPLIANCE

The CZMA of 1972 (16 United States Code [U.S.C.] Section [§] 1451) encourages coastal states to be proactive in managing coastal zone uses and resources. CZMA established a voluntary coastal planning program; participating states submit a Coastal Management Plan (CMP) to National Oceanographic and Atmospheric Administration (NOAA) for approval. Under CZMA, federal actions are required to be consistent, to the maximum extent practicable, with the enforceable policies of approved CMPs.

CZMA defines the coastal zone (16 U.S.C. § 1453) as extending, "to the outer limit of State title and ownership under the Submerged Lands Act" (*i.e.*, 3 nm from the shoreline in Louisiana, Mississippi and Alabama and 3 marine leagues [~ 9 mi] from the shoreline in Gulf of Mexico portions of Texas and Florida). The coastal zone extends inland only to the extent necessary to control the shoreline. Excluded from the coastal zone is the use of lands that are by law subject solely to the discretion of, or which are held in trust by, the federal government (16 U.S.C. § 1453).

Review of federal agency activities is conducted through the submittal of either a Consistency Determination or a Negative Determination. A federal agency shall submit a Consistency Determination when it determines that its activity may have either a direct or an indirect effect on a state's coastal zone or resources. In accordance with 15 CFR § 930.39, the consistency determination shall include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program and should be based upon an evaluation of the relevant enforceable policies of the management program. A federal agency may submit a Negative Determination to a coastal state when the federal agency has determined that its activities would not have an effect on the state's coastal zone or its resources or when conducting the same or similar activities for which Consistency Determinations have been prepared in the past.

Pursuant to 15 CFR § 930.41, the state has 60 days from the receipt of the Consistency Determination in which to concur with or object to the Consistency Determination, or to request an extension under 15 CFR § 930.41(b). Federal agencies shall approve one request for an extension period of 15 days or less.

In accordance with the CZMA, the Navy has reviewed the enforceable policies of each state's CZMP relevant to the Study Area. Based on the analysis in this Final EIS/OEIS, the enforceable policies of each state's CZMP, and pursuant to 15 CFR § 930.39, the Navy has prepared Federal Consistency Determinations for all affected states. Specific information regarding CZMA can be found in Appendix K. Federal Consistency Determinations or Negative Determinations were written for each state adjacent to the EIS/OEIS Study Area and will appear in Appendix L of the Final EIS.

4.3 RELATIONSHIP BETWEEN SHORT-TERM USE OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

NEPA requires analysis of the relationship between a project's short-term impacts on the environment and the effects that those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This means that choosing one option may reduce future flexibility in pursuing other options, or that committing a resource to a certain use may often eliminate the possibility for other uses of that resource.

With respect to marine mammals, the Navy, in partnership with the National Marine Fisheries Service (NMFS), is committed to furthering understanding of these creatures and developing ways to lessen or eliminate the impacts Navy training activities may have on these animals.

The proposed action would result in both short- and long-term environmental effects. However, the proposed action would not be expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or general welfare of the public. The Navy is committed to sustainable range management, including co-use of the GOMEX Range Complex with general public and commercial interests. This commitment to co-use will enhance long-term productivity of the range areas surrounding the GOMEX Range Complex.

4.4 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires that environmental analysis include identification of "any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of non-renewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (*e.g.*, energy or minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (*e.g.*, the disturbance of a cultural site).

For the alternatives, including the proposed action, most resource commitments are neither irreversible nor irretrievable. Most impacts are short-term and temporary, or long lasting but negligible. No culturally significant resources are known to occur in the area proposed for training activities. No habitat associated with threatened or endangered species would be lost as result of implementation of the proposed action. Since there would be no building or facility construction, the consumption of materials typically associated with such construction (*e.g.*, concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irreversibly lost. Implementation of the proposed action would require fuels used by aircraft, ships, and ground-based vehicles. Since fixed- and rotary-wing flight, and ship activities could increase relative to the baseline (current operations), total fuel use would increase. Fuel use by ground-based vehicles involved in training activities would also increase. Therefore, total fuel consumption would increase and this nonrenewable resource would be considered irretrievably lost.

4.5 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF ALTERNATIVES AND MITIGATION MEASURES

Increased training and testing operations on the GOMEX Range Complex would result in an increase in energy demand over the No Action Alternative. This would result in an increase in fossil fuel consumption, mainly from aircraft, vessels, ground equipment, and power supply. Although the required electricity demands of increased intensity of land-use would be met by the existing electrical generation infrastructure at the GOMEX Range Complex, the alternatives would result in a net cumulative negative impact on the energy supply.

Energy requirements would be subject to any established energy conservation practices at each facility. No additional power generation capacity other than the potential use of generators would be required for any of the operations. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing operations.

At the present time, the Navy, under the direction of the Energy Policy Act (EPAct) of 1992 and EO 13149, is actively testing and introducing several different types of alternate fuels (bio-diesel B100/B20, clean natural gas, fuel ethanol E85, fuel cells, *etc.*) to further reduce the impacts of its activities on the environment and non-renewable resources.

4.6 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL OF VARIOUS ALTERNATIVES AND MITIGATION MEASURES

Resources that would be permanently and continually consumed by project implementation include water, electricity, natural gas, and fossil fuels; however, the amount and rate of consumption of these resources would not result in significant environmental impacts or the unnecessary, inefficient, or wasteful use of resources. Nuclear powered vessels would be a benefit as they decrease the use of fossil fuels. In addition, construction activities related to increased training and testing operations on the GOMEX Range Complex would result in the irretrievable commitment of nonrenewable energy

resources, primarily in the form of fossil fuels (including fuel oil), natural gas, and gasoline construction equipment. With respect to operational activities, compliance with all applicable building codes, as well as project mitigation measures, would ensure that all natural resources are conserved or recycled to the maximum extent feasible. It is also possible that new technologies or systems would emerge, or would become more cost effective or user-friendly, which would further reduce reliance on nonrenewable natural resources. However, even with implementation of conservation measures, consumption of natural resources would generally increase with implementation of the alternatives.

Aircraft operations within the GOMEX OPAREA are the single largest airborne noise source. Noise levels in excess of 90 decibels can occur. Protective measures are in place. Sustainable range management practices are in place that protect and conserve natural and cultural resources as well as preserve access to training areas for current, emerging, and future training requirements, while addressing potential encroachments that threaten to impact range capabilities.

4.7 URBAN QUALITY, HISTORIC AND CULTURAL RESOURCES, AND THE DESIGN OF THE BUILT ENVIRONMENT

There are no urban areas under consideration in this Final EIS/OEIS and therefore no urban quality issues exist. Likewise, there is no new construction being proposed. Historic and cultural resources are addressed in Section 3.13.

CHAPTER 5 MITIGATION MEASURES

5.1 INTRODUCTION

Effective training in the Gulf of Mexico (GOMEX) Range Complex dictates that ship, submarine, and aircraft participants utilize their sensors and exercise weapons to their optimum capabilities as required by the mission. As discussed in Chapter 3, the Navy recognizes that the proposed actions have the potential to impact some marine resources in the vicinity of training. This chapter describes the Navy's overall mitigation approach as well as specific mitigation measures that would be implemented to protect marine mammals, sea turtles, and other resources during training activities. Some of these measures are generally applicable and others are designed to apply to certain geographic areas and/or for specific types of Navy training.

Due to the nature of the proposed action analyzed in this Final EIS/OEIS, mitigation measures for many elements of the action have been established through previous environmental analyses, consultation, and/or permitting processes.

As noted above, this chapter describes the overall approach to mitigation for the proposed action as well as specific mitigation measures to be implemented. Section 5.2 describes the Navy's overall mitigation approach. The Navy's Monitoring and Reporting Requirements are presented in Section 5.3 and research efforts are presented in Section 5.4. Mitigation measures performed by Navy personnel on a regular and routine basis are discussed in Section 5.5 and are known as "Standard Operating Procedures." Section 5.6 presents measures for specific training events. Section 5.7 presents coordination and reporting requirements. Section 5.8 provides alternative mitigation that was considered but eliminated. Section 5.9 discusses the effectiveness of visual observation including the detection probability and efficacy of mitigation measures. Measures for activities that are part of the proposed action, but are analyzed in separate environmental documents that are incorporated by reference are not necessarily included in this chapter. Mitigation measures specific to sonar use are addressed fully in the Final AFAST EIS/OEIS (DoN, 2009) and are presented in Sections 5.6.10 and 5.6.11.

5.2 APPROACH

Mitigation of impacts is defined in the Council on Environmental Quality (CEQ) regulations (40 CFR 1508.20) to include avoidance, minimization, rectification, reduction/elimination over time, and compensation. Given the nature of the proposed action and alternatives and potential impacts analyzed in this Final EIS/OEIS, the Navy believes that a comprehensive approach to mitigation for the GOMEX Range Complex requires focus on: (1) mitigation by avoidance, in which adverse impacts are avoided altogether by altering the location, design, or other aspect of an activity, and (2) minimization of impacts when avoidance is not feasible. An important complement to the *avoidance* and *minimization* of impacts is *monitoring* to track compliance with take authorizations, impacts on protected resources, and effectiveness of mitigation measures. Taken together, these three elements – avoidance, minimization, and monitoring - comprise the Navy's integrated approach to addressing potential environmental impacts.

Avoidance. Avoidance of geographic areas of particular sensitivity has been integrated into the proposed action and alternatives where feasible. Mitigation measures discussed later in this chapter involve avoidance of sensitive areas. Planning for training activities takes into consideration whether and how training locations could be planned to avoid sensitive areas (*e.g.*, those known to have a high density of protected species or the presence of a protected species of particular concern). Consideration is also given to avoiding smaller scale habitats (*e.g.*, *Sargassum* rafts, a known sea turtle habitat) as they

are encountered during an activity. Those avoidance measures that require an ongoing evaluation of conditions or awareness during an activity are listed later in this chapter.

Minimization. In some cases avoiding environmentally sensitive locations altogether is not possible. In these instances, mitigation measures have been designed to minimize the potential for impact on the resources of concern. These minimization measures are also listed in this chapter.

Monitoring. A well-designed monitoring program can provide important feedback for validating assumptions made in analyses and allow for adaptive management. Since monitoring will be a requirement for compliance with the final rule issued for this proposed action under the Marine Mammal Protection Act (MMPA), details of the monitoring program will be developed in coordination with National Marine Fisheries Service (NMFS) through those regulatory processes. A description of the monitoring program framework is provided in Section 5.3.

It is important to note that discussions with resource agencies as part of consultation and permitting processes may result in changes to the mitigation as described in this document. Such changes will be reflected in the Record of Decision (ROD) as well as in documents that result from other regulatory processes (*e.g.*, Endangered Species Act [ESA] Biological Opinion).

The final suite of measures developed in the Navy's application for a MMPA Letter of Authorization (LOA) are analyzed in this Final EIS/OEIS. In addition to the NEPA process, the public had an opportunity to provide input to NMFS through the MMPA process, both during the comment period following NMFS' Notice of Receipt of the application for a MMPA LOA, and during the comment period following NMFS' publication of the proposed rule. To make the findings necessary to issue the MMPA authorization, it may be necessary for NMFS to require additional mitigation or monitoring measures beyond those addressed in the Biological Evaluation (BE) submitted to NMFS on 8 January 2009. These could include measures yet to be developed in this Final EIS/OEIS. The suite of measures developed to date as a result of those MMPA processes are included and analyzed as part of this section.

5.3 MONITORING AND REPORTING MEASURES

5.3.1 Integrated Comprehensive Monitoring Plan

The Navy is committed to demonstrating environmental stewardship while executing its National Defense mission and is responsible for compliance with a suite of federal environmental and natural resources laws and regulations that apply to the marine environment. As part of those responsibilities, an assessment of the long-term and/or population-level effects of Navy training activities, as well as the efficacy of mitigation measures, is necessary. To address this need, the Navy is developing an Integrated Comprehensive Monitoring Plan (ICMP) for marine species to assess the effects of training activities on marine species and investigate population-level trends in marine species distribution, abundance, and habitat use in various range complexes and geographic locations where Navy training occurs. Although the ICMP is intended to apply to all Navy training, use of mid-frequency active (MFA) sonar and explosives in training and research, development, testing, and evaluation (RDT&E) will comprise a major component of the overall program.

The ICMP is currently in development, with Chief of Naval Operations Environmental Readiness Division (CNO-N45) having the lead. The program does not duplicate the monitoring plans for individual areas (e.g. AFAST, Hawaii Range Complex [HRC], Southern California [SOCAL], Cherry Point [CHPT]); instead it is intended to provide the overarching coordination that will support compilation of data from both range-specific monitoring plans as well as Navy funded research and development (R&D) studies. The ICMP will coordinate the monitoring programs progress towards meeting its goals and develop a data management plan. A program review board is also being considered to provide additional guidance. The ICMP will be evaluated annually to provide a matrix for

progress and goals for the following year, and will make recommendations on adaptive management for refinement and analysis of the monitoring methods.

The primary objectives of the ICMP are to:

- Coordinate monitoring of Navy training events, particularly those involving mid-frequency active sonar (MFAS) and underwater detonations (explosives), for compliance with the terms and conditions of ESA Section 7 consultations or MMPA authorizations;
- Coordinate data collection to support estimating the number of individual marine mammals and sea turtles exposed to sound levels above current regulatory thresholds;
- Assess the efficacy of the Navy's current marine species mitigation;
- Add to the knowledge base on potential behavioral and physiological effects to marine species from mid-frequency active sonar and underwater detonations; and
- Assess the practicality and effectiveness of a number of mitigation tools and techniques (some not yet in use).

Data collection methods will be standardized across the program to the extent possible to provide the best opportunity for pooling data from multiple regions. Some methods may be universally applicable; however, some may be utilized only in specific locations where conditions are most appropriate. For example, in Hawaii, there is significant baseline data on odontocetes from tagging, which can be used to provide context for tagging data collected during training events. The Navy's overall monitoring approach will seek to leverage and build on existing research efforts whenever possible. Additional Navy-funded research and development (R&D) studies and collaborations with academia and other institutions will be integrated as appropriate to enhance the data pool, and will be used in part to address objectives of the ICMP.

The Navy will be investing significant funding and resources towards monitoring programs and intends to conduct the research in a scientifically valid and robust manner. The Navy is committed to conducting research until these questions have been addressed to the satisfaction of both NMFS and Navy. Therefore, it is in the best interest of the Navy to choose studies wisely in each range complex that are the most likely to collect large data sets, and will enable the Navy and NMFS to answer the required questions. Some field methods may be applied throughout Navy ranges, while other methodologies may be specially selected for one or two ranges that are most likely to produce the best quality data. For example, in Hawaii, there are some baseline data on odontocetes from previous tagging (Baird *et al.*, 2006), which can be used to provide a context for any tagging data collected during training events. By using a combination of monitoring techniques or tools appropriate for the species of concern, the type of training activities conducted, sea state conditions, and the appropriate spatial extent, the detection, localization, and observation of marine species can be optimized, and return on the monitoring investment can be maximized in terms of data collection and mitigation effectiveness evaluation.

The primary tools available for monitoring generally include the following:

- Visual Observations – Surface vessel and aerial survey platforms can provide data on both long term population trends (abundance and distribution) as well as occurrence immediately before, during, and after training events. In addition, visual observation has the potential to collect information related to behavioral response of marine species to Navy training activities. Both Navy personnel (lookouts) and independent visual observers (Navy biologists) will be used from a variety of platforms (both Navy and third-party) for monitoring as appropriate and when logistically feasible.

- Passive Acoustic Monitoring – Autonomous Acoustic Recorders (moored buoys), High Frequency Acoustic Recording Packages (HARPS), sonobuoys, passive acoustic towed arrays, shipboard passive sonar, and Navy Instrumented Acoustic Ranges can provide data on presence/absence as well as localization, identification, and tracking in some cases. Passive acoustic observations are particularly important for species that are difficult to detect visually or when conditions limit the effectiveness of visual monitoring. Instrumented Navy ranges present a unique opportunity to take advantage of infrastructure that would otherwise not be available for monitoring such a large area. The Marine Mammal Monitoring on Navy Ranges (M3R) program takes advantage of this opportunity and may support long-term data collection at specific fixed sites.
- Tagging is an important tool for examining the movement patterns and diving behavior of cetaceans. Sensors can be used that measure location, swim velocity, orientation, vocalizations, as well as record received sound levels. Tagging with sophisticated digital acoustic recording tags (D-tags) may also allow direct monitoring of behaviors not readily apparent to surface observers. D-tags were recently deployed as part of a behavioral response study (BRS-07) initiated at the Atlantic Undersea Test and Evaluation Center (AUTEC) range in the Bahamas to begin identifying behavioral mechanisms related to anthropogenic sound exposure.
- Photo identification and tagging of animals – Photo identification contributes to understanding of movement patterns and stock structure that is important to determine how potential effects may relate to individual stocks or populations.
- Oceanographic and environmental data collection – Physical and environmental data related to habitat parameters are necessary for analyzing distribution patterns, developing predictive habitat and density models, and better understanding habitat use.

5.3.2 Reporting

In order to issue an Incidental Take Authorization (ITA) for an activity, Section 101(a)(5)(A) of the MMPA states that NMFS must set forth ‘‘requirements pertaining to the monitoring and reporting of such taking’’. Effective reporting is critical to ensure compliance with the terms and conditions of an LOA, and to provide NMFS and the Navy with data of the highest quality based on the required monitoring. As NMFS noted in its proposed rule, additional detail has been added to the reporting requirements since they were outlined in the proposed rule. The updated reporting requirements are all included below. A subset of the information provided in the monitoring reports may be classified and not releasable to the public. NMFS will work with the Navy to develop tables that allow for efficient submission of the information required below.

General Notification of Injured or Dead Marine Mammals

Navy personnel will ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as operational security allows) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training exercise utilizing Mid-frequency Active Sonar (MFAS), High Frequency Active Sonar (HFAS), or underwater explosive detonations. The Navy will provide NMFS with species or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available).

Annual Monitoring Plan Report

Data collected from the GOMEX Range Complex monitoring plan will be added to a Navy wide analysis of monitoring from other permitted Navy range complexes via the ICMP framework. The Navy will provide an annual monitoring report to NMFS HQ in fulfillment of the MMPA Letter of

Authorization (LOA) requirements. The report will provide information on the amount and spatial/temporal distribution of monitoring effort as well as summaries of data collected and any preliminary results that may be available from analysis. All subsequent analysis shall be completed in time for Navy's five-year report to NMFS in support of the MMPA permit process. All data will be considered pre-decisional during the course of the research studies to protect from premature conclusions being drawn.

Annual Exercise Report

The Navy will submit an Annual GOMEX Exercise Report which shall contain the subsections and information indicated below.

Major Training Exercises

This section shall contain the following information for Major Training Exercises (MTE) conducted in the
GOMEX Range Complex:

(a) Exercise Information (for each MTE):

- (i) Exercise designator.
- (ii) Date that exercise began and ended.
- (iii) Location.
- (iv) Number and types of active sources used in the exercise.
- (v) Number and types of passive acoustic sources used in exercise.
- (vi) Number and types of vessels, aircraft, etc., participating in exercise.
- (vii) Total hours of observation by lookouts (watchstanders).
- (viii) Total hours of all active sonar source operation.
- (ix) Total hours of each active sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)).
- (x) Wave height (high, low, and average during exercise).

(b) Individual marine mammal sighting information (for each sighting in each MTE).

- (i) Location of sighting.
- (ii) Species (if not possible—indication of whale/dolphin/pinniped).
- (iii) Number of individuals.
- (iv) Calves observed (y/n).
- (v) Initial Detection Sensor.
- (vi) Indication of specific type of platform observation made from (including, for example, what type of surface vessel, *i.e.*, Guided Missile Frigates [FFG], Guided Missile Destroyer [DDG], or Cruiser [CG])
- (vii) Length of time observers maintained visual contact with marine mammal(s).
- (viii) Wave height (in feet).

(ix) Visibility.

(x) Sonar source in use (y/n).

(xi) Indication of whether animal is <200yd, 200–500yd, 500–1000yd, 1000–2000yd, or >2000yd from sonar source in (x) above.

(xii) Mitigation Implementation—whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was.

(xiii) If source in use (x) is hull-mounted, true bearing of animal from ship, true direction ofship's travel, and estimation of animal's motion relative to ship (opening, closing, parallel)

(xiv) Observed behavior—Lookouts (Watchstanders) shall report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming, etc.)

(c) An evaluation (based on data gathered during all of the MTEs) of the effectiveness of mitigation measures designed to avoid exposing marine mammals to mid-frequency sonar. This evaluation shall identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.

5.3.3 Adaptive Management

The regulations under which the Navy's LOAs are issued will contain an adaptive management component (NMFS, 2009). This gives NMFS the ability to consider the results of the previous years' monitoring, research, and/or the results of stranding investigations when prescribing mitigation or monitoring requirements in subsequent years. In the event that NMFS concludes that there is a high likelihood that MFAS or explosive detonations were a cause of a Uncommon Stranding Event ([USE] as defined in 50 CFR § 216.291), NMFS will review the analysis of the environmental and operational circumstances surrounding the USE. In subsequent LOAs, based on this review and through the adaptive management component of the regulations, NMFS may require mitigation and monitoring measures be modified or supplemented if the new data suggest that modifications would either have a reasonable likelihood of reducing the chance of future USEs resulting from a similar confluence of events or would increase the effectiveness of the stranding investigations. Further based on this review and the adaptive management component of the regulations, NMFS may modify or add to the existing monitoring requirements if the data suggest that the addition of a particular measure would likely fill a specifically important data or management gap.

Monitoring Workshop

The Navy, with guidance and support from NMFS, will convene a Monitoring Workshop, including marine mammal and acoustic experts as well as other interested parties, in 2011. The Monitoring Workshop participants will review the monitoring results from the previous two years of Navy-wide monitoring and provide recommendations to the Navy and NMFS on the monitoring plan(s) after also considering the current science (including Navy research and development) and working within the framework of available resources and feasibility of implementation. NMFS and the Navy would then analyze the input from the Monitoring Workshop participants and determine the best way forward from a national perspective. Subsequent to the Monitoring Workshop, modifications would be applied to monitoring plans as appropriate.

5.4 RESEARCH EFFORTS

The Navy provides a significant amount of funding and support to marine research through a variety of organizations. From FY04 to FY08, the Navy provided over $94 million to universities, research

institutions, federal laboratories, private companies, and independent researchers around the world for marine life research. During this same time period, the DoD contributed nearly $6 million for a total of $100 million in marine life research projects. These projects include basic science efforts, such as baseline surveys, and do not include monitoring surveys or environmental planning document preparation (DoN, 2008b). In FY08 alone, the Navy spent over $26 million and the DoD almost $1 million towards this effort (DoN, 2008b). Currently, the Navy has budgeted nearly $22 million and the DoD has budgeted a half a million dollars for continued marine mammal research in FY09 (DoN, 2008b). Major topics of Navy-supported research include the following:

- Better understanding of marine species distribution and important habitat areas;
- Developing methods to detect and monitor marine species before and during training;
- Understanding the effects of sound on marine mammals, sea turtles, fish, and birds; and
- Developing tools to model and estimate potential effects of sound.

This research is directly applicable to Atlantic Fleet training activities, particularly with respect to the investigations of the potential effects of underwater noise sources on marine mammals and other protected species. Proposed training activities employ sonar and underwater explosives, which introduce sound into the marine environment.

The Marine Life Sciences Division of the Office of Naval Research currently coordinates six programs that examine the marine environment and are devoted solely to studying the effects of noise and/or the implementation of technology tools that will assist the Navy in studying and tracking marine mammals. The six programs are as follows:

1. Environmental Consequences of Underwater Sound,
2. Non-Auditory Biological Effects of Sound on Marine Mammals,
3. Effects of Sound on the Marine Environment,
4. Sensors and Models for Marine Environmental Monitoring,
5. Effects of Sound on Hearing of Marine Animals, and
6. Passive Acoustic Detection, Classification, and Tracking of Marine Mammals.

The Navy has also developed the technical reports referenced within this document, which include the Marine Resource Assessments (MRA) and the Navy OPAREA Density Estimates (NODE) reports (DoN, 2007a). Furthermore, research cruises by the National Marine Fisheries Service (NMFS) and by academic institutions have received funding from the U.S. Navy. For instance, the ONR contributed financially to the Sperm Whale Seismic Survey (SWSS) in the Gulf of Mexico, coordinated by Texas A&M. The goals of the SWSS are to examine effects of the oil and gas industry on sperm whales and what mitigations would be employed to minimize adverse effects to the species. All of this research helps in understanding the marine environment and the effects that may arise from the use of underwater noise in the Gulf of Mexico and western North Atlantic Ocean.

The Navy has sponsored several workshops to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and other research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods on instrumented ranges. However, acoustic detection, identification, localization, and tracking of individual animals still requires a significant amount of research effort to be considered a reliable method for marine mammal monitoring. The Navy supports research efforts on

acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential mitigation and monitoring tool.

Recently, a workshop was held to discuss the research required to understand the impact of tactical mid-frequency sonar transmission on fish, fisheries and fisheries habitat. Workshop participants included personnel from the Navy, academic universities, and NOAA Fisheries Service, who were selected based on their expertise in acoustics, fish hearing and fisheries biology. The objective of the workshop was to describe the range of scientific concerns regarding the effects of Navy training activities using tactical mid-frequency active sonar on fish and fisheries resources and to distill these concerns into a long-term research and development plan. The priorities of the workshop included larval fish effects, hearing capabilities, small pelagic and soniferous fish behavior and potential effects to fisheries.

Overall, the Navy will continue to fund ongoing research, and is planning to coordinate long term monitoring/studies of marine mammals on various established ranges and operating areas. The Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include mitigation and monitoring programs; data sharing with NMFS and via the literature for research and development efforts; and future research as described previously.

5.5 STANDARD OPERATING PROCEDURES (GENERAL MARITIME MEASURES)

The mitigation measures presented below are performed by Navy personnel on a regular and routine basis. These are routine measures and are considered "Standard Operating Procedures."

5.5.1 Personnel Training – Lookouts

The use of shipboard lookouts is a critical component of all Navy standard operating procedures. Navy shipboard lookouts (also referred to as "watchstanders") are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the Officer of the Deck (OOD) (*e.g.*, trash, a periscope, marine mammals, sea turtles) and all disturbances (*e.g.*, surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel serving as lookouts on station at all times (day and night) when a ship or surfaced submarine is moving through the water.

All personnel serving as lookouts on Navy ships and submarines are required to complete Marine Species Awareness Training (MSAT) as part of the lookout training program. MSAT includes instruction on the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, general observation at sea, and detecting/identifying marine mammals. MSAT has been reviewed by NMFS and acknowledged as suitable training.

1. All bridge personnel, Commanding Officers, Executive Officers, officers standing watch on the bridge, maritime patrol aircraft aircrews, and Mine Warfare (MIW) helicopter crews will complete MSAT.
2. Navy lookouts will undertake extensive training to qualify as a lookout in accordance with the Lookout Training Handbook (Naval Educational Training [NAVEDTRA] 12968-D).
3. Lookout training will include on-the-job instruction under the supervision of a qualified, experienced lookout. Following successful completion of this supervised training period, lookouts will complete the Personal Qualification Standard Program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects).

4. Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure to facilitate implementation of protective measures if marine species are spotted.
5. Surface lookouts would scan the water from the ship to the horizon and be responsible for all contacts in their sector. In searching the assigned sector, the lookout would always start at the forward part of the sector and search aft (toward the back). To search and scan, the lookout would hold the binoculars steady so the horizon is in the top third of the field of vision and direct the eyes just below the horizon. The lookout would scan for approximately five seconds in as many small steps as possible across the field seen through the binoculars. They would search the entire sector in approximately five-degree steps, pausing between steps for approximately five seconds to scan the field of view. At the end of the sector search, the glasses would be lowered to allow the eyes to rest for a few seconds, and then the lookout would search back across the sector with the naked eye.
6. At night, to increase effectiveness, lookouts would not continuously sweep the horizon with their eyes. Instead, lookouts would scan the horizon in a series of movements that would allow their eyes to come to periodic rests as they scan the sector. When visually searching at night, they would look a little to one side and out of the corners of their eyes, paying attention to the things on the outer edges of their field of vision. Lookouts will also have night vision devices available for use.

5.5.2 Operating Procedures and Collision Avoidance

1. Prior to major exercises, a Letter of Instruction, Naval Message or Environmental Annex to the Operational Order will be issued to further disseminate the personnel training requirement and general marine species mitigation measures.
2. Commanding Officers will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.
3. While underway, surface vessels will have at least two lookouts with binoculars; surfaced submarines will have at least one lookout with binoculars. Lookouts already posted for safety of navigation and man-overboard precautions may be used to fill this requirement. As part of their regular duties, lookouts will watch for and report to the OOD the presence of marine mammals and sea turtles.
4. On surface vessels equipped with a mid-frequency active sonar, pedestal mounted “Big Eye” (20x110) binoculars will be properly installed and in good working order to assist in the detection of marine mammals and sea turtles in the vicinity of the vessel.
5. Personnel on lookout will employ visual search procedures employing a scanning method in accordance with the Lookout Training Handbook (NAVEDTRA 12968-D).
6. After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook (NAVEDTRA 12968-D).
7. While in transit, naval vessels will be alert at all times, use extreme caution, and proceed at a “safe speed” so that the vessel can take proper and effective action to avoid a collision with any marine animal and can be stopped within a distance appropriate to the prevailing circumstances and conditions.

8. When whales have been sighted in the area, Navy vessels will increase vigilance and take reasonable and practicable actions to avoid collisions and activities that might result in close interaction of naval assets and marine mammals. Actions may include changing speed and/or direction and are dictated by environmental and other conditions (*e.g.*, safety, weather).
9. Naval vessels will maneuver to keep at least 500-yd (460 m) away from any observed whale and avoid approaching whales head-on. This requirement does not apply if a vessel's safety is threatened, such as when change of course will create an imminent and serious threat to a person, vessel, or aircraft, and to the extent vessels are restricted in their ability to maneuver. Restricted maneuverability includes, but is not limited to, situations when vessels are engaged in dredging, submerged operations, launching and recovering aircraft or landing craft, minesweeping operations, replenishment while underway and towing operations that severely restrict a vessel's ability to deviate course. Vessels will take reasonable steps to alert other vessels in the vicinity of the whale.
10. Where feasible and consistent with mission and safety, vessels will avoid closing to within 200-yd (183 m) of sea turtles and marine mammals other than whales (whales addressed above).
11. Floating weeds, algal mats, *Sargassum* rafts, clusters of seabirds, and jellyfish are good indicators of sea turtles and marine mammals. Therefore, increased vigilance in watching for sea turtles and marine mammals will be taken where these are present.
12. Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties. Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the ship will likely result in a closing of the distance to the detected marine mammal.
13. All vessels will maintain logs and records documenting training operations should they be required for event reconstruction purposes. Logs and records will be kept for a period of 30 days following completion of a major training exercise.

5.6 MITIGATION MEASURES FOR SPECIFIC AT-SEA TRAINING EVENTS

These actions are protective measures that are currently in place and will be used as applicable to activities described under each alternative in Chapter 2 of this Final EIS/OEIS.

5.6.1 Surface-to-Surface Gunnery and Firing Exercise Using IMPASS (up to and including 5-inch non-explosive rounds)

These activities occur in training areas W-151 A/B, W-155A, Panama City OPAREA (HSG/MGA), and UNDET Area E3 of the GOMEX Range Complex. Firing Exercise Using IMPASS only occurs in W-151A/B and W-155A.

1. Lookouts will visually survey for floating weeds, algal mats, and *Sargassum* rafts which may be inhabited by immature sea turtles in the target area. Intended impact will not be within 200 yards (182 m) of known or observed floating weeds, algal mats, *Sargassum* rafts, or coral reefs.
2. If applicable, target towing vessels will maintain a lookout. If a marine mammal or sea turtle is sighted in the vicinity of the exercise, the tow vessel will immediately notify the firing vessel in order to secure gunnery firing until the area is clear.

3. A 200-yard (182 m) radius buffer zone will be established around the intended target.
4. From the intended firing position, trained lookouts will survey the buffer zone for marine mammals and sea turtles prior to commencement and during the exercise as long as practicable. Due to the distance between the firing position and the buffer zone, lookouts are only expected to visually detect breaching whales, whale blows, and large pods of dolphins and porpoises.
5. The exercise will be conducted only when the buffer zone is visible and marine mammals and sea turtles are not detected within the target area and the buffer zone.

5.6.2 Small Arms Training – (such as 7.62 mm and .50 cal)

1. Lookouts will visually survey for floating weeds, algal mats, *Sargassum* rafts, marine mammals, and sea turtles. Weapons would not be fired in the direction of known or observed floating weeds, algal mats, *Sargassum* rafts, marine mammals, sea turtles, or coral reefs.

5.6.3 Small Arms Training – Explosive Hand Grenades (such as MK3A2 grenades)

1. Lookouts visually survey for floating weeds, algal mats, *Sargassum* rafts, marine mammals, and sea turtles.
2. A 200-yard radius buffer zone will be established around the intended target. The exercises will be conducted only if the buffer is clear of sighted marine mammals and sea turtles.

5.6.4 Air-to-Surface At-Sea Bombing Exercises (500-lb to 2,000-lb explosive bombs)

This activity occurs in W-155A/B (hot box) area of the GOMEX Study Area. The location was established to be within 150 nm from shore-based facilities (the established flight distance restriction for F-A18 jets during unit level training events).

1. Aircraft will visually survey the target and buffer zone for marine mammals and sea turtles prior to and during the exercise. The pre-exercise survey of the impact area would be made by flying at 1,500 feet altitude or lower, if safe to do so, and at the slowest safe speed. Release of ordnance through cloud cover is prohibited; aircraft must be able to actually see ordnance impact areas. Survey aircraft should employ most effective search tactics and capabilities.
2. A buffer zone of a 5,100-yard (4,663 m) radius would be established around the intended target zone. The exercises would be conducted only if the buffer zone is clear of sighted marine mammals and sea turtles.
3. If surface vessels are involved, lookouts would survey for *Sargassum* rafts, which may be inhabited by immature sea turtles. Ordnance would not be targeted to impact within 5,100 yards (4,663 m) of known or observed *Sargassum* rafts or coral reefs.
4. At-sea BOMBEXs using explosive ordnance will occur during daylight hours only.

5.6.5 Air-to-Surface At-Sea Bombing Exercises (non-explosive munitions)

1. If surface vessels are involved, trained lookouts would survey for *Sargassum* rafts, which may be inhabited by immature sea turtles, and for sea turtles and marine mammals. Ordnance would not be targeted to impact within 1,000 yards (914 m) of known or observed *Sargassum* Rafts, sea turtles, marine mammals, or coral reefs.
2. A 1,000-yard (914 m) radius buffer zone would be established around the intended target.
3. Aircraft will visually survey the target and buffer zone for marine mammals and sea turtles prior to and during the exercise. The pre-exercise survey of the impact area would be made by flying at 1,500 feet or lower, if safe to do so, and at the slowest safe speed. Release of ordnance

through cloud cover is prohibited; aircraft must be able to actually see ordnance impact areas. Survey aircraft should employ most effective search tactics and capabilities.

4. The exercise will be conducted only if marine mammals and sea turtles are not visible within the buffer zone.

5.6.6 Mine Neutralization Training Involving Underwater Detonations (up to and including 20-lbs NEW charges)

Mine neutralization involving underwater detonations occurs in shallow water (0-120 feet or 0-36 m) and is executed by divers using scuba. Historically this activity has occurred in shallow water portions of the Corpus Christi and Panama City OPAREAs in the GOMEX Study Area. These exercises utilize small boats that deploy from shore-based facilities. Oftentimes these small boats are rigid-hulled inflatable boats (RHIB) that are designed for shallow water and have limited seaworthiness necessitating a nearshore location. The exercise is a one-day event that occurs only during daylight hours; therefore, the distance from shore is limited.

1. Observers would survey the buffer zone, a 700-yard (640 m) radius from detonation location, for marine mammals and sea turtles from all participating vessels during the entire operation. A survey of the buffer zone (minimum of three parallel tracklines 219 yards [200 m] apart) using support craft would be conducted at the detonation location 30 minutes prior through 30 minutes post detonation. During late July through October, an additional surface observer would be added to more carefully look for hatchling turtles in the buffer zone. Aerial survey support would be utilized whenever assets are available.
2. Detonation operations will be conducted during daylight hours.
3. If a sea turtle or marine mammal is sighted within the buffer zone, the animal would be allowed to leave of its own volition. The Navy will suspend detonation exercises and ensure the area is clear for a full 30 minutes prior to detonation.
4. Divers placing the charges on mines and dive support vessel personnel would survey the area for sea turtles and marine mammals and report any sightings to the surface observers. These animals would be allowed to leave of their own volition and the buffer zone will be clear for 30 minutes prior to detonation.
5. No detonations will take place within 3.2 nm of an estuarine inlet (*e.g.*, Aransas or Corpus Christi Bay).
6. No detonations will take place within 1.6 nm of shoreline.
7. No detonations will take place within 1,000 ft of any known artificial reef, shipwreck, or live hard-bottom community.
8. Personnel will record any protected species observations during the exercise as well as measures taken if species are detected within the buffer zone.

5.6.7 Mine Countermeasures – Minesweeping Using Equipment Towed by Helicopters (MK-103)

1. Use trained lookouts to survey for *Sargassum* rafts, sea turtles and marine mammals prior to and during the exercise.
2. Establish a 250 yard (229 m) buffer zone around the towed equipment. Exercise will not be conducted if marine mammals or sea turtles are detected within the buffer zone.

5.6.8 Anchorage of Ships

These requirements are not applicable if going to an assigned anchorage.

1. Avoid *Sargassum* rafts.
2. Ships will not anchor in the vicinity of coral reefs, except in designated anchorages or for safety of ship: vicinity is defined as the anchor swing circle encompassing a portion of a coral reef..
3. Ships will not anchor in areas of known shipwrecks.

5.6.9 Mitigation Measures Related to Acoustic Effects Beyond Those Previously Described (Taken From the AFAST FEIS)

The AFAST Record of Decision (ROD), dated 23 Jan 2009 (DoN, 2009), provides detailed discussion of mitigation measures to be employed during activities analyzed in the Final AFAST EIS/OEIS. As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST ROD, the Navy would implement various mitigation measures to maximize the ability of operators to recognize instances when marine mammals are in the vicinity. These measures include the following:

1. Training personnel in lookout/watchstander duties;
2. Stationing at least three people on watch with binoculars at all times;
3. Stationing at least two additional people on watch during ASW exercises when MFA sonar is being used;
4. Requiring all personnel engaged in passive acoustic sonar operation to monitor for marine mammal vocalizations;
5. Using all available sensor and optical systems, such as night vision goggles during MFA and HFA active sonar activities;
6. Using only passive capability of sonobuoys when marine mammals are detected within 200 yd (183 m);
7. Limiting ship or submarine active transmission levels to at least 6 dB below normal operating levels when marine mammals are detected by any means within 1,000 yd (914 m) of the sonar dome (the bow);
8. Limiting ship or submarine active transmission levels to at least 10 dB below normal operating levels when marine mammals are detected by any means within 500 yd (457 m) of the sonar dome, or ceasing ship or submarine active transmissions when a marine mammal is detected by any means within 200 yd (183 m) of the sonar dome;
9. If the need for such power-down arises, following power-down requirements as though the system is operating at 235 dB, the normal operating level (i.e., power-down would be to 229 dB);
10. Operating sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives;
11. Requiring helicopters to observe or survey the vicinity of an ASW activity for ten minutes before first deployment of active (dipping) sonar in the water; prohibiting dipping sonar within 200 yd (183 m) of a marine mammal and ceasing pinging if a marine mammal closes to within 200 yd after pinging has begun; and
12. Coordinating with the local NMFS Stranding Coordinator; and submitting a report containing a discussion of the nature of any observed effects based on both modeled results of real-time events and sightings of marine mammals.

Special Conditions Applicable for Bow-Riding Dolphins: If, after conducting an initial maneuver to avoid close quarters with dolphins, the ship concludes that dolphins are deliberately closing in on the ship to ride the vessel's bow wave, no further mitigation actions would be necessary because dolphins

are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

The Navy and NMFS worked together to identify additional practicable and effective mitigation measures to address the following three issues of concern: (1) general minimization of marine mammal impacts; (2) minimization of impacts within the southeastern North Atlantic right whales' critical habitat; and (3) the potential relationship between the operation of mid and/or high-frequency active sonar and marine mammal strandings. Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the following general goals:

- Avoidance or minimization of injury or death of marine mammals wherever possible;
- A reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of mid- or high-frequency active sonar,
- Underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal above, or by reducing harassment takes only);
- A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of mid- or high-frequency active sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal listed above or by reducing harassment takes only);
- A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of MFA or HFA sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal listed above or to reducing the severity of harassment takes only);
- A reduction in adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time; and
- For monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

NMFS and the Navy had extensive discussions regarding mitigation as part of consultation on the proposed and final rules, in which several mitigation options and their respective practicability were explored. Ultimately, NMFS and the Navy developed the following measure, applicable to the GOMEX Range Complex, which the Navy and NMFS believes supports (or contributes) to the goals mentioned above.

Planning Awareness Areas (PAAs): The Navy has designated several Planning Awareness Areas (PAAs) based on areas of high productivity that have been correlated with high concentrations of marine mammals (such as persistent oceanographic features like upwellings associated with the Gulf Stream front where it is deflected off the east coast near the Outer Banks), and areas of steep bathymetric contours that are frequented by deep diving marine mammals such as beaked whales and sperm whales. In developing the PAAs, USFF was able to consider these factors because of geographic flexibility in conducting ASW training. USFF is not tied to a specific range support structure for the majority of the training for AFAST.

Additionally, the topography and bathymetry along the East Coast and in the Gulf of Mexico is unique in that there is a wide continental shelf leading to the shelf break affording a wider range of training

opportunities. The Navy shall avoid planning major exercises in the specified PAAs where feasible. Should national security require the conduct of more than four major exercises (COMPTUEX, JTFEX, Southeast Anti-Submarine Integration Training Initiative [SEASWITI], or similar scale event) in these areas (meaning all or a portion of the exercise) per year the Navy shall provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. To the extent operationally feasible, the Navy plans to conduct no more than one of the four above-mentioned major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) per year in the Gulf of Mexico. Based on operational requirements, the exercise area for this one exercise may include the De Soto Canyon. If national security needs require more than one major exercise to be conducted in the PAAs, which includes portions of the DeSoto Canyon, the Navy would provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. The PAAs will be included in the Navy's Protective Measures Assessment Protocol (PMAP) (implemented by the Navy for use in the protection of the marine environment) for unit level situational awareness (i.e., exercises other than COMPTUEX, JTFEX, or SEASWITI). The goal of PMAP is to raise awareness in the fleet and ensure common sense and informed oversight is injected into planning processes for testing and training evolutions.

5.6.10 Mitigation Measures Related to Explosive Source Sonobuoys (AN/SSQ-110A) (Taken from the AFAST FEIS)

As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST ROD dated 23 Jan 2009 (DoN, 2009), the Navy would implement the following mitigation measures for explosive source sonobuoys (AN/SSQ-110A) as well as for the follow on Advanced Extended Echo Ranging (AEER) system:

1. Crews will conduct visual reconnaissance of the drop area prior to laying their intended sonobuoy pattern;
2. Crews will conduct a minimum of 30 minutes of visual and aural monitoring of the search area prior to commanding the first post (source/receiver sonobuoy pair) detonation;
3. If a post (source/receiver sonobuoy pair) will be deployed within 1,000 yd (914 m) of observed marine mammal activity, crews will deploy the receiver only and monitor while conducting a visual search;
4. When operationally feasible, crews will conduct continuous visual and aural monitoring of marine mammal activity, including monitoring of their aircraft sensors from first sensor placement to checking off-station and of radio frequency range of these sensors; aural detection of marine mammal cues the aircrew to increase the diligence of their visual surveillance;
5. If marine mammals are visually detected within 1,000 yd (914 m) of the explosive source sonobuoy (AN/SSQ-110A) intended for use, then that payload shall not be detonated;
6. Aircrews will ensure a 1,000 yd (914-m) safety zone, visually clear of marine mammals, is maintained;
7. Aircrews shall only leave posts with unexploded charges in the event of a sonobuoy malfunction, an aircraft system malfunction, or when an aircraft must immediately depart the area due to issues such as fuel constraints, inclement weather, and in-flight emergencies;
8. Aircrews will ensure all payloads are accounted for; and
9. Marine mammal monitoring shall continue until out of their aircraft sensor range.

5.7 COORDINATION AND REPORTING REQUIREMENTS

The Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of training activities. Additionally, the Navy will follow internal chain of command reporting procedures as promulgated through Navy instructions and orders.

5.8 MEASURES CONSIDERED BUT ELIMINATED

As described in Chapter 3, the majority of estimated exposures to marine mammals during proposed activities would not cause injury. Potential effects on marine mammals would be further reduced with the implementation of mitigation measures described above. Therefore, the Navy concludes the proposed action and mitigation measures would achieve the least practicable adverse impact on species or stocks of marine mammals. A determination of "least practicable adverse impacts" includes consideration, in consultation with NMFS, of personnel safety, practicality of implementation, and impact of the effectiveness of the military training activity. Therefore, the following additional mitigation measures were analyzed and eliminated from further consideration because:

- they would result in impacts to training effectiveness, which would ultimately degrade military readiness;
- they present personnel safety concerns; or
- they are impractical and provide no known protective benefit.

Reduction in training. The requirements for training have been developed iteratively over many years to ensure sailors achieve levels of readiness that ensure they are prepared to properly respond to the many contingencies that may occur during deployment and actual combat. These training requirements are designed to provide the experience needed to ensure sailors are properly trained and proficient for operational success. There is not extra training built into the training plan, as this would not be an efficient use of resources (*e.g.*, fuel, time). Therefore, any reduction of training would not allow sailors to achieve satisfactory levels of readiness needed to accomplish their mission.

Establish and implement a set vessel speed. Navy personnel are required to use extreme caution and operate at a slow, safe speed consistent with mission and safety. Further, during periods of North Atlantic right whale migration, ships exercise heightened lookout vigilance and adjust speeds as necessary as an added measure to avoid this critically endangered species. Ships and submarines need to be able to react to changing tactical situations during training as they would in actual combat. Placing arbitrary speed restrictions would not allow them to properly react to these situations. By training differently than what would be needed in an actual combat scenario, there would be a decrease in training effectiveness and a reduction in crew's abilities.

Restrict training to certain geographic areas, during certain seasons, and during certain conditions (*e.g.*, low visibility, nighttime). Implementation of blanket restrictions on training as mitigation measures would dramatically reduce the realism of training with potentially severe national security consequences and would afford, at best, only highly speculative benefits to marine species populations. Personnel must train under the full range of conditions that might be encountered during deployment and in combat, and be in a state of readiness that allows them to identify and respond to changing environmental conditions 24-hours per day. On-the-job training in combat is the worst possible way of training personnel and places personnel and the success of the military mission at significant risk. Nonetheless, the Navy has considered limitations during certain seasons and for specific training events in the GOMEX Range Complex, particularly Unit Level Training (ULT) events involving explosive ordnance, where feasible when such limitations would not interfere with training missions and goals, and when other related training events provide the necessary exposure of personnel to the full spectrum of environmental conditions they may encounter during deployment and combat.

Expansion of Exclusion Area Delineated for Use with Explosive Detonations. Currently, the Navy uses certain exclusion zones for different explosive types, which means that an area of a certain size around an explosive must be clear of marine mammals for a certain amount of time prior to the detonation
of that explosive. For a few of the larger charges (MK-84s), the distance to the isopleths within which NMFS expects TTS would likely occur is larger than the distance that the Navy must ensure is clear prior to the initiation of some of the exercise types that utilize those larger charges (*i.e.*, an animal could be within the distance from a source where TTS may occur, but outside of the distance that the Navy is required to 'clear' prior to detonation. NMFS considered requiring an enlarged exclusion zone for use with these larger charges.

Monitoring of Explosive Exclusion Area During Exercises. For some explosive detonations, the Navy's current mitigation requires clearance of an area prior to the initiation of an explosive exercise, but
does not require continued monitoring of the area throughout the exercise (see Section 5.7). Under this measure, NMFS considered a requirement for Navy to continue monitoring the exclusion zone throughoutthe exercise and to take appropriate mitigation measures during the exercise should a marine mammal be spotted within that zone.

Visual monitoring using third-party observers from aircraft and vessels in addition to existing Navy-trained lookouts. Under the Integrated Comprehensive Monitoring Program for Marine Mammals described in Section 5.3, third-party lookouts would be used during exercises selected for data sampling. However, using third-party lookouts for all training events conducted by the Navy to supplement Navy lookout observations and/or provide a "check" of Navy-trained lookouts, would present logistical and security problems for the Navy.

- **Security.** Security clearances would need to be obtained for a large number of observers in order to cover all training events, since the exact time and location of all Navy training events is classified as SECRET.
- **Space.** Some training events span one or more 24-hour periods, with operations that are occurring underway continuously in that timeframe; therefore, enough third-party personnel would be needed to man the observation decks or aircraft during that timeframe. There is also severe space limitations onboard ship for berthing third-party crews, and there are no additional seats on aircraft involved in exercises. Overnight berthing of contractors and visitors onboard ships is currently accomplished only after significant planning and juggling of bunks, space, and Navy crew work shifts.
- **Scheduling.** Scheduling civilian vessels and/or aircraft to coincide with all training events would impact training effectiveness since exercise event timetables cannot be precisely fixed and, instead, are based on the free-flow development of tactical situations. Waiting for civilian aircraft or vessels to complete surveys, refuel, or be on station would slow the unceasing progress of the exercise and impact the effectiveness of the training activity.
- **Safety.** Surveying during training events also raises safety concerns with multiple, slow and low-flying civilian vessels and aircraft operating in the same sea space and airspace as military vessels and aircraft engaged in combat training activities. In addition, most of the training events take place far from land, limiting both the time available for civilian aircraft to be in the exercise area and presenting a concern should aircraft mechanical problems arise.

5.9 DETECTION PROBABILITY AND MITIGATION EFFICACY

5.9.1 Factors Affecting Detection Probability

The probability of visually detecting a marine animal is dependent upon two things. First, the animal and the observer must be in the same place at the same time. If the animal is not present, it cannot be seen (availability bias) (Marsh and Sinclair, 1989a). Second, when the animal is in a position to be detected by an observer and the observer in a position to detect the animal, the observer must perceive the animal (perception bias) (Marsh and Sinclair, 1989b). The factors affecting the detection of the animal may be probabilistically quantified as *g(0)*. That is, *g(0)* represents the chance that the animal will be available for detection (i.e., on the surface and in the observer's field of view) and that the observer will perceive the animal. A *g(0)* value of 1 indicates that 100 percent of the animals are detected; it is rare that this assumption holds true, as both perception and availability bias impact the overall value of *g(0)* for any given species.

Various factors are involved in estimating *g(0)*, including: sightability/detectability of the animal (species-specific behavior and appearance, school size, blow characteristics, dive characteristics, and dive interval); viewing conditions (sea state, wind speed, wind direction, sea swell, and glare); and observer (experience, fatigue, and concentration) and platform characteristics (pitch, roll, yaw, speed, and height above water). Thomsen et al. (2005) provide a complete and recent discussion of *g(0)*, factors that affect the detectability of the animals, and ideas on how to account for detection bias. Table 5.9-1 provides a range of values for *g(0)* for cetacean species in the GOMEX Study Area. It is important to note that *g(0)* as it is used here does not relate to the ability to identify an animal on any order, only that the animal will be detected.

5.9.1.1 Marine Mammals

There are many variables that play into how easily a marine mammal may be detected by an observer at the surface [i.e., the g(*0*) value for that species]. As discussed previously, some of these variables affect (or are affected by) the observer, the platform, and the conditions under which the observations are being made. Many of the variables, however, are directly related to the animal, its external appearance, its behavior and its life history. The size of the animal, its surface behavior, its dive behavior, and the overall gregariousness of the species all impact the ability of the observer to detect an individual at the surface.

The following is a much generalized discussion of the behavior and external appearance of the marine mammals with the potential to occur in the GOMEX Range Complex as these characters relate to the detectability of each species. The species are grouped loosely based on either taxonomic relatedness or commonalities in size and behavior (or both). Not all statements may hold true for all species in a grouping and outstanding exceptions are mentioned where applicable. The information presented in this section may be found in Jefferson *et al.* (2008) and sources within unless otherwise noted.

In general, large whales are fairly easy to detect due to their large size and prominent blow (Taylor et al., 2007). Also relatively easy to detect are large groups of individuals, particularly gregarious delphinids that may be visible from a great distance due to the disturbance they make when moving across the surface of the water. Less easy to detect are marine mammals that spend a great deal of time at depth or whose presence on the surface is solitary and inconspicuous (Taylor et al., 2007).

Large Whales

Species of large whales commonly found in the study area include the Bryde's whale and the sperm whale. Bryde's whales are generally large (adults can be up to 15.5 m) , often making them immediately detectable. However, Bryde's whales often have no visible blow and rarely fluke. Bryde's whales tend

to travel singly or in small groups ranging from pairs to groups of ten; Dive behavior varies, but Bryde's whales may dive as long as 20 min. Bryde's whales have *g(0)* values ranging from 0.90 to 1.00 (Table 5.9-1).

Sperm whales also belong to the large whales, with adult males reaching as much as 18 m (50 ft) in total length. Sperm whales at the surface would likely be easy to detect. They are large, have a prominent, 5 m (16 ft) blow, and may remain at the surface for long periods of time. They are known to raft (i.e., loll at the surface) and to form SAGs when socializing. Sperm whales may travel or congregate in large groups of as many as 50 individuals. They also engage in conspicuous surface behavior such as fluking, breaching and tail-slapping. However, sperm whales are long, deep divers and may remain submerged for over an hour. Sperm whales vocalize frequently (Teloni, 2005) and would probably be detected acoustically. Sperm whales have *g(0)* values ranging from 0.19 to 1.00 (Table 5.9-1).

Cryptic Species

Cryptic cetacean species are those that are known to be difficult to detect on the surface or that actively avoid vessels. These include beaked whales (family Ziphiidae), and dwarf and pygmy sperm whales (*Kogia* spp.).

Beaked whales are notoriously difficult to detect at sea. Beaked whales may occur in a variety of group sizes, ranging from single individuals to groups of as many as 100 (MacLeod and D'Amico, 2006). For beaked whale species occurring in the GOMEX Range Complexes, group sizes may range from 1 to 22 individuals. Beaked whale diving behavior in general consists of long, deep dives that may last for nearly 90 minutes followed by a series of shallower dives and intermittent surfacings (Tyack et al., 2006; Baird et al., 2007). However, individuals may remain at the surface for an extended period of time (perhaps an hour or more) or make shorter dives (MacLeod and D'Amico, 2006). Detection of beaked whales is further complicated because beaked whales often dive and surface in a synchronous pattern (MacLeod and D'Amcio, 2006) and they travel below the surface of the water. Beaked whales are odontocetes and use acoustic signals for communication and foraging. They are known to produce sounds ranging from low to high frequency (MacLeod and D'Amico, 2006). However, many of the sounds that have been recorded for beaked whales fall at or outside the upper range of human hearing (greater than 20 kHz), making acoustic detection less likely for these species than for species with a lower peak frequency. Beaked whales have *g(0)* values ranging from 0.13 to 1.00 (Table 5.9-1).

Dwarf and pygmy sperm whales (referred to broadly as *Kogia* spp.) are small cetaceans (3 to 4 m [10 to 13 ft] adult length) that are not seen commonly at sea. *Kogia* spp. are some of the most commonly stranded species in some areas, which suggests that sightings are not indicative of their overall abundance. This supports the idea that they are cryptic, perhaps engaging in inconspicuous surface behavior or actively avoiding vessels. When *Kogia* spp. are sighted, they are seen in groups of no more than five to six individuals. They have no visible blow, do not fluke when they dive, and are known to log (i.e., lie motionless) at the surface. When they do dive, they often will sink out of sight with no prominent behavioral display. There is little acoustic information on *Kogia* spp.; what is available suggests that *Kogia* spp. emit ultrasonic clicks with a peak frequency of 125 kHz (Marten, 2000), well outside of what is audible to the human ear. *Kogia* spp. are not likely to be detected acoustically. *Kogia* spp. have *g(0)* values ranging from 0.19 to 0.79 (Table 5.9-1).

Delphinids

There are 14 species of the family Delphinidae that may occur in the GOMEX Range Complexes. There are a variety of factors that make these species some of the most likely to be detected at sea by observers. Many species of delphinids engage in very conspicuous surface behavior, including leaping, spinning, bow riding, and traveling along the surface in large groups. Delphinid group sizes may range

from 10 to 10,000 individuals, depending upon the species and the geographic region. Species such as pilot whales, rough-toothed dolphins, bottlenose dolphins, Stenellid dolphins, and Fraser's dolphins are known to either actively approach and investigate vessels, or bow ride along moving vessels. Fraser's dolphins form huge groups that travel quickly along the surface, churning up the water and making them visible from a great distance. Delphinids may dive for as little as a minute to over thirty minutes, depending upon the species. Some species of delphinids are very vocal and may be easily detected acoustically if they are foraging or socializing. There are records of some species of Delphinids (spinner dolphins and pantropical spotted dolphins) actively avoiding vessels in the Eastern Tropical Pacific (ETP). This behavior is probably a response to the high levels of mortality associated with tuna fisheries in the ETP and has not been noted elsewhere in the world. Delphinids have *g(0)* values ranging from 0.19 to 1.00, with many species having much higher values.

TABLE 5.9-1
RANGE OF ESTIMATES FOR G(0) FOR
MARINE MAMMAL SPECIES FOUND IN THE GULF OF MEXICO

g(0)[1]	Location	Platform	Source
Threatened/Endangered Cetacean Species			
Sperm whale (*Physeter macrocephalus*)			
0.28-0.57	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.53-1.00	U.S. West Coast	Shipboard	(Barlow, 1995; Barlow and Gerrodette, 1996; Barlow and Sexton, 1996; Barlow, 2003a; Barlow and Taylor, 2005)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney *et al*., 1995)
0.87	Hawaii	Shipboard	(Barlow, 2003b, 2006)
0.32	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
Non-Threatened/Non-Endangered Cetacean Species			
Bryde's whale (*Balaenoptera edeni*)			
0.90-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.90	Hawaii	Shipboard	(Barlow, 2003b, 2006)
***Kogia* spp.**			
0.29-0.55	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.19-0.79	U.S. West Coast	Shipboard	(Barlow, 1995; Barlow and Sexton, 1996; Barlow, 1999, 2003a)
0.35	Hawaii	Shipboard	(Barlow, 2003b, 2006)

TABLE 5.9-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR
MARINE MAMMAL SPECIES FOUND IN THE GULF OF MEXICO

g(0)[1]	Location	Platform	Source
Ziphiidae (Beaked Whales)			
0.46-0.51	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka 2006)
0.19-0.21	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.13-1.00	U.S. West Coast	Shipboard	(Barlow, 1995; Barlow and Sexton, 1996; Barlow, 1999; Carretta *et al*., 2001; Barlow, 2003a; Barlow, *et al*. 2006)
0.23-0.45	Hawaii	Shipboard	(Barlow, 2003b, 2006)[2]
0.27	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney *et al*., 1995)
Bottlenose dolphin (*Tursiops truncatus*)			
0.62-0.99	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.67-0.96	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney *et al*., 1995)
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Spinner dolphin (*Stenella longirostris*)			
0.61-0.76	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.77-1.0	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.77-1.0	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Clymene dolphin (*Stenella clymene*)			
None available.			
Pantropical spotted dolphin (*Stenella attenuate*)			
0.37-0.94	U.S. Atlantic Coast	Shipboard	(Palka, 2006)[2]
0.77-1.00	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Atlantic spotted dolphin (*Stenella frontalis*			
0.37-0.94	U.S. Atlantic Coast	Shipboard	(Palka, 2006)[2]
Striped dolphin (*Stenella coeruleoalba*)			
0.61-0.77	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)
0.77-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Rough-toothed dolphin (*Steno bredanensis*)			
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 2003a)

TABLE 5.9-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR
MARINE MAMMAL SPECIES FOUND IN THE GULF OF MEXICO

g(0)[1]	Location	Platform	Source
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Fraser's dolphin (*Lagenodelphis hosei*)			
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Risso's dolphin (*Grampus griseus*)			
0.51-0.84	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.67-0.96	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney *et al*., 1995)
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
False killer whale (*Pseudorca crassidens*)			
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Pygmy killer whale (*Feresa attenuata*)			
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Killer whale (*Orcinus orca*)			
0.90	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.95-0.98	U.S. West Coast	Aerial	(Forney *et al*., 1995)
0.90	Hawaii	Shipboard	(Barlow, 2003b, 2006)
0.96	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
Melon-headed whale (*Peponocephala electra*)			
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Pilot whale (*Globicephala* spp.)			
0.48-0.67	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka 2006)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
0.93	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)

[1] *A g(0) value of 1.00 indicates that 100 percent of the animals are detected; it is rare that this assumption holds true. Departures of g(0) from 1.00 can be attributed to either perception bias or availability bias.*

[2] *These numbers were either determined by the source or applied by the source for abundance/density estimation analyses in the particular geographic location.*

5.9.1.2 Sea Turtles

The detection probability of sea turtles is generally lower than that of cetaceans. Sea turtles often spend over 90 percent of their time underwater (e.g., Byles, 1988; Renaud and Carpenter, 1994; Mansfield and Musick, 2003) and are not visible more than one or two meters below the surface (Mansfield and Musick, 2006). Shoop and Kenney (1992) postulated that, due to the dive behavior of sea turtles, marine surveys underestimate the total number of animals in a given area by as much as an order of magnitude. This suggests that standard visual observation efforts may be less effective in detecting sea turtles than

they are in detecting cetaceans. Sea turtles also are much smaller than cetaceans, so the effective distance from which they can be seen (from both surface and aerial platforms) is smaller (300 m [984 ft] for turtles versus over a kilometer for large whales or gregarious delphinids; Musick *et al.*, 1984). Shipboard surveys designed for sighting marine mammals are adequate for detecting large sea turtles (e.g., adult leatherbacks) but usually not the smaller-sized turtles (e.g., juveniles, *Lepidochelys* spp.). Pelagic juveniles may be especially difficult to detect. Aerial detection may be more effective in spotting sea turtles on the surface, particularly in calm seas and clear water, but it is possible that the smallest age classes are not detected even in good conditions (Marsh and Saalfeld, 1989). Visual detection of sea turtles, especially small turtles, is further complicated by their startle behavior in the presence of ships. Turtles on the surface may react to the presence of a vessel (dive) before it is detected by shipboard or aerial observers (Kenney, 2005). However, sea turtle reaction time is reduced in proportion to increasing vessel speeds (Hazel *et al.*, 2007).

There have been few dedicated surveys for sea turtles. There is no information available on specific *g(0)* values for turtles. Most of these studies have used mathematical models to calculate the proportion of surfaced turtles to submerged turtles based on the proportion of time sea turtles are expected to spend at the surface (obtained from tracking or tagging data). Byles (1988) found that for every loggerhead observed on the surface in Chesapeake Bay, approximately 19 were present but unobservable. Mansfield and Musick (2006) found that sea turtles spent more time at the surface during the spring than during the summer within the Chesapeake Bay. Therefore, the 1:19 (at surface/ under the surface) ratio would change depending on the season. However, sea turtles only spend a portion of the year in Chesapeake Bay and their surfacing behavior may be different than that of year-round residents in other locations. Not only are there no specific estimates of *g(0)* for turtles, but it is likely that the value shifts significantly depending on species, age class, season and geographic region.

Visual mitigation efforts for sea turtles will probably detect only those individuals that are very large or that spend a significant portion of their time at the surface. Sea turtles will not be detected acoustically.

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CHAPTER 6 CUMULATIVE IMPACTS

6.1 APPROACH

The approach taken in the analysis of cumulative impacts follows the objectives of NEPA, the Council on Environmental Quality (CEQ) regulations, and CEQ guidance. CEQ regulations (40 Code of Federal Regulations [CFR] §§ 1500-1508) provide the implementing procedures for NEPA. The regulations define cumulative impacts as:

> "'Cumulative impact' is the impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7)."
>
> "To determine the scope of environmental impact statements, agencies shall consider …[c]umulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement."

In addition, the CEQ has published guidance addressing implementation of cumulative impact analysis under NEPA. The CEQ guidance publication entitled *Considering Cumulative Impacts Under the National Environmental Policy Act, January 1997* states that the analyses should:

> "…determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative impacts of other past, present, and future actions… identify significant cumulative impacts…[and]…focus on truly meaningful impacts."

Based on the guidance provided within that CEQ publication, the Navy has determined the following types of potential cumulative impacts need to be analyzed:

- "additive" (the total loss of a resource from more than one incident),
- "countervailing" (adverse impacts that are compensated for by beneficial effects), and
- "synergistic" (when the total effect is greater than the sum of the effects taken independently).

However, the analysis of cumulative impacts may go beyond the scope of project-specific direct and indirect impacts to include expanded geographic and time boundaries and a focus on broad resource sustainability. The true geographic range of an action's effect may not be limited to an arbitrary political or administrative boundary. Similarly, the impacts of an action may continue beyond the time the action ceases. This "big picture" approach is becoming increasingly important as growing evidence suggests that the most significant impacts result not from the direct impacts of a particular action, but from the combination of individual, often minor, impacts of multiple actions over time. The underlying issue is whether or not a resource can adequately recover from the impact of an action before the environment is exposed to a subsequent action or actions.

The proposed action is to achieve and maintain Fleet readiness using the GOMEX Range Complex to support and conduct current, emerging, and future training and Research, Development, Testing, and Evaluation (RDT&E) activities. This complex consists of targets and instrumented areas, airspace, and surface and subsurface operating areas (OPAREAs). The activities analyzed in this document include current, emerging, and future proposed Navy training and RDT&E events within Navy-controlled OPAREAs, airspace, and ranges, and Navy-funded range capabilities enhancements (including infrastructure improvements).

The proposed action will not make radical changes to the GOMEX Range Complex facilities, events, training, or RDT&E capacities. Rather, the actions proposed in the No Action Alternative, Alternative 1, and Alternative 2 are incremental increases that would result in relatively small-scale, but critical, enhancements that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission.

6.1.1 Assumptions Used in the Analysis

The cumulative impacts analysis in this chapter differs from the analysis conducted for the alternatives detailed in Chapter 3 because the cumulative impacts analysis considers an expanded geographic area and extended timeframe. Therefore, the cumulative impacts analysis includes additional impacts on the physical, biological, and human environments associated with GOMEX Range Complex activities.

In accordance with NEPA, the cumulative impacts analysis takes into consideration combined impacts of past, present, and reasonably foreseeable future activities. Therefore, the baseline utilized in the alternatives analysis presented in Chapter 3 of this Final EIS/OEIS could not be used in the cumulative impacts analysis. The baseline associated with the cumulative impact analysis had to take into account the effects of both past and present activities. In accordance with NEPA, the cumulative impacts analysis must take into consideration the incremental contribution of the proposed action to the existing baseline. However, as activities increase within the Study Area, the baseline will change. Thus, the baseline for the cumulative impacts analysis must include past, present, and reasonably foreseeable future activities.

The incremental contribution of the proposed action in each area is relatively small and would most likely continue to reduce in size as non-military activities increase within the Study Area. Overall, it is more difficult to analyze cumulative impacts versus project-specific impacts. The Navy recognizes the need to identify and quantify the factors causing environmental change and threshold triggers associated with the environmental response.

6.1.2 Summary and Significance of Past Cetacean Stranding Events Related to Military Use of Sonar

Cetaceans face challenges from a multitude of man-made sources (Geraci *et al.*, 1999, NMFS 2007a), including intentional hunting, fishing gear entanglement, ship strikes (Laist *et al.*, 2001), ensonification, pollution, habitat modification, gunshots, and toxic algal blooms. During the past 11 years, Navy sonar has been linked to only 5 stranding events, with a total of 51 stranded animals and 38 mortalities. The 38 mortalities equate to an average of approximately 3 cetacean mortalities per year over the past 11 years.

The majority of these five strandings are unique from other strandings because the stranding of whales occurred over a short period of time, stranded individuals were spatially co-located, traumas in stranded animals were consistent between events, and active sonar was known or suspected to be in use. Moreover, in several of these strandings, activities involved multiple ships operating in the same area over extended periods of time in close proximity. Furthermore, operations occurred across a relatively short horizontal distance, in areas surrounded by landmasses, and of at least 3,281 feet (ft) (1,000 meters [m]) in depth near a shoreline with a rapid change in bathymetry. In these cases, unique conditions may have existed in the active sonar activity area that, in their aggregate, may have contributed to the marine mammal strandings. However, these conditions are not present in the majority of other documented marine mammal strandings, and current science suggests that multiple factors, both natural and man-made, may be acting alone or in combination to cause marine mammals to strand.

Overall, the number of deaths during stranding events associated with mid-frequency active sonar exposure is small in comparison to the number of marine mammals killed annually through fishing by-

catch and whaling operations. For example, a 2006 report by scientists from Duke University and the University of St. Andrews estimated that approximately 3,030 cetaceans die annually in U.S. waters as a result of by-catch (Read *et al*., 2006). When extrapolated to consider global impacts, the number increases to 308,000 deaths annually. In addition to by-catch, some countries still engage in whaling operations, whether for research or for commercial purposes. Such operations led to the death of approximately 560 cetaceans annually from 1986 through 2007 (International Whaling Commission, 2008). Thus, the overall contribution of cetaceans' stranding resulting in death associated with exposure to naval mid-frequency sonar is relatively small when compared to all the other non-military activity related to marine mammal stranding and effects, as shown in Figure 6.1-1.

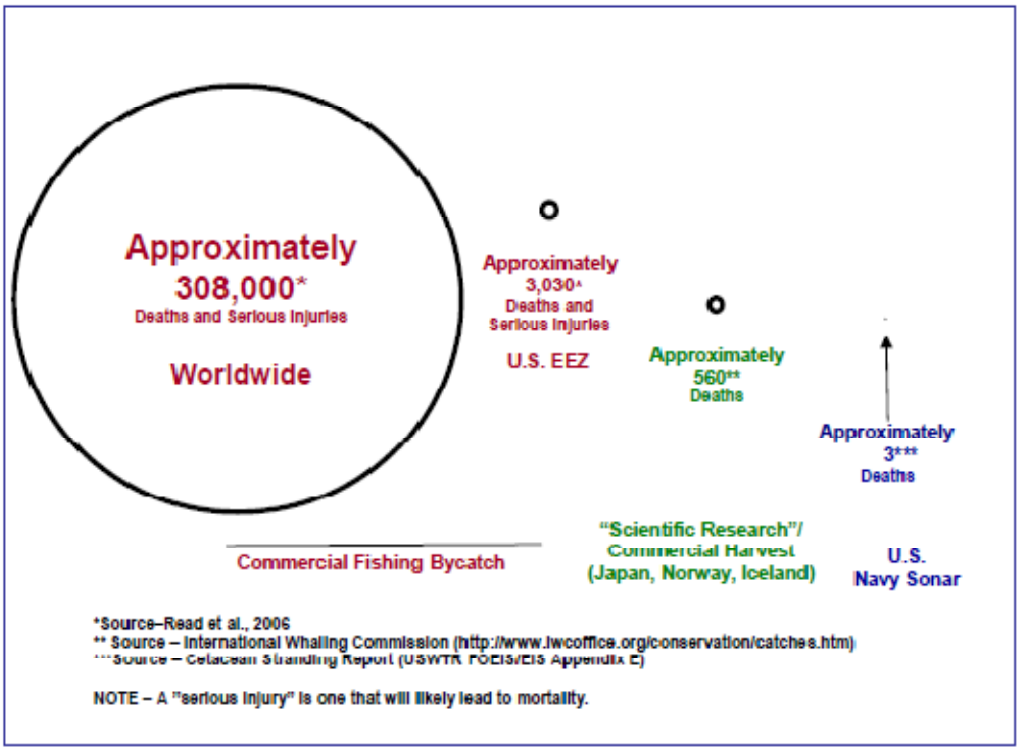

Figure 6.1-1 Annual Comparison of Cetacean Death by Activity

The Navy has made the protection of marine mammals a top priority and in conjunction with the National Oceanic and Atmospheric Administration (NOAA), has developed mandatory science-based mitigation measures that allow the Navy to conduct active sonar activities with the utmost care for the ocean environment. Refer to Chapter 5, Mitigation Measures, for additional information.

6.1.3 Organization of Chapter 6

The Chapter 6 organization presents past, present, and reasonably foreseeable future actions and their potential impacts. Chapter 6 is organized to help the reader understand how the data are presented. Past and present actions are presented in Section 6.2. Actions for civilian commercial and recreational activities are presented in Section 6.2.1; federal and state activities (other than military) are in Section 6.2.2; and military activities are presented in Section 6.2.3. Reasonably foreseeable future actions are presented in Section 6.3. That section is further divided into military operations (Section 6.3.1) and other federal and state agency actions (Section 6.3.2). Section 6.4 is a discussion of

cumulative impacts relative to the proposed action. Finally, Section 6.5 is a summary of cumulative impacts by resource area.

6.2 PAST AND PRESENT ACTIONS

Various types of past and present actions not related to the proposed action have the potential to impact the resources identified in Chapter 3. Section 6.2 is an overview of those actions and emphasizes components of the activities relevant to the impacts analysis in Chapter 3. Geographic distribution, intensity, duration, and the historical impacts of similar activities are considered when determining whether a particular activity may contribute cumulatively and significantly to the effect identified in Chapter 3. The past and present actions discussed in this section are based upon the best available data that are available to the public as of September 1, 2009.

6.2.1 Commercial and Recreational Activities

The fishing industry affects resources, including marine mammals and sea turtles. The mean annual mortality of Western North Atlantic marine mammals as a result of by-catch is estimated at 2,615 (*i.e.*, 702 cetaceans and 1,913 pinnipeds) (Waring *et al.*, 2008). Adverse effects to protected marine species are possible due to gillnet, longline, trawl gear, and pot fisheries. Additionally, commercial fisheries may incidentally entangle and drown or injure cetaceans by lost and expended fishing gear (*e.g.*, Northridge and Hofman, 1999). For example, entanglement in fixed fishing gear, in particular in sink gillnets and a variety of pot and trap fisheries, is one of the most important factors depressing the growth rate of the North Atlantic right whale population (Kenney, 2002). Additionally, fisheries may indirectly compete with cetaceans by reducing the amount of primary food source accessible to cetaceans, thereby negatively affecting their numbers (Trites *et al.*, 1997). Southeastern shrimp trawl and summer flounder/scup/black sea bass fisheries are considered to be most likely to adversely affect sea turtles; however, shrimp trawling has the greatest effect. However, the use of "turtle-excluder devices" (TEDs) in the shrimp fishery was estimated to reduce sea turtle bycatch by approximately 97 percent (NOAA, 2004). As an example of the success of TEDs, in South Carolina waters, mortality was reduced by approximately 44 percent in the law's first four years (Gibbons, 2008).

Fisheries are classified first, according to the total effect of all fisheries on each marine mammal stock and second, by addressing the effect of individual fisheries on each stock. This classification method includes consideration of the rate, in numbers of animals per year, of incidental mortalities and serious injuries of marine mammals due to commercial fishing operations relative to the potential biological removal (PBR) level for each stock. The PBR level is the maximum number of animals, not including natural mortalities, which may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (NMFS, 2007b). Category I fisheries are the most detrimental to marine mammals and are defined as having an annual mortality and serious injury of a stock in a given fishery of greater than or equal to 50 percent of the PBR level (NMFS, 2007b). Table 6.2-1 shows the Category I commercial fisheries in the Atlantic Ocean and Gulf of Mexico and the marine mammal species affected.

TABLE 6.2-1
CATEGORY I COMMERCIAL FISHERIES IN THE ATLANTIC OCEAN AND GULF OF MEXICO

Fishery Description	Estimated Number of Vessels/ Persons	Marine Mammal Species Incidentally Killed/Injured		
Gillnet Fisheries	>1,011	Fin whale Humpback whale Long-finned pilot whale Minke whale Atlantic Ocean right whale Short-finned pilot whale	Bottlenose dolphin Common dolphin Harbor porpoise Risso's dolphin White-sided dolphin	Gray seal Harbor seal Harp seal Hooded seal
Longline Fisheries	94*	Cuvier's beaked whale Long-finned pilot whale Mesoplodon beaked whale Northern bottlenose whale Pygmy sperm whale Short-finned pilot whale	Atlantic spotted dolphin Bottlenose dolphin Common dolphin Pantropical spotted dolphin Risso's dolphin	----
Trap/Pot Fisheries	13,000	Fin whale Humpback whale Minke whale Atlantic Ocean right whale	----	Harbor seal

NMFS, 2007b

**Some Caribbean fisheries are included in this number*

Along the Atlantic and Gulf Coast, almost 2.8 billion pounds of fish were commercially caught with a value of over $2.1 billion (NMFS, 2007c). In addition, over 12 million Americans participate in saltwater recreational fishing along the Atlantic and Gulf Coast (NMFS, 2007c). In the past ten years, the number of participants has increased 54 percent and the number of recreational fishing trips has increased to 82 million trips (NMFS, 2007c). Nationwide, recreational saltwater recreational fishing generated over $30 billion in sales in 2000 and supported about 350,000 jobs (Steinbeck *et al.*, 2004).

Temporary, Emergency Action, Gulf Reef Fish Longline Restriction

Effective May 18, 2009 through October 28, 2009 an emergency rule has been implemented for area closures applicable to the bottom longline component of the reef fish fishery in the exclusive economic zone of the Gulf of Mexico as requested by the Gulf of Mexico Fishery Management Council to reduce incidental take and mortality of sea turtles. A Federal Register notice was published on May 1, 2009 asking for comments on the proposed rule. The emergency rule may be extended for up to an additional 186 days. The Gulf of Mexico Fishery Management Council is preparing an FMP amendment to address this issue on a permanent basis which, if approved, would be implemented through notice and comment rulemaking (Federal Register, 2009g).

6.2.1.1 Commercial and Recreational Fisheries – Western Gulf of Mexico

In 2006, commercial fishing in the western Gulf of Mexico (i.e., Texas) brought in 117 million pounds of fish valued at $197 million (NMFS, 2007d). Examples of fish caught include snapper, menhaden,

tuna, crab, oyster, and shrimp (NMFS, 2007e). Between 2000 and 2001, recreational anglers in Texas caught 2.5 million fish in the Gulf of Mexico.

6.2.1.2 Commercial and Recreational Fisheries – Eastern Gulf of Mexico

In 2006, commercial fishing in the eastern Gulf of Mexico brought in 1.2 billion pounds of fish valued at $493 million (NMFS, 2007d). Examples of fish caught include snapper, grouper, mullet, crab, oyster, shrimp, and lobster were the species caught that brought in the most money. In 2006, recreational anglers brought in about 73 million pounds of fish (NMFS, 2007d).

6.2.1.3 Cruise Ship/Passenger Ship Operations

In the Gulf of Mexico, Galveston and Houston, Texas are the primary ports of embarkation for cruises to the western Caribbean. Texas ports have been amongst the fast growing ports in the United States until a nearly 18 percent decline in 2006 (Cruise Lines International Association, 2008). In addition to bringing the obvious economic benefits to the region, the cruise industry also adds volume to ocean traffic and contributes noise to the ocean. They also contribute to the loading of debris in the ocean environment. Several laws govern the disposal of solid waste from cruise ships including International Convention for the Prevention of Pollution from Ships and Act to Prevent Pollution from Ships (prohibits the at-sea disposal of plastic waste), Marine Plastic Pollution Research and Control Act of 1987 (prohibits discharging garbage within three nautical miles (nm) of shore, certain types of garbage between 3-25 nm offshore, and discharging plastic anywhere), and the Clean Water Act (CWA) (prohibits discharging pollutants from a point source into waters of the U.S.) to name a few.

6.2.1.4 Marine Ecotourism (Whale-Watching and Dolphin-Watching)

Over 20 different species of whales and dolphins live in the Gulf of Mexico. Historic whaling accounts of hunting sperm whales in the Gulf of Mexico date to the 1800s and today a resident population remains in the Gulf year-around (Lang, 2009). Fifteen groups of killer whales have been sighted in the Gulf since deep-water surveys began in 1992 and estimates of the numbers of whales in the Gulf have varied widely from 49 to 227, with the actual number possible to be 500 living in the Gulf north of a line extending from Key West, Florida to Brownsville, Texas (texaslesstraveled.com, 2009). Effects of whale-watching on cetaceans may be measured in a short time-scale (*i.e.*, startle reaction) or as a long-term effect on reproduction or survivability (International Fund for Animal Welfare [IFAW], 1995). There is little evidence to show that short-term effects have any relation to possible long-term effects on cetacean individuals, groups, or populations (IFAW, 1995). Whale-watching could have an effect on whales by distracting them, displacing them from rich food patches, or by dispersing food patches with wake or propeller wash.

6.2.1.5 Gulf Oil Spill of 2010

The April 20, 2010, explosion and fire on the Mobile Offshore Drilling Unit Deepwater Horizon MC252, approximately 50 miles southeast of the Mississippi Delta, killed 11 people and led to the British Petroleum (BP) oil spill, the largest in U.S. history and potentially the second-largest in world history (NMFS, 2010). Approximately 184 million gallons of oil leaked into the Gulf of Mexico over the course of 87 days before it was successfully capped on July 15, 2010 (Restore the Gulf, 2010a). The casing and annulus of the MC252 were sealed by cement on September 17, 2010. As of September 19, 2010, BP was making plans to abandon the MC252 well and plug and abandon the relief wells (BP, 2010a). The spill has impacted Gulf Coast coastlines, fisheries, and ecosystems, and is expected to continue to affect the region for years.

British Petroleum is responsible for the clean-up and has hired response teams to support their efforts. Oil has been diluted and dispersed using chemical dispersants, which introduce unknown environmental

effects (Renner, 2010). Oil has also been removed by burning, filtering off-shore, and collecting for later processing, which may also have continued environmental implications. Much of the escaped oil is located within the water column or is in the benthos in the offshore areas surrounding the spill, making it difficult to clean up or remove. Natural attenuation, via existing oil-eating microbes may be what ultimately removes the oil from the environment.

Wildlife and ecosystems are threatened primarily due to factors such as petroleum toxicity and oxygen depletion in the water. More than 400 species that live in the Gulf and associated islands, marshlands, and beaches are at risk, including listed sea turtles, fish, birds, and marine mammals. As of October 17, 2010 approximately 100 marine mammals, 1,100 sea turtles, and 8,000 birds have been documented to be affected by the Gulf oil spill (Restore the Gulf, 2010b). Oil can directly affect wildlife through physical contact, ingestion, inhalation and absorption. In addition, oil contamination can impact habitats and food resources, which may result in longer lasting effects. Sea turtles in particular may be susceptible to the nearshore and coastal impacts from oil. Sea turtles may experience oiling impacts on nesting beaches when they come ashore to lay their eggs, and their eggs may be exposed during incubation potentially resulting in increased egg mortality and/or possibly developmental defects in hatchlings (USFWS, 2010). Oil on the skin and shell of a marine turtle can affect respiration, salt gland functions, digestive and immune systems, and blood chemistry (NOAA, 2003). Oil exposure can increase egg mortality and lead to developmental defects, as well as cause direct mortality in hatchlings, juveniles, and adults (NOAA, 2003). Birds are likely to be exposed to oil as they float on the surface or dive for food. The need for marine mammals to surface to breathe also may bring them into direct contact with spilled oil. Food chain impacts may affect all species through ingestion and potential reduced prey availability.

The ecosystem could require years, or even decades to recover, as demonstrated by previous spills. Oil has the potential to persist in the environment long after a spill event and has been detected in sediment 30 years after a spill (USFWS, 2010). On sandy beaches, oil can sink deep into the sediments. In tidal flats and salt marshes, oil may seep into the muddy bottoms. Effects of oil in these systems have the potential to have long-term impacts on wildlife populations.

Fishing, oil drilling, and tourism were adversely affected by the oil spill. On July 12, 2010 the National Oceanic and Atmospheric Association expanded the fishing closure in the Gulf to 84,101 square miles, or 35% of the Gulf, which was the largest fishing closure during the spill (NOAA, 2010). As of October 5, 2010, NOAA had reduced the closure to only 23,360 square miles, or 10% of the Gulf, but many fishermen and workers in the seafood packing industry are still out of work. Moratoria on oil drilling in the gulf temporarily suspended work for thousands of employees, resulting in lost wages and economic hardship. The ban was lifted October 12, 2010 (Miami Herald, 2010). The tourism industry, dependent on summer vacationers, is also experiencing declines. Lodging and restaurants in coastal towns and cities are reported lower occupancies and revenues than past summers (Associated Press, 2010). As of October 7, 2010, BP had paid out over $1.4B in loss claims to individuals and businesses and is still accepting and processing claims (BP, 2010b). Long-term socioeconomic impacts resulting from the Gulf of Mexico oil spill cannot be projected at this time. Much of the economic recovery will depend on public education about the safety/risks of Gulf harvested seafood, the future of deep water drilling in the region, and the changed perception of coastal cities by potential vacationers.

Long-term impacts of the spill are still uncertain, therefore the Navy's cumulative impact analysis is limited to best available science at this time. Although the long-term additive, synergistic, magnifying, or multiplicative effect of spilled oil and dispersants and other natural and anthropogenic stressors within the Action Area remain to be determined, consultation with the National Marine Fisheries Service pursuant to the MMPA indicates that the Navy's proposed GOMEX training exercises are not

expected to further impact the physical marine ecosystem. Further, NMFS considered the spill as one of the potential stressors on endangered or threatened individuals in the action area, and determined that while individuals are likely to experience disruptions in their normal behavioral patterns caused by Navy activities, they are not likely to be killed, injured, or experience measurable reductions in their current or expected future reproductive success as a result of that exposure. The Navy will continue to assess potential cumulative impacts associated with the Gulf oil spill in cooperation with other federal, state and local governmental agencies. To date, the Navy's focus has been on providing a variety of equipment and logistical sites to support the ongoing clean-up efforts in the Gulf.

6.2.2 Federal and State Activities (other than Military Operations)

6.2.2.1 Exploration, Extraction, and Production of Oil, Gas, and Alternative Energy on the Outer Continental Shelf

The Energy Policy Act of 2005 amended Section 8 of the Outer Continental Shelf Lands Act (43 United States Code [USC] 1337) to give the Secretary of the Interior authority to issue a lease, easement, or right-of-way on the Outer Continental Shelf (OCS). In response to this new authority, the Minerals Management Service (MMS) of the U.S. Department of the Interior (DOI) is establishing an Alternative Energy and Alternate Use Program on the OCS to approve and manage potential activities. Alternative energy uses include (but are not limited to), wind, wave, solar, underwater current, and hydrogen. This authority includes alternative uses of existing facilities for aquaculture, research, education, recreation, or support for offshore events and facilities.

A Programmatic Environmental Impact Statement (PEIS) was prepared to examine the potential environmental consequences of implementing the Alternative Energy and Alternate Use Program and will be used to establish initial measures to mitigate environmental consequences. The Record of Decision for the PEIS is dated December 2007 (MMS, 2007b).

Eight countries have wind turbines installed offshore; however, none have been built in the United States (AWEA, 2009). The Interior Department has issued leases to five companies to collect wind speed and other data to find the best sites for building wind farms on the outer continental shelf which includes the GOMEX Study Area (Greentech Media, 2009). The Long Island Power Authority and Cape Wind projects in the North Atlantic region are the only United States projects undergoing NEPA reviews. Due to environmental reviews and permitting, the Interior Department projects up to two years before construction could begin (LATimes, 2009).

The *Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf: Final Rule Environmental Assessment* and associated Finding of No Significant Impact are dated April 2009. The Environmental Assessment (EA) is supported by the *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternative Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement* (October 2007). The EA analyzes a proposed action to promulgate regulations for the Renewable Energy and Alternative Use (REAU) Program. The MMS prepared the EA to determine whether promulgation of the final rule will have a significant effect on the human environment and whether an EIS must be prepared. The FONSI is dated April 2009 and determines that based upon analyses in the EA no significant effects on the human environment have been identified that would result from promulgation of the final rule. Therefore, MMS has determined that an EIS is not required.

Structure Removal

Lessees and operators of offshore oil/gas structure legs/pilings must request approval for a structure removal. All structure removals require an environmental assessment by the MMS and if explosives are used, an Endangered Species Section 7 Consultation with NMFS is required. NMFS sends observers to

every structure removal where explosives are used. Since 1986 when the observer program started, only one sea turtle is known to have been harmed (MMS, 2009a).

6.2.2.2 Minerals Management Service Regulated Activities – Eastern Gulf of Mexico

Two lease sales in the Eastern Gulf of Mexico Planning Area were held in 2003 and 2005 for Lease Sale 189 and Sale 197, respectively (MMS, 2003). This lease sale area abuts the westernmost border of the Eastern Planning Area, and comprises 256 blocks covering more than 2,317 square miles (mi^2) in water depths of 15,200 to 9,800 ft. The northeast corner of the proposed lease sale area is located in W-155A (approximately 90 mi from the Alabama coast and 100 mi from the Florida coast). The great majority (94%) of the area is located in Eglin Water Training Areas 1 and 3. A small number of lease blocks have been drilled and/or are in gas production.

There were two prohibitions on offshore drilling in the East Gulf. A 1990 Executive Order signed by Present George H.W. Bush established a moratorium on new oil and gas leasing in the OCS. In July 2008, President George W. Bush lifted the 1990 prohibition. The second prohibition, is the 2006 Gulf of Mexico Energy Security Act of 2006 (HR 6111) which prohibits drilling in the Gulf of Mexico within 125 miles of the Florida coastline in the Eastern Planning Area and 100 miles from the Florida coastline in the Lease Area 181 of the Central Planning Area. Further it prohibited drilling in all areas east of the Military Mission Line. This prohibition is set to expire on June 30, 2022. Through the annual appropriations process, Congress has restricted such activities in approximately 85% of the OCS, including a small portion of the eastern Gulf of Mexico. In 2008, Congress did not include the leasing prohibition in legislation funding federal government agencies and programs beyond September 30, 2008, the end of the fiscal year; however, the 2006 statutory ban is still in effect; therefore, significant portions of the eastern Gulf of Mexico will not be available for leasing until 2022. These areas include mostly the areas of the eastern Gulf of Mexico directly off the coast of Florida (HOR Staff Analysis, 2009).

6.2.2.3 Minerals Management Service Regulated Activities – Central Gulf of Mexico

The MMS Central Planning Area extends into the western portion of W-155 (Pensacola OPAREA) as shown in Figure 6.2-1 (MMS, 2003). The Central Gulf of Mexico Sale 206 was held March 19, 2008 and attracted $3,677,688,245 in high bids and 1,057 bids on 513 tracts of land (MMS, 2008a). The MMS has accepted high bids valued at $3,671,052,702 and awarded 603 leases to the successful high bidders who participated in Sale 206 (MMS, 2008d). The Central Gulf Lease Sale 208 resulted in the award of 328 leases valued at $690,163,194 in high bids. Seventy companies submitted 476 bids on 348 tracts in the sale which was held in March 2009 (MMS, 2009b).

6.2.2.4 Minerals Management Service Regulated Activities – Western Gulf of Mexico

The MMS has accepted high bids valued at $483,959,404 and awarded 313 leases to bidders who participated in the Western Gulf of Mexico Oil and Gas Lease Sale 207. Fifty-three companies submitted 423 bids on 319 tracks in the Western Gulf of Mexico Lease Sale 207 on August 20, 2008 (MMS, 2009c). The blocks of the sale are from 9 to 250 mi offshore and are anticipated to result in the production of 242 to 423 million barrels of oil and 1.64 to 2.64 trillion cubic ft of natural gas (MMS, 2008a).

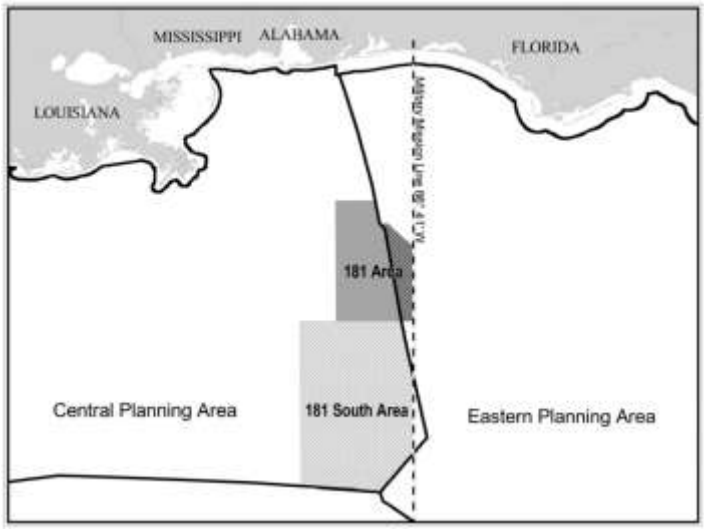

Figure 6.2-1 Central and Eastern Gulf of Mexico Planning Area
Source: DoN, 2008a

Western Gulf Lease Sale 200 was held in August 2006. Mustang Island Area Blocks 793, 799, and 816 (off the southeastern coast of Texas) were included in this lease sale. These three blocks have been used by the Navy for equipment testing and Mine Warfare (MIW) training exercises. However, the Navy did not object to these blocks being offered for lease under the condition of no surface occupancy. The following stipulations were added to events in the naval MIW area:

(1) For below-seabed activities, the lessee agrees that no activity including, but not limited to, structures, drilling rigs, pipelines, and/or anchoring, will be located on the seabed or in the water column above within any portion of the lease. All exploration, development, and production activities or activities must take place from outside the lease by the use of directional drilling or other techniques.

(2) Prior to submission of Exploration Plans and Development Operations Coordination Documents regarding any activities on or under the seabed of these blocks, the lessee will consult with the Commander, MIW Command, to determine the compatibility of the lessee's plans with scheduled military events. The Explorations Plans and Development Operations Coordination Documents shall contain a statement certifying the consultation and indicating whether the Commander, MIW Command, has any objection to activities and schedule of the Explorations Plans and Development Operations Coordination Documents (MMS, 2006).

Some activities associated with offshore exploration, development, and production could potentially contribute to the cumulative effects to the air, water, and biological resources analyzed in Chapter 3 (MMS, 2003). However, the majority of such activities are located in the central and western Gulf of Mexico, from Mississippi to Texas. Because of the distance between these activities, it is expected that air and water movement will disperse any pollutants to the point of insignificance (MMS, 2003). Underwater noise associated with these activities is concentrated in the central and western Gulf of Mexico as well (MMS, 2003).

The potential exists for effects to protected marine mammals and sea turtles, particularly from underwater noise associated with seismic airgun exploration and explosive rig removal (MMS, 2003). These species are quite mobile and may traverse large portions of the Gulf of Mexico during migrations or in search of prey. Therefore, they cannot be considered stationary resources that are immune to the

effects of activities occurring outside the Study Area. For example, a dolphin could potentially be exposed to harassing or injurious levels of noise during oil exploration activities in the central Gulf of Mexico and subsequently be exposed to similar noise levels due to sonar or detonations in the Study Area a short time later (MMS, 2003). NMFS suggests that one of the criteria for behavioral effects is that the same individual animal be exposed to repeated stressors.

In 2002, consultation between the MMS and NMFS resulted in implementation of mitigation measures intended to decrease effects to marine mammals (particularly sperm whales) resulting from seismic surveys. The MMS reports that since then, there have been no incidents of injury or harassment. However, the MMS obtained a permit from NMFS to "take" up to 200 bottlenose and spotted dolphins (combined) associated with oil and gas activities (NOAA, 2002).

The oil and gas pipeline network offshore of Gulf Coast states is extensive. Figure 6.2-2 shows the extent of active and proposed pipelines as of July 2008. A few pipelines encroach on the westernmost edge of W-155 (Pensacola OPAREA).

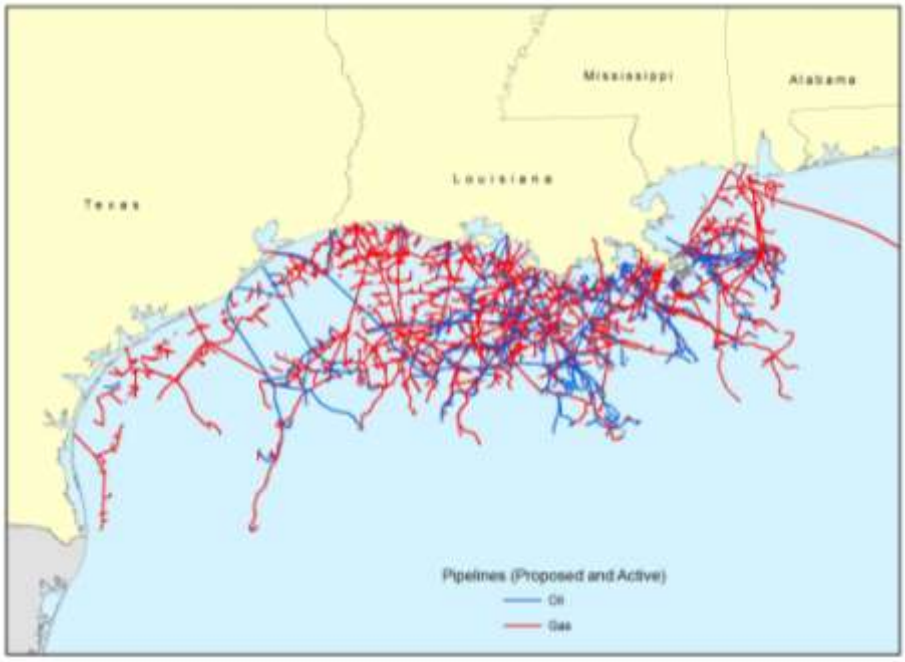

Figure 6.2-2 Active and Proposed Pipelines Regulated by the MMS

Source: MMS, 2008b

Bids for the Western Gulf of Mexico Federal Oil and Gas Lease Sale 210 were held August 19, 2009 and resulted in 189 bids from 26 companies on 162 tracts offered offshore Texas (MMS, 2009d). The sum of all bids received totaled $145,186,365. The high bid ($28,133,843 for Keathley Canyon, Block 96 submitted by BP Exploration & Production, Inc.) will go through a strict evaluation process to ensure the public receives fair market value before a lease is awarded (DOI, 2009).

6.2.2.1 State-Regulated Oil and Gas Activities

The Submerged Lands Act of 1953 gives individual states the rights to marine natural resources from the coastline to no more than 3 nm into the Atlantic Ocean and Gulf of Mexico. In Texas and the west coast of Florida, state jurisdiction extends from the coastline to no more than 3 marine leagues into the

Gulf of Mexico (MMS, 2007a). Natural resources beyond the abovementioned areas would be regulated by the MMS. Therefore, any oil or gas activities occurring within 3 nm of the coast would be state regulated.

6.2.2.1.1 Eastern Gulf of Mexico

Legislation is currently in process at the state and federal level to remove the prohibition against drilling. Oil and gas activities conducted off the coast of states other than Florida are likely to have a similar suite of effects as those conducted in federal waters, but to a much lesser degree. State activities are not expected to contribute significantly to the overall effects of oil and gas activities in the Gulf of Mexico.

6.2.2.1.2 Western Gulf of Mexico

Texas and Louisiana offer some lease sales in state waters, independent of the Federal OCS Program. Production has been in decline in recent years, while the number of wells has risen (MMS, 2003; United States Air Force [USAF], 2004a). This trend is expected to continue. The State of Mississippi began offering tax breaks to companies in 1994 based on the types of discovery and the methods used. As a result, many inactive wells were brought back into production and new wells have been drilled (USAF, 2004a). Alabama has leased a limited number of tracts in state waters. However, the last lease sale was held in 1997, and further lease sales are not expected in the near future (MMS, 2003).

6.2.2.2 Dredging Operations

The construction and maintenance of federal navigation channels are ongoing activities in the Gulf of Mexico. NMFS identified dredging operations as an activity that may cause sea turtle mortality. Hopper dredges move faster than sea turtles and can entrain (or trap) them. NMFS issued Biological Opinions (BO) with the U.S. Army Corps of Engineers (USACE) for the U.S. Atlantic coast and the Gulf of Mexico and has concluded that implementation of reasonable and prudent measures will result in no jeopardy to sea turtle species. Dredging activities also have the potential to affect the protected Gulf and shortnose sturgeons, particularly juveniles that may not be able to avoid entrainment. This potential effect has not been quantified. Dredging operations obviously affect the geology of an area, as the floor topography is altered and turbidity occurs.

6.2.2.3 Maritime Traffic – Commerce and Shipping Lanes

A large volume of ship traffic navigates the Gulf of Mexico. Traffic includes ships traveling within the Gulf to ports in the United States and Mexico as well as in and out of the Gulf through the Florida Straits and Yucatan Channel. Commercial (domestic and international) shipping comprises the vast majority of this traffic. Nine primary shipping lanes radiate north from the Yucatan Straits into the Study Area, while several major shipping lanes bisect the Florida Straits. Many large ports exist in the Gulf of Mexico area, the largest of which are Galveston, Texas; New Orleans, Louisiana; and Tampa, Florida (DoN, 2007a).

Marine transportation is expected to grow. Surface vessel traffic is a major contributor to noise in all oceans, particularly at low frequencies. The effect on marine species is unknown, but it is possible that this persistent noise may impact marine mammals' use of sound for communication and hunting.

The Gulf of Mexico is heavily traveled by marine vessels, with several commercial ports occurring near Navy OPAREAs. Three major ports within the GOMEX Range Complex, Corpus Christi, New Orleans and Pensacola, were ranked in the top 150 U.S. ports by tonnage in 2000 (RITA/BTS, 2002). Commercial shipping lanes do traverse the GOMEX Range Complex, but are controlled by the use of directional shipping lanes for large vessels (cargo, container ships, and tankers) (Figure 3.14-1). Traffic

flow controls are also implemented to ensure that harbors and ports-of-entry remain as uncongested as possible. Military and civilian use of the offshore areas is compatible because naval vessels conducting hazardous operations are confined to areas away from shipping lanes. Hazardous operations are communicated to all vessels and operators by use of NOTMARs published by the USCG. Some Navy operational activities must avoid shipping vessels transiting through the OPAREAs; because the OPAREAs are located in an exclusive economic zone (the exclusive economic zones extend 200 nm from the coastal baseline [the baseline usually follows the mean-high tide]), no disruption to commercial shipping can be imposed.

6.2.2.4 Ship Strikes

NMFS has identified commercial and recreational traffic and recreational pursuits as potentially having adverse effects on sea turtles and cetaceans through propeller and boat strike damage (USAF, 2004a). Private vessels participating in high-speed marine activities are particular threats.

Ship strikes or ship collisions with whales are a recognized source of whale mortality worldwide. The most vulnerable marine mammals are those that spend extended periods of time at the surface restoring oxygen levels within their tissues after deep dives (*e.g.*, the sperm whale). Laist *et al.* (2001) identified 11 species known to be hit by ships. Of these species, fin whales are struck most frequently; right whales, humpback whales, sperm whales, and gray whales are hit commonly. A review of recent reports on ship strikes provides some insight regarding the types of whales, locations, and vessel involved, but also reveals significant gaps in the data. The Large Whale Ship Strike Database report provides a summary of the 292 worldwide confirmed or possible whale/ship collisions from 1975 through 2002 (Jenson and Silber, 2003). The report also notes that these totals represent a minimum number of collisions, because the vast majority goes undetected or unreported.

All types of ships can hit whales, and in most cases the animal is either seen too late, not observed until the collision occurs, or not detected. The ability of a ship to avoid a collision and to detect a collision depends on a variety of factors, including environmental conditions, ship design, size, and manning. Smaller ships, such as Navy destroyers and Coast Guard cutters, have a number of advantages for avoiding ship strikes compared to most merchant vessels. For instance, naval and Coast Guard ships have their bridges positioned forward, offering good visibility ahead of the bow.

Additionally, military crew sizes are also much larger than those of merchant ships and have dedicated lookouts posted during each watch. These vessels are generally twin screw and much more maneuverable than single screw commercial craft. Due to smaller ship size and higher deck manning, Navy and Coast Guard vessels are likely to detect any strike that does occur, and these agencies' standard operating procedures include reporting of ship strikes (see Chapter 5 for additional information regarding mitigation procedures). Overall, the percentage of Navy traffic relative to other large shipping traffic is very small (on the order of 2%).

NOAA continues to review all shipping activities and their relationship to cumulative effects, in particular on large whale species. According to the NOAA report (Jenson and Silber, 2003), the factors that contribute to ship strikes of whales are not clear, nor is it understood why some species appear more vulnerable than others. Nonetheless, the number of known ship strikes indicates that deaths and injuries from ships and shipping activities remain a threat to endangered large whale species, and to North Atlantic right whales, in particular (Jenson and Silber, 2003).

Maritime traffic also increases underwater noise. The amount of noise produced by a ship depends on its type, size, and operational mode. Large commercial vessels emit low frequency noise in ranges similar to those used by some large whales (mysticetes) when communicating with each other (NMFS, 2006a). This communication between whales could be masked by vessel noise. Masking not

only interferes with communication, but also with the animal's ability to detect and avoid approaching ships (NMFS, 2006a). Masking can be due to one individual ship or the constant drone in the ocean from increases in boat traffic. Boat traffic has steadily increased over the years; however, the number of large ships is predicted to double over the next two to three decades (Southall, 2005).

6.2.2.5 Expended Materials

Expended materials include any man-made object expended, disposed of, or abandoned that enters the coastal or marine environment. It may enter directly from a ship, or indirectly when washed out to sea via rivers, streams, and storm drains. Types of expended materials include plastics, abandoned vessels, glass, metal, trash, and rubber. These materials can injure or kill marine life, interfere with navigation safety, create adverse economic impacts to shipping and coastal industries, and pose a threat to human health (NOAA, 2007).

During the 2007 International Coastal Cleanup Campaign event, worldwide volunteers discovered 235 animals entangled in expended materials. As shown in Table 6.2-2, expended fishing line was responsible for nearly half of all entanglements, followed closely by rope and fishing nets (Ocean Conservancy [OC], 2007). This is an annual effort by the OC and the summary of animals entangled in expended materials is published annually.

TABLE 6.2-2
SUMMARY OF ANIMALS ENTANGLED IN EXPENDED MATERIALS

Debris	Invertebrates	Fish	Reptiles	Birds	Mammals	Amphibians	Total	
Balloon/ribbon/string	0	0	0	4	1	0	5	2.1%
Beverage Can	1	1	0	0	0	0	2	0.9%
Building Materials	2	0	0	0	2	0	4	1.7%
Crab/Lobster/Fish Traps	2	1	0	0	0	0	3	1.3%
Fishing Line	22	32	5	43	8	0	110	46.8%
Fishing Nets	13	12	0	6	4	0	35	14.9%
Glass Bottles	3	2	1	0	2	0	8	3.4%
Miscellaneous	2	0	2	5	1	0	10	4.3%
Plastic Bags	2	3	0	12	5	0	22	9.4%
Plastic Container	0	0	0	0	1	0	1	0.4%
Rope	1	9	2	6	5	1	24	10.2%
Six-Pack Holders	0	2	0	1	0	0	3	1.3%
Tire	0	1	1	0	0	0	2	0.9%
Wire	1	0	0	4	1	0	6	2.6%
Totals	**49**	**63**	**11**	**81**	**30**	**1**	**235**	**100.0 %**
Total Percentage	**20.9%**	**26.8 %**	**4.7%**	**34.5 %**	**12.8%**	**0.4%**	**100.0 %**	

Source: OC, 2007

6.2.3 Seismic Survey and Scientific Research

Seismic surveys occur throughout the Study Area. One of the most active organizations performing oceanographic seismic surveys is the Lamont-Doherty Earth Observatory (LDEO). Seismic surveys performed by LDEO utilize airguns, sonar, and sub-bottom profilers, all of which have the possibility of harassing marine mammals. The deepwater Gulf of Mexico is the primary source of gas production intended to offset declines from gas fields on the shelf. Modern three-dimensional seismic surveys are

the main survey method used for these efforts and sometimes cover hundreds of blocks and involve several months of acquisition time (Petzet, 1999). The OCS Deep Water Royalty Relief Act provides economic incentives for operators to develop fields in water depths greater than 656.17 ft. Between 18 and 47 percent of the lease blocks in the Gulf of Mexico are undergoing geological surveys in any given year. During Gulf Cetaceans (GulfCet) I and II surveys, seismic exploration signals were detected 10 to 21 percent of the time, respectively (Davis *et al.*, 2000).

The potential exists for effects to protected marine mammals and sea turtles from underwater noise associated with seismic airgun surveys. LDEO has had Incidental Harassment Authorizations (IHA) for surveys off the northern Yucatan Peninsula, northern Gulf of Mexico, southeast Caribbean, and in the mid- and northwest Atlantic Ocean (DoN, 2008a); however, these IHAs are all now expired. NMFS has determined that minor adverse behavioral effects to sea turtles may result from seismic survey activities in deeper federal waters, but these effects would be short-term and minor. Effects to sea turtles have not yet been analyzed in states where nesting beaches and important foraging areas may be present (USAF, 2005a).

The 1994 amendments to the Marine Mammal Protection Act (MMPA), under a General Authorization, allowed the conduct of activities that involve low-impact harassment levels of marine mammals in the wild. Activities encompassed by the General Authorization for Scientific Research do not require a scientific research and enhancement permit. The activities covered under the General Authorization are limited to bona fide research that only involves Level B harassment of non-ESA-listed marine mammals and generally include, but are not limited to, photo-identification studies, behavioral observations, vessel surveys, and aerial surveys over water or land, as well as over pinniped rookeries if flown at altitudes greater than 1,000 ft (DoN, 2008a). In addition to the General Authorization, NMFS also issues commercial and education photography permits. These permits allow for photography of non-listed marine mammals that result at a maximum in Level B harassment. Additional activities authorized include those related to imports for public display of marine mammals, as well as import and export of marine mammal parts.

6.2.3.1 Environmental Contamination and Biotoxins

Insufficient information is available to determine how, at what levels, or in what combinations, environmental contaminants may impact cetaceans (Marine Mammal Commission [MMC], 2003). There is growing evidence that high contaminant burdens are associated with several physiological abnormalities, including skeletal deformations, developmental impacts, reproductive and immunological disorders, and hormonal alterations (Reijnders and Aguilar, 2002). DeSwart *et al.* (1996) conducted a study where harbor seals were fed contaminated Baltic herring and their immune function was monitored over a two-and-a-half-year period. The results of this study showed that chronic exposure to environmental contaminants accumulated through the food chain had an adverse effect on the immune function of those harbor seals. This further suggests that environmental contaminates may have an adverse immunological effect on free-ranging seals in areas with similar contamination levels as that observed in this study (DeSwart *et al.*, 1996). Since no similar studies have been conducted with other marine mammal species, it may be reasonably concluded that similar impacts could occur in other marine mammals, such as cetaceans.

Several die-offs have been reported for cetaceans. Biotoxins, viruses, bacteria, and El Niño activities have been implicated separately in recent mass mortality activities (Domingo *et al.*, 2002). A mass mortality activity for humpback whales, apparently associated with biotoxins, occurred along the beaches of Massachusetts in 1987 through 1988. Geraci *et al.* (1999) concluded that the whales died from saxitoxin poisoning after consumption of Atlantic mackerel containing the toxin. During the summer of 2003, 17 humpback whales, three fin whales, one minke whale, one long finned pilot whale,

and three whales of undetermined species were found dead in the vicinity of Georges Bank. Although saxitoxin was found in several samples collected, it was not present at lethal levels. Domoic acid was also detected and suspected as a probable cause, but because no brain samples were collected, the role of this biotoxin could not be confirmed (MMC, 2004; DoN, 2005a).

6.2.3.1 Recreational Diving

Popular sport diving sites within the Study Area consist of natural and artificial reefs as well as shipwrecks. In 1999 an estimated 83,780 dive trips occurred offshore between Texas and Alabama (MMS, 2001). The 5,000 offshore oil and gas structures in the Gulf (located primarily in Louisiana and Texas waters and on the adjoining outer continental shelf), provide shelter and are an indirect contributor of food for benthic, demersal, and pelagic fish. Of dives conducted offshore between Texas and Alabama, 93.6 percent of them occurred within 300 feet of an oil or gas structure. A popular diving destination in the Gulf of Mexico is the Flower Garden Banks National Marine Sanctuary, which consists of the East and West Flower Gardens and Stetson Bank (NOAA, 2008a, b, c). The sanctuaries are approximately 130 miles northeast of the Corpus Christi OPAREA and approximately 190 miles west of the New Orleans OPAREA.

6.2.4 Military Operations

This section will discuss past and present military operations occurring within the GOMEX Study Area.

6.2.4.1 Ships to Reefs (REEFEX)

An artificial reef is a man-made structure that is developed for the purpose of benefiting marine life, improve hydrodynamics for surfing or to control beach erosion. Artificial reefs allow algae, barnacles, corals and oysters to attach to the surface of the structure which in turn provides structure and food for the assemblages of fish. Obsolete U.S. Navy vessels make excellent artificial reefs in U.S. coastal waters. On May 17, 2006, the *USS Oriskany*, a decommissioned aircraft carrier, was sunk 24 mi off the coast of Pensacola, Florida to form an artificial reef. Extensive ecological and human health studies were conducted by Navy scientists in conjunction with the Environmental Protection Agency (EPA) to demonstrate no adverse impact from reefing the ship. The USNS General Hoyt S. Vandenberg, a retired U.S. Navy warship was sunk in the Florida Keys National Marine Sanctuary, seven miles south of Key West, on May 27, 2009. The sinking of the vessel was an $8.6 million project to divert fishing and diving from the natural reefs and is projected to annually increase the economy of Monroe County by $7.5 million (CNN, 2009).

6.2.4.2 Proposed Ship Trials in the Gulf of Mexico

A Programmatic Overseas Environmental Assessment (POEA) to assess a proposed action for the conduct of ship trials, including high speed tests, in the Gulf of Mexico over a period of five years was completed in June 2009. The Request for Letter of Authorization for Incidental Take of Marine Mammals was submitted in June, 2007. The OEA addressed the tests performed during ship trials that have potential to affect the marine environment. The trials involve tests of all aspects of the ship's operational capabilities. Testing with the potential to impact the marine environment includes full-power high-speed endurance runs (equal to or greater than 25 knots) and weapons systems. Ship trials are proposed to occur near the completion phase of construction when all necessary pre-requisites for preparing a ship to safety depart for sea are completed. Ships will proceed underway from their building yard to an open ocean area in the Gulf of Mexico as show in Figure 6.2-3. The proposed high speed sea trials would not include testing of combat systems or the use of active sonar. The only testing with the potential to impact the marine environment are high speed endurance runs. Avoidance of impacts to marine and coastal resources, such as species protected by the Endangered Species Act and the Marine Mammal Protection Act, and conflicts with other activities occurring in the Gulf of Mexico

influenced the selection of the proposed test site(see Figure 6.2-3). In addition, protective measures developed by the Navy and reviewed by National Marine Fisheries Services will be in place during the proposed action. Results from the analysis documented in OEA conclude that implementation of the proposed action preferred alternative would not result in significant harm to the resources of the global commons. The duration of ship trials is generally planned to occur over a period of approximately three to five days. Implementation of protective measures will help ensure that the potential environmental impact of conducting sea trials would not be significant. A detailed marine mammal and sea turtle protective measures plan has been developed. The plan includes the use of the same aerial and shipboard visual monitoring efforts that were employed successfully during the shock trial of the WINSTON S. CHURCHILL in 2001 in which no deaths or injuries to marine mammals were detected. To maximize the probabilities of detecting marine mammals and sea turtles and to ensure vessel safety, test events that would exceed 25 knots would only be conducted during daytime and with sea surface conditions not exceeding Sea State 3 (i.e., 15 knots wind and 4 ft waves). The protective measures plan includes site selection, pre-detonation and post-detonation monitoring and is designed to produce the least practicable adverse impact on marine mammals and sea turtles. In the after-action report dated December, 2008, there were no observed injuries or mortalities to marine mammals and sea turtles during the shock trial detonations.

6.2.4.1 Military Training - Eastern Gulf of Mexico

6.2.4.1.1 Amphibious Ready Group/Marine Expeditionary Unit Readiness Training

The Navy and Marine Corps conducted one readiness training exercise at Eglin AFB. The training occurred in 2003 and Fleet Forces Command does not plan to conduct this training at Eglin AFB in the near future.

Transport of the Marine Expeditionary Unit (MEU) was conducted by naval ships from various locations throughout the United States to the Gulf of Mexico. Expeditionary Strike Group (ESG) activities occurred within the Inner Transport Area, which covers a 5- by 20-mi rectangular box approximately 1 to 7 mi from the beach. During the 10-day exercise, ESG ships remained in the assigned box at slow speed (5 to 10 knots) or at anchor (U.S. Marine Corps *et al.*, 2003). Events included launch/recovery of aircraft and launch/recovery of Landing Craft Air Cushion (LCAC), Landing Craft Utility (LCU), and Amphibious Assault Vehicles (AAV). The ESG consisted of three amphibious ships that were augmented by two or three cruisers/destroyers. No ship-to-shore movements of ground forces occurred from cruisers and destroyers and no more than seven aircraft operated during a single activity (U.S. Marine Corps *et al.*, 2003).

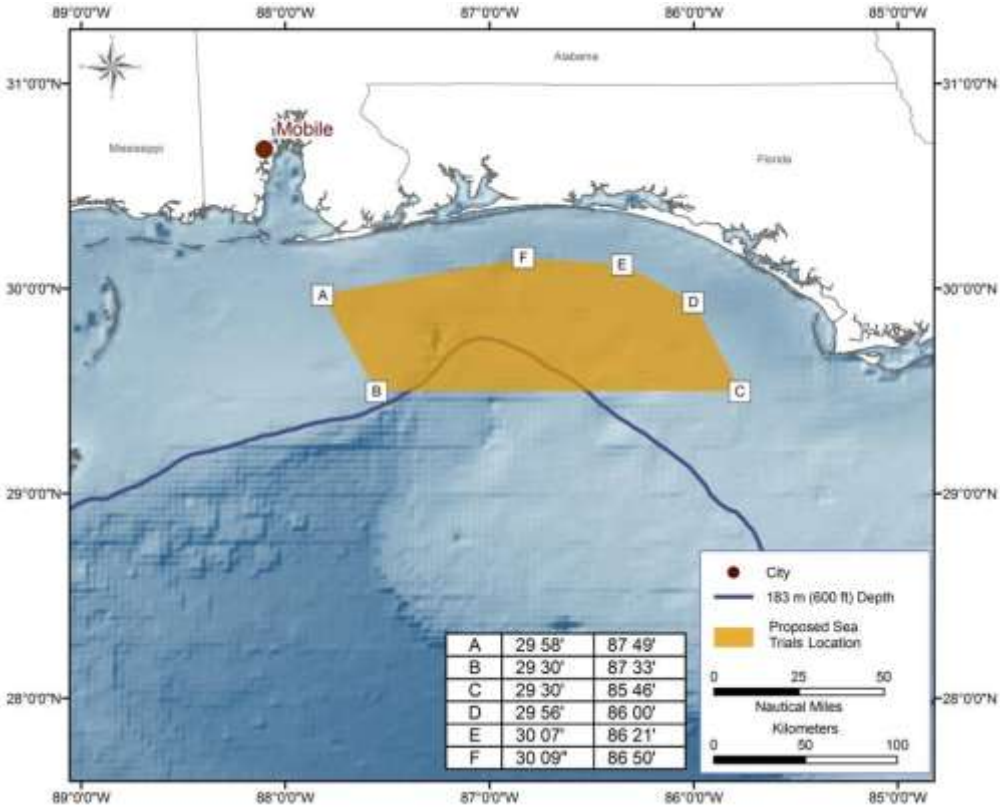

Figure 6.2-3 Gulf of Mexico Test Area

Potential effects from ESG/MEU activities included noise, socioeconomic effects, and effects to biological resources, particularly to sensitive species (U.S. Marine Corps *et al.*, 2003). During the 10-day period of exercises, approximately 130 crossings of LCACs between Navy ships and shore, 78 crossings by AAVs, and 42 crossings by LCUs occurred. These crossings had the potential to transmit noise into the marine environment, potentially disturbing marine species such as sea turtles and marine mammals (U.S. Marine Corps *et al.*, 2003). In addition, there was a potential for vessels to physically strike some animals.

The number of sea turtles potentially affected by surface vessels was evaluated in the Biological Evaluation for ESG/MEU activities and is summarized in Table 6.2-3.

TABLE 6.2-3
SEA TURTLES POTENTIALLY AFFECTED BY ESG/MEU ACTIVITIES

Species	Number of Sea Turtles at the Surface	Number of Surface and Submerged Sea Turtles	Number of Hatchlings
Loggerhead	3.9	26.0	2.0
Leatherback	0.5	2.2	0.1
Kemp's ridley	0.2	0.7	0
Unidentified	0.4	2.2	N/A
Green	*	*	1.3
Total	**5**	**31**	**3.4**

Source: U.S. Marine Corps *et al.*, 2003
N/A = not applicable
* Turtles listed as unidentified by GulfCet II are assumed to include green sea turtles

Table 6.2-34 indicates that the expected maximum number of sea turtles within the vessel transit area was less than 35. Realistically, effects from ESG/MEU events that included, for example, vessel transit and troop movements, were limited to turtles at the surface. Thus, less than nine turtles would occupy the surface of the transit area over the 10-day exercise. An additional potential effect to sea turtles was the possibility of surface vessels physically disturbing large *Sargassum* mats. These mats are considered likely habitat for juvenile turtles, as well as habitat for a number of fish species during various life stages. Large *Sargassum* mats, however, are distributed in a very patchy manner and are usually associated with ocean current convergence lines. Effects to *Sargassum* therefore were not considered likely (U.S. Marine Corps *et al.*, 2003).

The United States Fish and Wildlife Service (USFWS) issued a BO in 2003 in response to a BA submitted by the Navy and Air Force. The USFWS anticipated incidental takes of the four species of sea turtles and the flatwoods salamander that occur on Eglin AFB, and issued an incidental take statement pursuant to Section 7 of the ESA. The incidental take statement contains reasonable and prudent measures with implementing terms and conditions to help minimize takes.

NMFS issued a BO for the proposed MEU training on April 9, 2003. The BO states that the proposed air and land events are not likely to adversely affect ESA-listed species under purview of NMFS, including sperm whales, Gulf sturgeon, and smalltooth sawfish. NMFS further concluded that the proposed action's effects on designated Gulf sturgeon critical habitat are insignificant. Finally, NMFS concluded that the proposed ESG/MEU training is not likely to adversely affect species or critical habitat protected by the ESA, including loggerhead, green, and leatherback sea turtles.

The vessels transiting between Navy ships and shore would introduce noise into the water, which could disturb protected species such as sea turtles or marine mammals. The noise characteristics (frequency, energy level, *etc.*) were not quantified, but were considered inconsequential when compared to the baseline level of noise produced by surface vessels in the Gulf of Mexico (U.S. Marine Corps *et al.*, 2003).

The magnitude and intensity of vessels, materials, and troops moving to and from shore necessitated the closing of the OPAREA to commercial and recreational fishing. However, considering the small size of the exercise areas and the short time duration required for each landing activity, MEU training and activities were not expected to interfere with commercial and recreational fishing activities, and the effect was considered minimal (U.S. Marine Corps *et al.*, 2003).

6.2.4.1.2 Eglin Gulf Test and Training Range Operations

Eglin AFB supported nearly 39,000 sorties during the timeframe of fiscal year (FY) 1995 through 1999 (USAF, 2002). Most of the sorties were flown over the Gulf of Mexico, in the Eglin Gulf Test and Training Range (EGTTR). Mission activities conducted within the EGTTR can be summarized as Air Operations and Ordnance Testing and Training. Air Operations include all manned and unmanned aircraft flights through the EGTTR. Ordnance testing and training involves the release of expendables, which are defined as items that are deployed, released, or consumed (or potentially consumed) while performing an activity. Examples of expendables include bombs, missiles, bullets, chaff, flares, and other miscellaneous items. Test and training missions are described below.

EGTTR activities may include effects to air quality, water quality, sensitive species and habitats, non-protected species, airspace management, and effects due to noise (USAF, 2002). Mission-generated air emissions were analyzed to enable comparison to National Ambient Air Quality Standards (NAAQS). The results are summarized in Table 6.2-4.

TABLE 6.2-4
AIR EMISSIONS ASSOCIATED WITH EGTTR MISSIONS

Criteria Pollutant	Averaging Time	NAAQS	W-155A	W-155B	W-168 A/B/C	W-470A	W-470B	W-470C
CO	1-hour	40 mg/m^3	1.62E-06	1.08E-06	8.67E-08	2.41E-05	2.17E-05	3.94E-05
	8-hour	10 mg/m^3	1.13E-06	7.42E-07	6.07E-08	1.69E-05	1.52E-05	2.76E-05
NO_2	Annual	100 µg/m^3	4.30E-03	3.81E-03	6.72E-05	1.23E-01	1.10E-01	2.02E-01
SO_2	3-hour	1300 µg/m^3	2.95E-04	2.52E-04	8.09E-06	6.06E-03	5.30E-03	9.71E-03
	24-hour	365 µg/m^3	2.06E-04	1.76E-04	5.66E-06	4.23E-03	3.71E-03	6.79E-03
	Annual	80 µg/m^3	7.60E-05	6.51E-05	2.09E-06	1.56E-03	1.37E-03	2.50E-03
PM_{10}	24-hour	150 µg/m^3	2.92E-04	3.38E-04	1.65E-05	6.15E-03	5.63E-03	1.03E-02
	Annual	50 µg/m^3	1.08E-04	1.25E-04	6.10E-06	2.27E-03	2.08E-03	3.81E-03

Source: USAF, 2002
EGTTR = Eglin Gulf Test and Training Range; CO = carbon monoxide; µg/m^3 = micrograms per cubic meter; mg/m^3 = milligrams per cubic meter; NAAQS = National Ambient Air Quality Standards; NO_x = nitrogen oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; SO_x = sulfur oxides
* Units of measurement for the criteria pollutants in each of the Warning Areas of the EGTTR are the same as those given for the NAAQS column

Water quality may be negatively affected from the introduction of chemical materials from jet fuel, munitions, chaff, and flares. Fuel may be introduced into the water by the occasional downing of a target drone and by emergency in-flight fuel release (USAF, 2002). Table 6.2-5 and Table 6.2-6 show the maximum amount of fuel deposited by these actions between 1995 and 2000. In reality, the amount is far less because the extreme volatility of the substance results in a significant amount (approximately 99%) of evaporation during descent. The remainder would disburse through the action of waves and currents.

TABLE 6.2-5
ESTIMATED VOLUME OF FUEL RELEASED BY DRONES DURING EGTTR MISSIONS

Drone Type	Quantity	Average Fuel Amount (gallons/drone)	Total Fuel Released (gallons)
QF-4	21	1,030	21,630
QF-106/4	35	735	25,725
BQM-34	20	40	800
MQM-107	23	30	690
		TOTAL	**48,845**

Source: USAF, 2002

TABLE 6.2-6
ESTIMATED FUEL RELEASE FROM IN-FLIGHT EMERGENCIES DURING EGTTR MISSIONS

Aircraft Type	IFE Sorties that Released Fuel	Average Released Fuel (gallons/sortie)	Total Fuel Released (gallons)	Fuel (gallons) Reaching Surface
F-15/F-15E	220	735	161700	1,620
F-18	4	735	2940	30
F-111	2	735	1470	20
F-117	0.2	735	150	2
AC/MC/C-130	0.5	1,470	700	10
		TOTAL	**166,960**	**1,682**

Source: USAF, 2002

IFE = In-Flight Emergencies

Chaff is primarily used as a defense mechanism and is released from engaged aircraft. Discharge of chaff results in the release of millions of aluminum dipoles (short fibers similar in appearance to human hair) that create an electromagnetic cloud around the aircraft, shrouding the plane from enemy radar and defense systems. The main chemical component of concern in chaff is aluminum. Due to the wide dispersion over large areas of the eastern Gulf of Mexico, chaff dispersion would vary for each of the water ranges (USAF, 2002). A small portion of the chaff may dissolve over time. An assessment suggests that approximately 0.06 percent of the initial aluminum weight would dissolve in seawater. Although no criteria exist for aluminum in oceanic waters, it is a naturally occurring trace element (river input) in seawater and found at variable concentrations. Effects are therefore considered negligible (USAF, 2002).

Flares are high-temperature heat sources that are ejected from aircraft to confuse and divert enemy heat-seeking or heat-sensitive missiles. Flares are also used to illuminate surface areas during nighttime events. The principal chemical element of concern is magnesium. The total amounts of magnesium added to the Gulf of Mexico surface waters would be less than 0.0002 percent (W-151) and 0.0005 percent (W-470) of the background concentration (1.35 grams per liter [g/L] [11,266 pounds [lbs]/gallon [gal]) of magnesium in the Gulf of Mexico surface waters. Due to this extremely small amount, no adverse effects are anticipated (USAF, 2002).

Test and training missions conducted by Eglin AFB result in numerous flight activities in the EGTTR involving a variety of aircraft and missiles flying at a wide range of altitudes and traveling at speeds ranging from slow subsonic to supersonic. Subsonic and supersonic aircraft noise is basically continuous over the EGTTR while missions are in progress. Supersonic noise from EGTTR missions was determined not likely to adversely affect dolphins or other biological or socioeconomic (human) resources (USAF, 2002).

Underwater noise resulting from gunnery missions has been calculated. Noise results from 25-mm, 40-mm, and/or 105-mm rounds being fired at the water surface. Various noise levels were found to be pertinent to effects to protected species. The distance from an exploding shell that these noise levels would reach was determined, and then the number of animals potentially affected was calculated. Generally, for the purposes of the EGTTR Programmatic Environmental Assessment, noise levels above 205 decibels (dB) referenced to 1 dB re 1 μPa^2 s are considered injurious, levels above 182 dB re 1 μPa^2 s are considered non-injurious harassment, and levels above 176 dB re 1 μPa^2 s are considered behavioral harassment. This 176 dB re 1 μPa^2 value was employed by the Air Force for behavioral takes of marine mammal species and was based on the *EA for the Use of the AN/SSQ-110A Sonobuoys in Deep Ocean Waters*. The harassment level is now set at 177 dB for all Air Force activities. Table 6.2-7 and Table 6.2-8 show the number of protected species potentially affected. All gunnery missions used in these calculations occur in W-151.

TABLE 6.2-7
YEARLY ESTIMATED NUMBER OF MARINE MAMMALS AFFECTED BY THE GUNNERY MISSION NOISE

Species	Adjusted Density (No./km^2)	Level A Harassment Injurious 205 dB* EFD for Ear Rupture	Level B Harassment Non-Injurious 182 dB* EFD for TTS	Level B Harassment Non-Injurious 176 dB* EFD for Behavior
Bryde's whale	0.007	<0.001	0.010	0.041
Sperm whale	0.011	<0.001	0.016	0.064
Dwarf/pygmy sperm whale	0.024	<0.001	0.035	0.139
Cuvier's beaked whale	0.10	<0.001	0.015	0.058
Mesoplodon spp.	0.019	<0.001	0.028	0.110
Pygmy killer whale	0.030	<0.001	0.044	0.174
False killer whale	0.026	<0.001	0.038	0.151
Short-finned pilot whale	0.027	<0.001	0.039	0.157
Rough-toothed dolphin	0.028	<0.001	0.041	0.163
Bottlenose dolphin	0.810	0.006	1.177	4.706
Risso's dolphin	0.113	0.001	0.164	0.657
Atlantic spotted dolphin	0.677	0.005	0.984	3.934
Pantropical spotted dolphin	1.077	0.008	1.565	6.258
Striped dolphin	0.237	0.002	0.344	1.377
Spinner dolphin	0.915	0.007	1.330	5.316
Clymene dolphin	0.253	0.002	0.368	1.470
Unidentified dolphin**	0.053	<0.001	0.077	0.308
Unidentified whale	0.008	<0.001	0.012	0.046
All marine mammals	4.325	0.032	6.29	25.13

Source: USAF, 2002
EFD = Energy Flux Density; km^2 = square kilometers; No. = number; TTS = temporary threshold shift
* dB = dB re 1 µPa^2 s
** Bottlenose dolphin/Atlantic spotted dolphin

TABLE 6.2-8
YEARLY ESTIMATED NUMBER OF SEA TURTLES AFFECTED BY THE GUNNERY MISSION NOISE

Species	160 dB	170 dB	180 dB	190 dB	200 dB
Sea Turtles (number)	215	20.2	2.1	0.2	0.02

Source: USAF, 2002
dB = decibels

Underwater noise may also affect non-protected resources such as fish. Impulsive noise at sufficient intensity is known to cause injury to the swim bladder and other air spaces inside fish. However, the intermittent nature of both the EGTTR missions and the presence of large schools of fish make significant effects unlikely (USAF, 2002).

Direct physical effects to sensitive species and habitat (sea turtles, marine mammals, and *Sargassum* mats) may occur when the surface of the water is physically struck by gunnery ordnance or other falling objects. However, only a small number of animals were calculated to be potentially affected (physically struck or startled) by falling objects (USAF, 2002). The BO issued by NMFS estimates one sperm whale and four sea turtles. Eglin AFB also requested a renewal for authorization to take up to 271

marine mammals by harassment incidental to conducting air-to-surface gunnery missions in the Gulf of Mexico.

The large number of sorties flown over the EGTTR over the course of a year requires dedicated management of military and commercial airspace. However, these activities have been occurring for years, and control of the airspace is well-established. Therefore, no additional effects are anticipated (USAF, 2002).

6.2.4.1.3 Cape San Blas Activities

Eglin AFB maintains property on Cape San Blas (CSB), Florida. Air Force facilities on CSB indirectly support nearly all air events within the EGTTR W-151 (Panama City OPAREA), as well as some of the air events in W-470. Additionally, CSB facilities directly support some air missions (5,415 during FY 94 through FY 97), including surface-to-air missile launches. Up to 26 surface-to-air missiles may be launched per year (four Patriot, 16 Caesar Trumpet, and six Viper). Some smaller, portable missiles are also fired at QF-4 drones, with up to two drones potentially downed in the Gulf of Mexico per year. In addition, CSB may support limited surf zone testing and training activities in the nearshore shallow waters. Although no specific test or training missions are identified, typical activities include underwater navigation and reconnaissance missions, as well as small inert munitions activities performed by the Navy Explosive Ordnance Disposal training school (USAF, 1999).

CSB activities may include effects to air quality, water quality, sensitive species and habitats, airspace management, and effects due to noise. The CSB Programmatic Environmental Assessment (EA) identified issues associated with restricted access, noise, habitat alteration, expended materials, electromagnetic radiation, chemical materials, and direct physical effects (USAF, 1999).

For the purpose of public safety and the security of test and training events, use of land and water areas and airspace beyond Air Force property boundaries is occasionally and briefly restricted for some surface-to-air missile activities. It is expected that water access will be restricted for approximately 69 hours per year (USAF, 1999).

Expended materials from CSB missions results primarily from the surface-to-air missile launch missions. Missile components and drones from missile tests typically consist of aluminum and steel housing assemblies, optical sensors, guidance and control electronics, radio transmitters and receivers, and a power supply that may include lithium or nickel-cadmium batteries. Although most typical missions do not plan for the intentional downing of drones, surface-to-air missiles and drone targets that potentially fall on land have relatively benign environmental effects. Expended materials falling into nearshore waters have the potential to physically strike a boat, person, marine animal, or other receptor at the surface. Calculations predict, however, that the likelihood is extremely remote (USAF, 1999).

The introduction of chemical materials into the CSB environment occurs primarily from missile and rocket exhaust emissions as a result of the surface-to-air missile launch activities. The amount of chemical materials released into the air and water is summarized in Table 6.2-9.

TABLE 6.2-9
CHEMICAL MATERIALS ASSOCIATED WITH MISSILE LAUNCH ACTIVITIES

Environmental Receptor	Chemical Material	Maximum Exposure (mg/m^3)
Air	Al_2O_3 (alumina)	0.021
	CO (carbon monoxide)	39.11
	HCl (hydrochloric acid)	0.012
	NO_x (nitrogen oxides)	0.009
Water	JP-8 Fuel (Jet Propulsion fuel, type 8)	0.023

Source: USAF, 1999
mg/m^3 = milligrams per cubic meter

The number of aircraft and missile flights in the CSB vicinity requires management of military and commercial airspace. However, these activities are expected to fall well within the management capabilities of airspace controllers (USAF, 1999).

6.2.4.1.4 Santa Rosa Island Activities

Eglin AFB controls 7.4 mi^2 of Santa Rosa Island (SRI), which includes 15 Air Force test sites. In addition to the SRI land mass, the surf zone is also considered part of the zone of effect. The surf zone is a shallow area covering the continental shelf seaward of SRI to a depth of approximately 9 mi. The distance from the SRI shoreline that corresponds to this depth varies from approximately one-half mi at the western side of the Air Force property to 1.5 mi at the eastern side (USAF, 2005b). Several activities conducted on SRI and in the surf zone have the potential to affect the resources analyzed in Chapter 4 of the Santa Rosa Island Mission Utilization Plan Programmatic Environmental Assessment (USAF, 2005b).

Electronic Countermeasures (ECM) and Electronic Systems Testing are conducted in the vicinity of SRI (USAF, 2005b). Training is routinely done aircraft-against-aircraft or aircraft-against-ground/surface ship systems. Any part of the EGTTR can be used for this type of training, but it is mostly done over the water. Surface-to-air missile tests launch missiles from a variety of locations, including A-15 on SRI and surface vessels, at target aircraft in the EGTTR. A variety of surf zone testing/training activities may occur as needed and include mine clearance testing and explosive ordnance disposal training (USAF, 2005b).

Although the number of missile and aircraft flights is not quantified, air pollutant emission is a potential effect issue, as is airspace management. Sorties associated with SRI lack the intensity and frequency of those associated with other activities, and the effects are considered minimal (USAF, 2005b).

If increased use of the surf zone occurs, the potential for effects to geology, water quality, cultural resources, marine life, and sensitive species and habitats exist (USAF, 2005b). Mine clearance and ordnance disposal could result in underwater detonations on or close to sediment. This could cause turbidity and damage to essential fish habitat (EFH) (such as natural or artificial reefs) and cultural resources. Turbidity would be very brief and localized, as wave and current action would disperse the sediments (USAF, 2005b). Environmental regulations would require that such training not be undertaken in the vicinity of cultural resources, EFH, or other sensitive habitats. A small amount of chemical materials would be added to the water column, but would be diluted to the point of insignificance (USAF, 2005b). Detonations could cause injury to sensitive species such as sea turtles and marine mammals, and to non-protected resources such as fish. However, surveys for the presence of protected species would be required before conducting such activities. Therefore, effects are considered unlikely (USAF, 2005b).

6.2.4.1.5 Precision Strike Weapons Test

The U.S. Air Force Air Armament Center and the Navy, in cooperation with the 46th Test Wing Precision Strike Division, proposes to conduct a series of Precision Strike Weapons (PSW) test missions during the next five years utilizing resources within the Eglin Military Complex, including two sites in the EGTTR (USAF, 2005a). The weapons to be tested are the Joint Air-to-Surface Stand-off Missile (JASSM) AGM-158 A and B, and the small-diameter bomb (SDB) GBU-39/B. The JASSM is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets. The SDB weapon is a 250-lb class, air-to-surface, precision-guided munition. As many as two live and four inert JASSM missiles per year would be launched from an aircraft above the Gulf of Mexico at a target located approximately 17.3 to 27.6 mi offshore of Eglin AFB (USAF, 2005a). Detonation of the JASSM would occur under one of three scenarios:

- Detonation upon impact with the target, about 5 ft above the Gulf of Mexico surface.
- Detonation upon impact with a barge target at the surface of the Gulf of Mexico.
- Detonation at 120 milliseconds after contact with the surface of the Gulf of Mexico.

In addition to the JASSM explosive, as many as six live and 12 inert SDBs per year would also be dropped on the target. Targets would be located in less than 200 ft of water and more than 12 nm offshore (USAF, 2005a). Detonation of the SDBs would occur under one of two scenarios:

- Detonation of one or two bombs upon impact with the target, about 5 ft above the Gulf of Mexico surface.
- Height of burst test: Detonation of one or two bombs about 10 to 26 ft above the Gulf of Mexico surface.

Activities associated with PSW testing may potentially affect water quality, biological resources, and the anthropogenic (man-made) environment (USAF, 2005a). Chemical products may be released into the aquatic environment during explosive detonations. The detonation of explosives usually results in the complete combustion of the original material and the emission of carbon dioxide, carbon, carbon monoxide, water, and nitrogen compounds. Residual chemical products are usually extremely dilute and are dispersed within hours by wave and current action. Although data are lacking, these compounds are not expected to persist in the marine environment, and there is expected to be no effects to sea turtles, marine mammals, or the marine environment in general (USAF, 2005a). During the time of activities, a safety zone on the surrounding water surface would be closed to commercial and recreational fishing. However, the total closed area compared to other areas available in the Gulf of Mexico would be insignificant. In addition, the closures would be infrequent (USAF, 2005a).

Exploding JASSM and SDB bombs will result in both pressure waves and noise in the marine environment (USAF, 2005a). Detonations would have the potential for effects to protected and non-protected marine species (sea turtles, marine mammals, and fish). Injury can result from the shock wave interacting with air spaces in an animal's body, such as swim bladders, the inner ear, and viscera. At farther distances from the detonation, noise may cause hearing impairment or behavioral modification in individuals. The BO by NMFS (NMFS, 2008b) related to PSW activities included calculations of sea turtles potentially affected before and after mitigation measures. After the implementation of the required measures, a total of 12 sea turtles may be affected (lethally and non-lethally) over a five-year period (NMFS, 2006b). The number of marine mammals potentially affected as estimated by Eglin AFB is summarized in Table 6.2-10 and Table 6.2-11. NMFS has approved an incidental take permit for Air Force/Navy activities to allow for one mortality, two injuries, and 53 harassment takes of marine mammals) (NMFS, 2008c). The Letter of Authorization was issued to Eglin AFB. The authorization is effective from March 19, 2009, through March 18, 2010 (Federal Register, 2009a).

TABLE 6.2-10
MARINE MAMMAL DENSITIES AND RISK ESTIMATES FOR LEVEL A HARASSMENT (205 dB EFD 1/3-OCTAVE BAND) NOISE EXPOSURE DURING PSW MISSIONS

Species	Density	Number of Animals Exposed from 1-ft Depth Detonations	Number of Animals Exposed from >20-ft Depth Detonations
Summer			
Dwarf/pygmy sperm whale	0.013	0.0024	0.0247
Bottlenose dolphin	0.81	0.1491	1.5417
Atlantic spotted dolphin	0.677	0.1246	1.2886
T. truncatus/S. frontalis	0.053	0.0098	0.1009
TOTAL		**0.29**	**3.0**
Winter			
Dwarf/pygmy sperm whale	0.013	0.0024	0.0285
Bottlenose dolphin	0.81	0.1491	1.7737
Atlantic spotted dolphin	0.677	0.1246	1.4824
T. truncatus/S. frontalis	0.053	0.0098	0.1161
TOTAL		**0.29**	**3.4**

Source: USAF, 2005a dB = decibels; EFD = Energy Flux Density; ft = feet; PSW = Precision Strike Weapon

TABLE 6.2-11
MARINE MAMMAL DENSITIES AND RISK ESTIMATES FOR LEVEL B HARASSMENT (182 dB EFD 1/3-OCTAVE BAND) NOISE EXPOSURE DURING PSW ACTIVITIES

Species	Density	Number of Animals Exposed from 1-foot Depth Detonations	Number of Animals Exposed from >20-foot Depth Detonations
Summer			
Dwarf/pygmy sperm whale	0.013	0.0226	0.5070
Bottlenose dolphin	0.81	1.4089	31.5886
Atlantic spotted dolphin	0.677	1.1776	26.3735
T. truncatus/S. frontalis	0.053	0.0922	2.0669
TOTAL		**2.7**	**60.5**
Winter			
Dwarf/pygmy sperm whale	0.013	0.0280	0.8633
Bottlenose dolphin	0.81	1.7448	53.7906
Atlantic spotted dolphin	0.677	1.4583	44.9300
T. truncatus/S. frontalis	0.053	0.1142	3.5196
TOTAL		**3.3**	**103.1**

Source: USAF, 2005a
dB = decibels; EFD = Energy Flux Density; ft = feet; PSW = Precision Strike Weapons

6.2.4.1.6 Naval Surface Warfare Center Panama City Division

Naval Surface Warfare Center (NSWC) Panama City Division (PCD) is the Navy's premier research and development organization focused on littoral (coastal region) warfare and expeditionary (designed for military activities abroad) warfare. NSWC PCD provides RDT&E and support for expeditionary warfare, activities in extreme environments, MIW, maritime events, and coastal activities. Littoral and expeditionary warfare events are conducted in a natural operating environment with direct access to the Gulf of Mexico, St. Andrew Bay, and associated coastal regions. The Gulf of Mexico provides an environment that can substitute for many of the littoral areas in the world for current and future Navy activities. The NSWC PCD events occur in W-151, W-155, W-470, and St. Andrew Bay.

RDT&E activities involve a variety of naval assets, including ships, aircraft, and underwater systems that support eight primary test capabilities: air, surface, and subsurface activities; sonar, electromagnetic, laser, and ordnance events; and projectile firing occurring within or over the water environment up to the average high tide mark. The majority of tests are conducted using inert/non-explosive mine substitutes, although occasionally testing requires actual mine detonation in real-world circumstances. A brief overview of the eight RDT&E events is provided in the following paragraphs.

Air activities conducted by NSWC PCD to support the RDT&E activities mainly utilize helicopters (MH-53, MH-60, UH-1, and variants). Five types of RDT&E activities conducted from aircraft at NSWC PCD include: (1) support activities for clearance and monitoring, (2) tows of an object that contains active or passive sensors towed in the water column (the water between the surface and the sea floor), (3) captive carriage to test the handling of aircraft during transport, separation, and release of objects, and (4) aerial separation of objects that would not be retrieved, to test inert objects, rockets, and/or mines and the aircraft's flight effects on deployment of such items. The fifth activity includes the only form of live aerial expendables, which includes gun firing at predetermined targets from a helicopter.

Surface events for NSWC PCD RDT&E includes: support activities, tows (a type of test), deployment and recovery unmanned underwater vehicles (UUV), sonobuoys, targets, and other test systems, and the testing of new, alternative, or upgraded hydrodynamics and propulsion, navigational, and communication systems.

Subsurface events activities include diving, salvage, robotic vehicles, UUVs, and mooring and burying of mines. NSWC PCD also develops, upgrades, and manages new underwater mine systems. Tests are required to collect data and information to analyze functionality of the various systems developed at NSWC PCD. Other MIW testing conducted at NSWC PCD requires placement of temporary minefields at varying depths (surf zone to 600 ft) at NSWC PCD. These temporary target fields consist of inert mines, mine-like objects (MLO), and versatile exercise mines, which are used to simulate bottom and moored mine threats.

Sonar events at NSWC PCD involve testing various sonar systems in the ocean and the laboratory to demonstrate the systems' capability to detect, locate, and characterize MLOs under various environmental conditions. These activities include sonars that range in frequency from 1 kilohertz (kHz) to 3 megahertz (mHz) and are typically mounted on a towed body or other underwater moving platform.

Electromagnetic events at NSWC PCD consist of developing and testing an array of magnetic sensors that generate electromagnetic fields used in mine countermeasures (MCM) activities.

Laser events include underwater mine identification and air-to-water mine identification. Laser activities are typically conducted from aircraft, but ship-based tests are also conducted.

Ordnance events and **projectile firing** make up the final two events conducted at NSWC PCD. NSWC PCD leads the development of naval airborne, surface, organic, and shallow water MCM systems. Real-life test scenarios that involve live explosives are required to demonstrate the capability and effectiveness of the systems developed and tested at NSWC PCD. Live testing is only conducted after a system has successfully completed inert testing and an adequate amount of data have been collected to support the decision for live testing. These tests require that live mines be closely monitored and that the minimum number of live munitions necessary to meet the testing requirement be used. Live testing may occur from the surf zone out to the outer perimeter of NSWC PCD. Gunfire might be used during test missions, including 5-in, 20-mm, 25-mm, 30-mm, 40-mm, 76-mm, and various small arms ammunition. Projectiles associated with these rounds are mainly armor-piercing

projectiles. The 5-in round is a high-explosive projectile containing approximately 8 lbs of explosive material.

A Request for a Letter of Authorization for the Incidental Harassment of Marine Mammals Resulting from the Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities was submitted to the Office of Protected Resources, National Marine Fisheries Service in March 2008. The NSWC PCD EIS/OEIS Record of Decision, signed January 15, 2010 lists the mitigation measures as listed in NMFS' Final Rule.

6.2.4.2 Western Gulf of Mexico

6.2.4.2.1 NAS Corpus Christi

NAS Corpus Christi is located just south of Corpus Christi, Texas, on the eastern side of the state. The overall command assignment is pilot training. The Chief of Naval Air Training oversees the training operation through the Southeast Region with five training air wings, 16 training squadrons, more than 14,000 Navy and civilian personnel, the Blue Angels Flight Demonstration Squadron, the Naval Aviation Schools Command and the National Museum of Naval Aviation. The installation supports some 400,000 naval flight events per year (DoN, 2006). NAS Corpus Christi is also home to the Helicopter Mine Countermeasures Squadron FIFTEEN (HM-15), a squadron of MH-53E Sea Dragons The Sea Dragon helicopter is used primarily for Airborne Mine Countermeasures with secondary missions of vertical shipboard delivery and assault support (DoN, 2008a). The largest tenant command at NAS Corpus Christi is the Corpus Christi Army Depot. Other major tenants include Commander, Naval Mine and Anti-Submarine Warfare Command; the United States Coast Guard, the United States marine Aviation Training Support Group, and the United States Customs and Border Protection Service. There are more than 50 tenant commands and activities located on the NAS.

Just north of NAS Corpus Christi is Aransas National Wildlife Refuge, which is comprised of over 115,000 acres that provide vital resting, feeding, wintering, and nesting grounds for migratory birds and native Texas wildlife. The refuge is known for having the largest wild flock of endangered whooping cranes in the winter. The Arkansas National Wildlife Refuge and NAS Corpus Christi have coexisted for many years as the refuge was established in 1937 and the base was established in 1941. The Integrated Natural Resources Management Plan and Bird Aircraft Strike Hazard Programs are key components for supporting active military training and managing highly diverse migratory bird resources in the midst of the largest migratory bird flyway in North America. The Department of Defense and the navy are active partners with the U.S. Fish and Wildlife Service and non-government organizations in the conservation and management of migratory birds in the United States.

6.2.4.3 Northern Gulf of Mexico

6.2.4.3.1 VIRGINIA Class Submarine Initial Operational Testing and Evaluation

During a 19-day period in August, 2008 (DoN, 2008b) Anti-Submarine Warfare shallow water, Mine Warfare, and Advanced Mine Simulation System testing activities occurred in the non-territorial waters within Warning Area 151, within the Panama City OPAREA, which is located in the northern Gulf of Mexico. These events occurred successively during both daytime and nighttime hours to ensure testing effectively simulates realistic operational scenarios. Underwater acoustic sources included mid- and high-frequency active sonar, Directional Command Activated Sonobuoy System tonal sonobuoys, and portable underwater tracking system transponders. An Environmental Assessment and subsequent Finding of No Significant Impact (DoN, 2008c) concluded that implementation of the activities would not result in significant harm to the resources of the global commons.

6.3 Reasonably Foreseeable Future Actions Relevant to the Proposed Action

6.3.1 Military Operations

6.3.1.1 Letter of Authorization for the Incidental Harassment of Marine Mammals Resulting from the Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities

A Request for a Letter of Authorization (LOA) for the Incidental Harassment of Marine Mammals Resulting from the Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities was submitted to the Office of Protected Resources, National Marine Fisheries Service in March 2008. The LOA and associated rule, issued January 21, 2010, cover the taking of marine mammals incidental to RDT&E operations that occur within the NSWC PCD.

The proposed action is to improve NSWC PCD's capabilities to conduct new and increased mission operations for the DoN and other customers. The DoN evaluated potential environmental effects associated with the littoral and expeditionary warfare activities proposed for the NSWC PCD Study Area, which includes military warning areas W-151 (includes Panama City Operating Area), W-155 (includes Pensacola Operating Area), W-470, and SAB. NSWC PCD's activities occur either on or over the waters present within the NSWC PCD Study Area. All shoreside support activities are managed by Naval Support Activity Panama City (NSA PC). No hazardous waste is generated at sea during NSWC PCD RDT&E activities. The LOA evaluates only the in-water activities related to NSWC PCD's RDT&E activities conducted within the NSWC PCD Study Area, and does not address routine shoreside management functions performed by NSA PC (DoN, 2008b).

6.3.1.2 Surveillance Towed Array Sensor System Low Frequency Active Sonar

The Final Supplemental Environmental Impact Statement (SEIS) for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar was issued in April 2007, and the Record of Decision (ROD) was issued in August 2007 (DoN, 2007a; 2007b). Under the action, a maximum of four systems would be deployed in the Pacific-Indian ocean area and in the Atlantic-Mediterranean area. Of an estimated maximum 294 underway days per year, the SURTASS LFA sonar would be operated in the active mode about 240 days. During these 240 days, active transmissions would occur for a maximum of 432 hours per year per vessel. The duty cycle of the SURTASS LFA sonar would be limited (it would generally be on between 7.5 and 20 percent of the time [7.5 percent is based on historical LFA operations since 2003 and the physical maximum limit is 20 percent]). The LFA transmitters would be off the remaining 80 to 92.5 percent of the time (DoN, 2007a). The decision, as stated in the ROD, implemented Alternative 2 as the Preferred Alternative (DoN, 2007b).

Under Alternative 2, the SURTASS LFA sonar would be employed with geographical and seasonal restrictions to include maintaining sound pressure level below 180 dB within 12 nm (22 km) of any coastline and within the offshore biologically important areas that are outside of 12 nm (22 km). During the annual LOA process, the Navy will evaluate potential offshore biologically important areas within the proposed operating areas for each ship and incorporate restrictions, as required, into the LOA applications for NMFS's review and action. LFA sound fields will not exceed 145 dB within known recreational and commercial dive sites. Monitoring mitigation includes visual, passive acoustic, and active acoustic (high-frequency marine mammal monitoring [HF/M3] sonar) to prevent injury to marine animals when employing SURTASS LFA sonar by providing methods to detect these animals within the 180 dB LFA mitigation zone (DoN, 2007a).

The Final SEIS analyzed potential impacts to fish, sea turtles, marine mammals, and socioeconomics (commercial and recreational fishing, research and exploration activities, other recreational activities). Under Alternative 2, the potential impact on any stock of fish, sharks or sea turtles from injury was

considered negligible, and the effect on the stock of any fish, sharks or sea turtles from significant change in a biologically important behavior was considered negligible to minimal. Any auditory masking in fish, sharks or sea turtles is expected to be of minimal significance and, if occurring, would be temporary (DoN, 2007a). The potential impact on any stock of marine mammals from injury is considered to be negligible, and the effect on the stock of any marine mammal from significant change in a biologically important behavior is considered to be minimal. Any momentary behavioral responses and possible indirect impacts to marine mammals due to potential impacts on prey species are considered not to be biologically significant effects. Any auditory masking in mysticetes, odontocetes, or pinnipeds is not expected to be severe and would be temporary (DoN, 2007a). Further, there will be no significant impact to socioeconomic resources.

NMFS issued the Final Rule for the taking of Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to the U.S. Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar in August 2007 (NMFS, 2008a). NMFS has determined that the incidental taking of marine mammals resulting from SURTASS LFA sonar operations would have a negligible impact on the affected marine mammal species or stocks over the 5-year period of LFA sonar operations. That assessment is based on a number of factors: (1) The best information available indicates that effects from SPLs less than 180 dB will be limited to short-term Level B behavioral harassment averaging less than 12 percent annually for all affected marine mammal species; (2) the mitigation and monitoring is highly effective in preventing exposures of 180 dB or greater; (3) the results of monitoring as described in the Navy's Comprehensive Report supports the conclusion that takings will be limited to Level B harassment and not have more than a negligible impact on affected species or stocks of marine mammals; (4) the small number of SURTASS LFA sonar systems (two systems in FY 2008 and FY 2009 (totaling 864 hours of operation annually), 3 in FY 2010 (totaling 1296 hours of operation annually), and 4 systems in FY 2011 and FY 2012 (totaling 1728 hours of operation annually) that would be operating world-wide; (5) that the LFA sonar vessel must be underway while transmitting (in order to keep the receiver array deployed), limiting the duration of exposure for marine mammals to those few minutes when the SURTASS LFA sonar sound energy is moving through that part of the water column inhabited by marine mammals; (6) in the case of convergence zone propagation, the characteristics of the acoustic sound path, which deflect the sound below the water depth inhabited by marine mammals for much of the sound propagation (see illustration 67 FR page 46715 [July 16, 2002]); (7) the findings of the Scientific Research Program on low-frequency sounds on marine mammals indicated no significant change in biologically important behavior from exposure to sound levels up to 155 dB; and (8) during the 40 LFA sonar missions between 2002 and 2006, there were only three visual observations of marine mammals and only 71 detections by the HF/M3 sonar, which all resulted in mitigation protocol suspensions in operations. These measures all indicate that while marine mammals will potentially be affected by the SURTASS LFA sonar sounds, these impacts will be short-term behavioral effects and are not likely to adversely affect marine mammal species or stocks through effects on annual rates of reproduction or survival. In addition, mortality of marine mammals is not expected to occur as a result of LFA sonar operations (NMFS, 2008a). At this time, the Navy has no plans to employ SURTASS LFA in the GOMEX Study Area.

6.3.1.3 Naval Explosive Ordnance Disposal School Training

The mission of the Naval Explosive Ordnance Disposal School (NEODS) is to detect, recover, identify, evaluate, render safe, and dispose of unexploded ordnance that constitutes a threat to people, material, installations, ships, aircraft, and events. The NEODS facilities are located at Eglin AFB, Florida. The proposed training at Eglin involves recognizing ordnance, reconnaissance, measurement, basic understanding of demolition charges, and neutralization of conventional and chemical ordnance. MCM

detonation is one important function of NEODS, which involves mine-hunting and mine-clearance events (USAF, 2004b).

The NEODS proposes to use the Gulf of Mexico waters off SRI for a portion of the class. The NEODS would utilize areas approximately 1 to 3.45 mi offshore of Test Site A-15, A-10, or A-3 for MCM training. The students would be taught techniques for neutralizing mines by diving and hand-placing charges adjacent to the mines. The detonation of small, live explosive charges adjacent to the mine disables the mine function. Inert mines are utilized for training purposes. This training would occur offshore of SRI six times annually at varying times within the year (USAF, 2004b).

During training, five charges packed with C-4 explosive material will be set up adjacent to the mines. A charge contains a total net explosive weight of nearly 6 lbs, with C-4 comprising 5 lbs of the total. No more than five charges will be utilized over the two-day period. The five 5-lb C-4 charges will be detonated individually with a maximum separation time of 20 minutes between each detonation. The time of detonation will be limited to an hour after sunrise and an hour before sunset. MLOs/inert mines, Versatile Exercise Mine Systems (VEMs), and other expended materials will be recovered and removed from the Gulf of Mexico waters when training is completed (USAF, 2004b).

NEODS activities could potentially cause effects to geology, water quality, noise, biological and cultural resources, and artificial reefs. Detonations will likely disturb sediments and produce turbidity, but the effects are temporary and not considered significant. Activities conducted on or in the vicinity of sensitive habitats, such as natural or artificial reefs, could negatively affect the function of such structures as fish habitat. Cultural resources could also be damaged by the detonations or associated activities. However, environmental regulations require surveys for such resources, which should result in no effects.

C-4 is a common variety of military plastic explosive, and the explosive material RDX (also known as cyclonite or hexogen) makes up around 90 percent of C-4 by weight. According to the BO by NMFS concerning NEODS activities, bioaccumulation of RDX does not appear to be of concern in aquatic organisms, and there are no data to indicate biomagnification of RDX in fish and other animal tissues. RDX and any other chemical resulting from detonations would occur in extremely low concentrations and would be dispersed by wave and current action. The BO concludes that, although data are lacking, there appears to be no effects on sea turtles, marine mammals, or the marine environment in general.

Detonations would result in both pressure waves and noise in the marine environment. Effects to sea turtles and marine mammals could result from exposure to these metrics (USAF, 2004b, 2004c). The BO by NMFS included calculations of sea turtles potentially affected before and after mitigation measures. After the implementation of the required measures, a total of six sea turtles are expected to be affected (lethally and non-lethally) over a five-year period. The number of marine mammals potentially affected as estimated by Eglin AFB is summarized in Table 6.3-1. NMFS has approved an incidental take permit for NEODS activities allowing for 14 dolphin takes by harassment (NMFS, 2006c).

A request has been submitted to NMFS by Eglin AFB for the take of marine mammals by Level B harassment. In turn, NMFS has published a Federal Register notice requesting comments on its proposal to issue an incidental harassment authorization to the Air Force to take, by Level B harassment, two species of cetaceans at Eglin AFB beginning in October 2008. NMFS is also requesting comments on its intent to promulgate regulations in 2009 governing the take of marine mammals over a 5-year period. NMFS issued an IHA for these activities in 2005, 2006, and 2007. No activities have occurred to date (Federal Register, 2008a).

TABLE 6.3-1
NUMBER OF MARINE MAMMAL EXPOSED TO NOISE DUE TO NEODS ACTIVITIES

Species	Density (per km^2)	Number of Animals Exposed to Level A Harassment from 30 Detonations per Year	Number of Animals Exposed to Level B Harassment from 30 Detonations per Year
Summer			
Bottlenose dolphin	0.81	0.21	3.96
Atlantic spotted dolphin	0.677	0.18	3.30
T. truncatus/S. frontalis	0.053	0.01	0.27
TOTAL		**0.40**	**7.53**
Winter			
Bottlenose dolphin	0.81	0.21	4.02
Atlantic spotted dolphin	0.677	0.18	3.36
T. truncatus/S. frontalis	0.053	0.01	0.27
TOTAL		**0.40**	**7.65**

USAF, 2004b
km^2 = square kilometers; NEODS = Naval Explosive Ordnance Disposal School

6.3.1.4 Conversion of Two F-15 Fighter Squadrons to F-22 Fighter Squadrons at Tyndall AFB, Florida

The Air Force has identified the need to replace the F-15 aircraft with the new F-22 "Raptor" (USAF, 2000). Advantages of the F-22 include the use of stealth technology, sophisticated radar and electronic systems, and the ability to fly at supersonic speeds without using afterburners. The Air Force proposes to convert two of the three F-15 Fighter Squadrons at Tyndall AFB, Florida, to F-22 Fighter Squadrons. The conversion would occur over a five-year period with a continual reduction of F-15s lasting three or more years. This plan relies on a gradual transition of aircraft with the total number of aircraft stationed at Tyndall AFB slowly increasing to a maximum of 104 during FY 2008 and ending with a total number of 87 in FY 2011. At the end of the conversion, a single F-15 Fighter Squadron would remain at Tyndall. A total of 60 F-22s would ultimately be assigned to Tyndall AFB (USAF, 2000).

The introduction of a new aircraft would obviously require increased training sorties. The total number of sorties would increase by approximately 26 percent during the peak year (FY 2008). Starting at the end of the conversion (FY 2011), a 7 percent annual increase over current activities is anticipated. Around Tyndall AFB, the increase in airspace use is approximately three events per hour, and in the special use areas (military airspace), the increase averages approximately two sorties per day (USAF, 2000). Table 6.3-2 shows the estimated annual number of sorties throughout the conversion period.

TABLE 6.3-2
ESTIMATED ANNUAL NUMBER OF SORTIES ASSOCIATED WITH F-22 CONVERSION AT TYNDALL AFB

Aircraft	Current	Peak Year FY 2008	Changes in Sorties Current to Peak	End-State FY 2011	Changes in Sorties Current to End-State
F-15	16,688	8,783	-7,905	5,270	-11,418
F-22	0	12,222	+12,222	12,600	+12,600
Cumulative Total	**16,688**	**21,005**	**+4,317**	**17,870**	**+1,182**

Source: USAF, 2000

Two major airspace actions are proposed: (1) expanded utilization of currently used special airspace, and (2) expanded use of other available special use airspace in the region. The over-water airspace proposed for use includes W-470, W-151, and W-168 (USAF, 2000). The estimated annual number of sorties is summarized in Table 6.3-3.

TABLE 6.3-3
ESTIMATED ANNUAL NUMBER OF SORTIES BY AIRSPACE ASSOCIATED WITH F-22 CONVERSION AT TYNDALL AFB

Airspace	Baseline (FY 1998)	Peak (FY 2008)		End-State (FY 2011)	
	F-15	F-15	F-22	F-15	F-22
W-470 A	4,391	2,249	1,791	1,350	1,846
W-470 B	3,180	1,628	1,297	977	1,337
W-470 C	1,205	617	491	370	507
W-151 A,B	856	510	670	306	690
W-151 C,D	857	451	1,403	271	1,446
W-168	0	65	2,326	39	2,398
Total by Aircraft	**10,489**	**5,520**	**7,978**	**3,313**	**8,224**
Total by Year	**10,489**	**13,498**		**11,537**	

Source: USAF, 2000

F-22 training would result in an increase in the quantities of chaff and flares expended, the majority of which are expended over water ranges (USAF, 2000). As part of the program, the Air Force proposes to train pilots in the use of the internal aircraft gun. This would consist of shooting 20-mm inert training rounds at targets towed by an F-15 aircraft. The aerial gunnery training would occur only in W-470 and W-151. Tyndall currently does not utilize 20-mm training as part of F-15 training (USAF, 2000). The estimated quantities of chaff bundles, flares, and 20-mm rounds are shown in Table 6.3-4.

Increased noise produced in the Warning Areas is expected to be inconsequential (USAF, 2000). The resulting effects on air quality were estimated for Tyndall AFB and for Bay County for both the peak year and the end-state. The results are summarized in Table 6.3-5.

Training activities would result in extremely small (maximum of 0.04% of background in W-470) quantities of chemical elements such as aluminum and magnesium being added to the marine waters of the Gulf of Mexico. These additions are too small to affect Gulf of Mexico waters or any of the biological resources found there. The levels would be further reduced through the physical movements of tides, currents, waves, and wind, which serve to disperse chemical materials (USAF, 2000). In addition, there is a potential for increased noise levels within the W-470 area. However, based on the location of Tyndall AFB and its proximity to the Gulf of Mexico, the majority of flights, including takeoffs and landings, would not occur over populated areas.

TABLE 6.3-4
ESTIMATED ANNUAL NUMBER OF CHAFF AND FLARE EXPENDITURES ASSOCIATED WITH F-22 CONVERSION AT TYNDALL AFB

Airspace	Baseline (FY 1998)		Peak Year (FY 2008)			End-State (FY 2011)		
	Chaff	Flares	Chaff	Flares	20 mm	Chaff	Flares	20 mm
W-470 A	128,042	64,021	91,882	45,941	45,967	72,682	36,341	45,967
W-470 B	92,717	46,359	66,533	33,266	45,967	52,630	26,315	45,967
W-470 C	35,146	17,573	25,221	12,610	4,086	19,950	9,975	4,086
W-151 A,B	24,970	12,485	26,819	13,410	3,065	22,655	11,327	3,065
W-151 C,D	24,984	12,492	42,164	21,082	3,065	39,048	19,524	3,065
W-168	0	0	54,382	27,191	0	55,423	27,711	0
Over-water Total	**305,859**	**152,930**	**307,001**	**153,500**	**102,150**	**262,388**	**131,193**	**102,150**

Source: USAF, 2000; mm= millimeter

TABLE 6.3-5
ESTIMATED EFFECTS ON AIR QUALITY ASSOCIATED WITH F-22 CONVERSION AT TYNDALL AFB

Category	Pollutant (% Change)					
	CO	NO2	PM10	SO2	Pb	VOCs
Tyndall Peak Year (FY 2008) Change	-7.10%	46.42%	10.59%	17.84%	20.00%	-24.90%
Bay County Peak Year Change	-0.07%	1.34%	0.20%	0.01%	-	-0.52%
Tyndall End-State (FY 2011) Change	-23.93%	30.69%	0.14%	1.90%	20.00%	-42.15%
Bay County End-State Change	-0.25%	0.89%	0.00%	0.00%	-	-0.88%

Source: USAF, 2000
CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter less than 10 microns in diameter; SO_x = sulfur oxides; Pb = lead; VOC = volatile organic compound

6.3.1.5 B61 Joint Test Assembly Weapons Systems Evaluation Program

The B61 is a thermonuclear, lightweight bomb approximately 141.6 inches long and 13.3 inches in diameter with an average weight of 750 pounds. Air Combat Command has requested the use of Eglin AFB as an alternative to the Department of Energy's (DOE) Tonopah Test Range for conducting B61 Joint Test Assembly Weapons Systems Evaluation Program flight tests (DoN, 2008a). The military has nuclear weapons in active inventory, which are full-up weapons ready for use, called war reserve (WR) nuclear weapons. Every year a certain number of these WR nuclear weapons are randomly selected to be shipped to a DOE production facility where selected parts from those WR weapons are used to build a Joint Test Assembly (JTA). The JTAs are then flight tested to assess the performance of the WR parts. Each JTA retains as many of the WR components as possible including portions of the explosive package, but no JTA configuration is capable of providing a nuclear detonation (DoN, 2008a).

The goal for the testing is high-speed, low- and high-altitude release on Test Area (TA) B-70 (DoN, 2008a). The desired target will be a 300 x 300 foot concrete pad constructed on TA B-70. Additional testing would include a shallow-water drop in the Gulf of Mexico (W-151 in less than or equal to 50-foot depth). Aircraft drop JTAs during flight following a predetermined altitude (500 to 6,000 ft) as directed by Flight Safety. The JTAs would be immediately removed after each test. Therefore, other on-site assets may include chase boats used in the retrieval of the JTA from the Gulf of Mexico target drop areas (DoN, 2008a). The preferred testing scenario involves one JTA drop every two years for each profile on both TA B-70 and W-151 (Table 6.3-6).

TABLE 6.3-6
JTA WSEP FLIGHT TEST PROPOSED ACTION (PER TWO-YEAR PERIOD)

Profile	B-70	EGTTR W-151 Shallow-Water Drop
Freefall Air (FFA) – parachute	1	1
Retarded Ground (REG) – parachute	1	1

Source: DoN, 2008b
EGTTR = Eglin Gulf Test and Training Range; JTA = Joint Test Assembly; WSEP = Weapons Systems Evaluation Program

The chemical materials of interest for the B61 JTA testing are depleted uranium, thermal batteries, neutron generators, and other hazardous materials and explosives. All other explosives and hazardous materials contained in the B61 JTA are classified Secret and cannot be identified or discussed in detail (DoN, 2008b).

These activities may potentially affect water quality and biological resources (protected species) (DoN, 2008b). Although the B61 JTA spin rocket and motor would produce explosion products that may enter Gulf of Mexico waters, these amounts are minimal and are not expected to produce any environmental effects. The B61 JTA would be immediately retrieved upon entry into the Gulf of Mexico, and the neutron generator should remain intact. Calculations regarding the possible direct physical strike of a protected marine animal suggest that only 0.000045 dolphins and 0.00000895 sea turtles would be affected per test. These numbers are so low as to be discountable (DoN, 2008b).

6.3.1.6 Fiber Optic Cable Installation

There is a proposal for Eglin AFB to partner with Gulf Fiber Corp. and the Navy to bring an armored fiber optic cable from the Gulf of Mexico to either Panama City, Florida, or Eglin property on SRI (USAF, 2004a). If the cable goes to Eglin property, it would be run to Test Site A-3, and from there would be connected to the AT&T backbone near U.S. Highway 98.

Gulf Fiber Corp. is developing a fiber network between production oil platforms off Texas, Louisiana, Mississippi, and Alabama, and would provide the military with fiber conductivity into the Gulf of Mexico. This capability would support joint Gulf Test and Training Range operations (USAF, 2004a). Figure 6.3-1, Figure 6.3-2, and Figure 6.3-3 show the current fiber optic ring, a proposed pathway from an oil platform to A-3, and possible future routes.

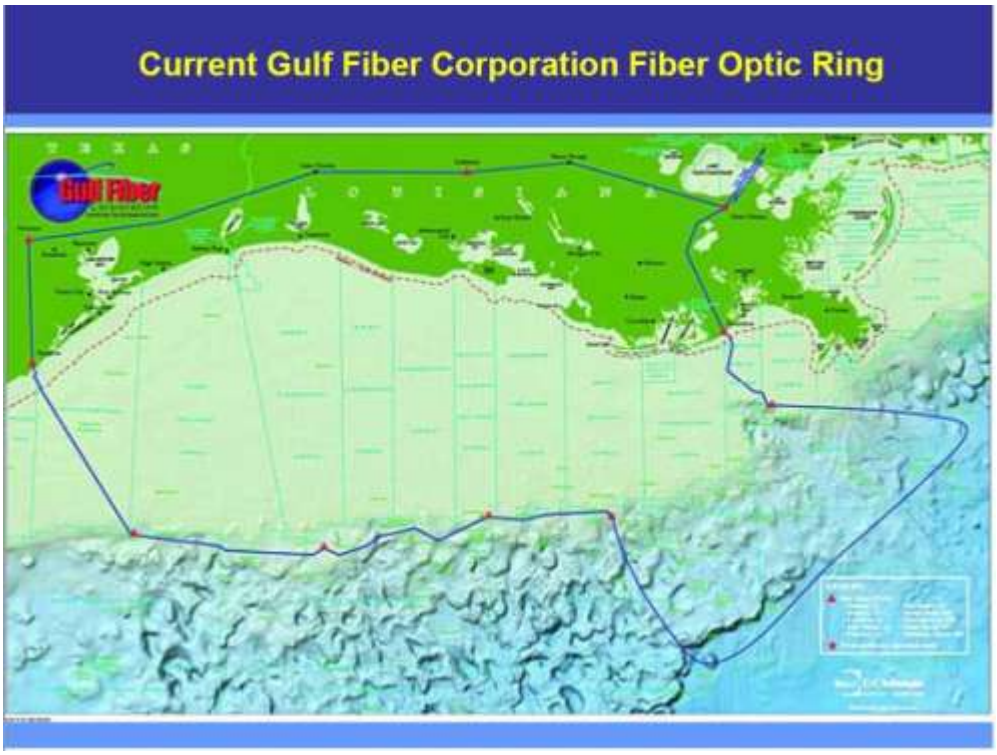

Figure 6.3-1 Existing Fiber Optic Ring in the Gulf of Mexico
Source: USAF, 2004a

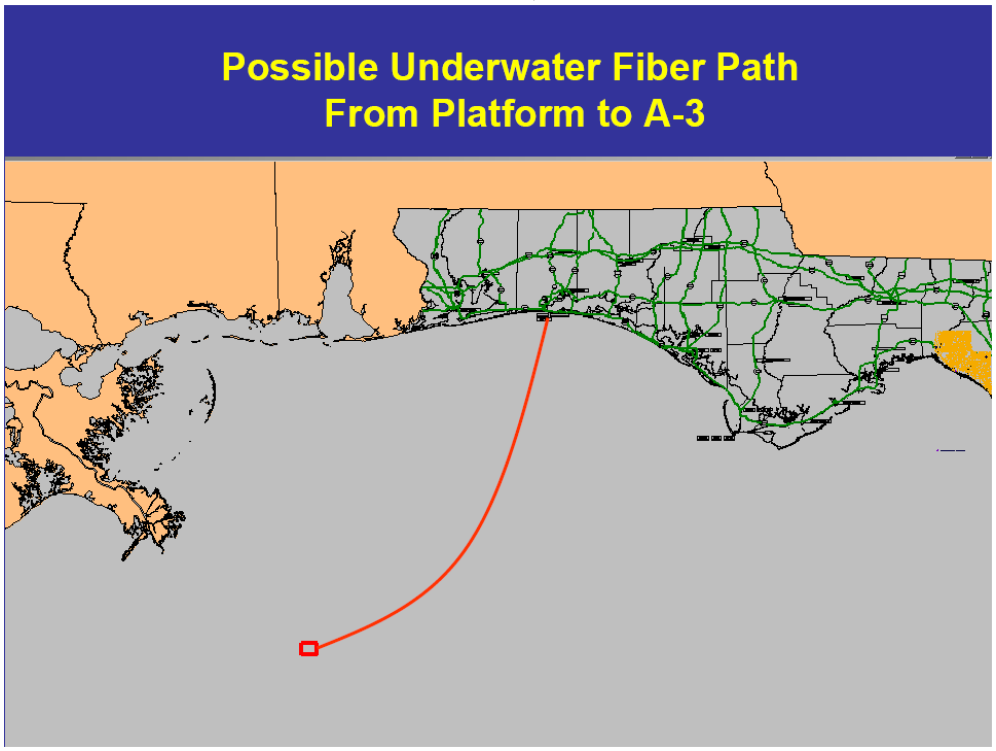

Figure 6.3-2 Proposed Fiber Optic Cable Pathway from Oil Platform to A-3
Source: USAF, 2004a

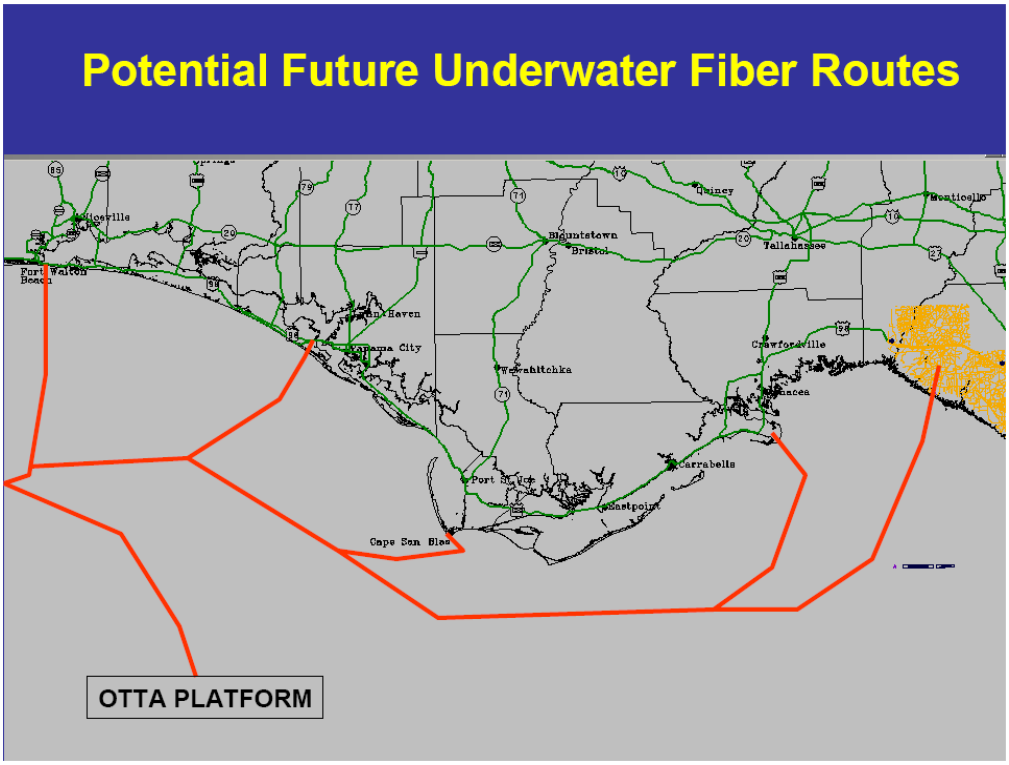

Figure 6.3-3 Potential Future Fiber Optic Cable Pathways

Source: USAF, 2004a

Resources potentially affected by the cable installation include geology, biological resources, and cultural resources (USAF, 2004a). Installation of the cable would necessitate the disturbance of the sea floor for relatively long distances. The proposed pathways could intersect with EFH, artificial reefs, and submerged cultural resources (USAF, 2004a).

6.3.1.7 Proposed Implementation of the Base Realignment and Closure 2005 Decisions and Related Actions at Eglin Air Force Base, Florida

The U.S. Air Force, in cooperation with the Army, Navy, and Marines have published the Draft Environmental Impact Statement (March, 2008) for the proposed implementation of the Base Realignment and Closure (BRAC) 2005 Decisions and Related Actions at Eglin AFB, Florida. The proposed action is to implement the 2005 BRAC Report decisions by relocating the 7th Special Force Group (Airborne) to Eglin AFB and conducting joint initial graduate-level pilot training in the Joint Strike Fighter (JSF) for the Navy, Marines, and Air Force at Eglin AFB. The proposed action would result in a group of new missions at Eglin AFB, mandated by implementation of the BRAC Commission decisions, which would create significant growth in Eglin's personnel and military activities over the next several years.

Flight training activities associated with the JSF would include flying operations and ordnance use. The EIS analyzes potential impacts associated with airspace, noise, land use, socioeconomics and environmental justice, transportation, utilities, air quality, safety, solid waste, hazardous materials and hazardous waste, physical resources, biological resources, and cultural resources. The EIS identifies mitigations and best management practices that the proponent (the U.S. Air Force) would implement to minimize or offset potential adverse impacts. After considering the potential environmental consequences analyzed for the alternatives, the U.S. Air Force will decide whether to implement the Air

Force Preferred Alternative or another of the alternatives. The No Action Alternative cannot occur because the BRAC Commission decisions are legally mandated (USAF, 2008a).

The partial Record of Decision for the Final BRAC EIS published on February 9, 2009 stated that a Supplemental EIS was under development and expected in September 2010. Additionally, the Air Force decisions to beddown 59 F-35 Primary Assigned Aircraft (PAA), implement associated cantonment construction and limited flight training operations. Decision regarding the beddown of additional aircraft has been deferred pending completion of the SEIS (USAF, 2009).

6.3.1.8 United States Navy Restricted Area, Panama City, Florida

The U.S. Army Corps of Engineers is establishing ten restricted areas at Naval Support Activity, Panama City, Florida. A majority of military (multi-service) dive training is concentrated at Naval Support Activity where the restricted areas in Panama City waters meet strict military training parameters that cannot be duplicated elsewhere. While the military training in and around St. Andrews Bay has existed in harmony with local boat traffic and development since 1945, these on-going military activities within the waters of St. Andrews Bay are being formalized to preserve current military training and maximize public safety. To achieve this formalization, the Corps of Engineers is establishing ten separate restricted areas where military activities currently occur. The "restricted" areas would be temporarily unavailable to the public during periods of military training activities. This is a continuation of existing training and not an increase in restriction of the area (Federal Register, 2008b).

6.3.1.9 Safety Zone, Perdido Regional Host Outer Continental Shelf Platform in the Gulf of Mexico; Interim Rule

The Eighth Coast Guard District is headquartered in New Orleans and covers all or part of 26 states throughout the Gulf Coast and heartland of America. Annually the Coast Guard is involved in over 6,000 search and rescue cases, assists over 7,000 mariners, saves over 37 million dollars in property, responds to over 4,000 marine environmental pollution incidents and conducts more than 1,500 law-enforcement boardings. The district protects 1,200 miles of coastline and 10,300 miles of inland navigable waterways located in their area of responsibility. The district is home to 54 vessels (USCG, 2008).

The Coast Guard is establishing a safety zone around the Perdido Regional Host gas platform. The platform needs to be protected from vessels operating outside the normal shipping channels and fairways. Placing a safety zone around the platform will significantly reduce the threat of allisions, oil spills, and releases of natural gas. The safety zone established by this regulation is in the deepwater area of the Gulf of Mexico; 1,000 ft (304.8 m) or greater depth extending to the limits of the Exclusive Economic Zone (EEZ) contiguous to the territorial sea of the United States and extending to a distance up to 200 nautical mi from the baseline from which the breadth of the sea is measured. Navigation in the area of the safety zone consists of large commercial shipping vessels, fishing vessels, cruise ships, tugs with tows and the occasional recreational vessel. The deepwater area also includes an extensive system of fairways. Entry into this zone is prohibited unless specifically authorized by the Captain of the Port Corpus Christi or a designated representative (Federal Register, 2009b).

6.3.1.10 Air-to-Surface Gunnery Exercises within the Eglin Gulf Test and Training Range (EGTTR)

The NMFS has issued an IHA (Dec 2008) for Level B harassment to take marine mammals incidental to conducting air-to-surface gunnery exercises within the EGTTR. The Authorization is valid December 11, 2008 to December 11, 2009. The Authorization is valid only for activities associated with air-to-surface gunnery exercises utilizing gunnery rounds of 25-mm, 40-mm, 105-mm Full-Up, and 105=-mm

Training Round containing 0.0662 lb, 0.865 lb, 4.7 lb and 0.34 lb of explosive, respectively (NMFS, 2008c/d.

6.3.1.11 Construction of Joint Improvised Explosive Device Defeat Organization (JIEDDO) Battle Course at Camp Keller Range, Biloxi, Mississippi

The Navy prepared an Environmental Assessment to assess the proposed action for developing a training facility to provide realistic, accurate, and up-to-date counter-Improvised Explosive Devices (IED) training support to deploying service members adjacent to the existing Camp Keller Small Arms Range (DoN, 2009a). The Finding of No Significant Impact was signed on September 28, 2009. The Range is an outdoor firing range that is used to qualify personnel that are preparing for deployment overseas. JIEDDO's initiatives are designed to help maximize combat personnel capabilities that include technical and forensic exploitation of devices, explosives detection, and IED-specific pre-deployment training for Service personnel.

The JIEDDO Battle Course is on U.S. Forest Service land in Harrison County at Camp Keller Biloxi, Mississippi (See Figure 6.3-4). Components of the proposed action and Alternatives are primarily a 2,500 square foot facility and a system of roadways to use for training.

Figure 6.3-4 Camp Keller and Vicinity

6.3.1.12 Proposed Establishment of the Meridian 2 Military Operations Area at Naval Air Station Meridian, Mississippi

A proposed action is under development to establish and utilize a new Military Operations Area (MOA) proximate to NAS Meridian, Mississippi. The proposed airspace would have a designed altitude of 8,000 feet MSL to 17,999 MSL and would be divided into two sections; a northeastern block, referred to as Meridian 2 East and a southwestern block referred to as Meridian 2 West. The proposed MOA would be approximately 25 miles southwest of NAS Meridian. The purpose of the proposed action is to establish a new MOA where naval aviators at NAS Meridian can complete their required readiness training and ensure that mission capabilities are sustained. The need for the proposed action is to support the increase in aircraft sorties that is required as a result of a recent change in the Navy's pilot training syllabus. This change will require the Training Air Wing One (TW-1) to increase the number of annual T-45C aircraft sorties from 32,000 to 37,000; which will saturate the existing Meridian 1 MOA. In addition, airspace areas where TW-1 currently conducts training are projected to see an increase in sorties from other military installations. TW-1 proposes to execute as many as 800 sorties per month in the Meridian 2 MOA.

6.3.1.13 U.S. Army Corps of Engineers

6.3.1.13.1 Environmental Impact Statement (EIS) for the Southwest Coastal Louisiana Feasibility Study for Calcasieu, Cameron and Vermillion Parishes, Louisiana

The United States Corps of Engineers (USCOE) has published an NOI to prepare an EIS for the Southwest Coastal Louisiana Feasibility Study for Calcasieu, Cameron and Vermilion Parishes, Louisiana. The USCOE will evaluate a full suite of structural, nonstructural and coastal restoration measures to achieve hurricane protection and storm damage risk reduction within Calcasieu, Cameron and Vermilion Parishes in Louisiana. The study area is highly susceptible to flooding from tidal surges associated with hurricanes and tropical storms due to its close proximity to the Gulf of Mexico (Federal Register, 2009c).

6.3.1.13.2 Supplemental Environmental Impact Statement (SEIS) to Evaluate Construction of Authorized Improvements to the Gulfport Harbor Federal Navigation Project in Harrison County, Mississippi

The Mobile District USCOE has published a NOI to prepare a SEIS to address the potential impacts associated with construction of authorized improvements to the Federal Gulfport Harbor navigation project in Harrison County, Mississippi. The proposed action includes widening the Federally authorized Mississippi Sound channel to 300 ft and the Bar Channel to 400 ft. Additionally, disposal of the associated dredged material would be placed beneficially in water depths of 25 ft or greater east of the Chandeleur Islands and material dredged from within the Ship Island Pass (littoral zone) would be placed in the existing littoral zone disposal area in water depths between 14 ft and 18 ft. Future maintenance material dredged from the navigation channel would be placed in open-water sites within Mississippi Sound utilizing thin-layer disposal methods, the existing littoral zone disposal area, and within the existing Ocean Dredged Material Disposal Sites (Federal Register, 2009d).

6.3.1.13.3 Notice of Availability (NOA) of the Draft Comprehensive Plan and Integrated Programmatic Environmental Impact Statement (EIS) for the Mississippi Improvements Program, Jackson, Harrison, and Hancock Counties, Mississippi

The USCOE has announced the notice of availability for a Draft Comprehensive Plan and Integrated Programmatic EIS for the Mississippi Coastal Improvements Program for Jackson, Harrison, and Hancock Counties. The EIS proposed actions address the potential impacts associated with actions to

comprehensively address hurricane and storm damage reduction, prevention of salt water intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes in coastal Mississippi. The tentatively selected plan elements for construction include ecosystem restoration of the barrier islands, mainland beaches, and sites at Admiral Island, Turkey Creek, Dantzler, Bayou Cumbest, Franklin Creek, Deer Island, and submerged aquatic vegetation in Bayou Cumbest which will restore approximately 3,210 acres of emergent tidal marsh, wet pine savannah, scrub/shrub, submerged aquatic vegetation, and beach and dune habitats. The draft plan recommends selected flood damage reduction elements, including Forrest Heights Levee, High Hazard Risk Reduction Plan Phase I, Waveland Flood Proofing Pilot Projects, and Moss Point Municipal Facility relocation (Federal Register, 2009e).

6.3.2 Other Federal and State Agency Actions

6.3.2.1 Safety Zone, Perdido Regional Host Outer Continental Shelf Platform in the Gulf of Mexico; Interim Rule

The Eighth Coast Guard District is headquartered in New Orleans and covers all or part of 26 states throughout the Gulf Coast and heartland of America. Annually the Coast Guard is involved in over 6,000 search and rescue cases, assists over 7,000 mariners, saves over 37 million dollars in property, responds to over 4,000 marine environmental pollution incidents and conducts more than 1,500 law-enforcement boardings. The district protects 1,200 miles of coastline and 10,300 miles of inland navigable waterways located in their area of responsibility. The district is home to 54 vessels including 210-foot medium endurance cutters; 87-foot patrol boats, river tenders, a 225-foot buoy tender, 175-foot coastal buoy tenders; and 64-foot self-propelled barges. (USCG, 2008).

The Coast Guard is establishing a safety zone around the Perdido Regional Host gas platform. The platform needs to be protected from vessels operating outside the normal shipping channels and fairways. Placing a safety zone around the platform will significantly reduce the threat of allisions, oil spills, and releases of natural gas. The safety zone established by this regulation is in the deepwater area of the Gulf of Mexico; 1,000 ft (304.8 m) or greater depth extending to the limits of the Exclusive Economic Zone (EEZ) contiguous to the territorial sea of the United States and extending to a distance up to 200 nautical mi from the baseline from which the breadth of the sea is measured. Navigation in the area of the safety zone consists of large commercial shipping vessels, fishing vessels, cruise ships, tugs with tows and the occasional recreational vessel. The deepwater area also includes an extensive system of fairways. Entry into this zone is prohibited unless specifically authorized by the Captain of the Port Corpus Christi or a designated representative (Federal Register, 2009b).

6.3.2.2 Onshore and Offshore Liquefied Natural Gas Facilities

Liquefied natural gas (LNG) is natural gas that has been cooled about -260 °F until the gas is in its liquid form. When natural gas is liquefied, it decreases to 1/600 of its original volume, which makes it ideal for shipping (Federal Energy Regulatory Commission [FERC], 2005). LNG is transported to LNG terminals by tankers equipped with insulated walls and systems to keep the LNG in liquid form. Once LNG is unloaded from ships at LNG terminals, it is stored as a liquid until it is warmed to convert it back to natural gas. The natural gas is then sent through pipelines for distribution (FERC, 2005).

LNG is odorless, colorless, non-toxic, and will not burn as a liquid. LNG vapors will not explode in a confined environment and are only flammable at concentrations of 5 to 15 percent with air (FERC, 2005). This makes LNG relatively harmless unless vapors are at flammable concentrations around an ignition source.

FERC, the United States Coast Guard (USCG) and the Maritime Administration (MARAD) regulate LNG facilities. LNG facilities that lie within state waters are regulated by FERC per the Energy Policy

Act of 2005. The USCG and MARAD have jurisdiction over the LNG facilities within federal waters under the Federal Deepwater Ports Act of 1974 (FERC, 2006).

6.3.2.2.1 Eastern Gulf of Mexico

There are currently no existing or proposed and approved FERC or MARAD/USCG-regulated LNG terminals in the eastern Gulf of Mexico. However, two terminals, one off the western coast of Florida and the other in the eastern Gulf of Mexico, have been proposed to MARAD/USCG and are awaiting a decision (FERC, 2007).

6.3.2.2.2 Western Gulf of Mexico

The western Gulf of Mexico is the only region in which a MARAD/USCG-regulated LNG terminal (Gulf Gateway Energy Bridge - Excelerate Energy) has been constructed (FERC, 2007). Two proposed LNG terminals, one offshore Louisiana and the other at Port Pelican, have been approved for construction by MARAD/USCG (FERC, 2007).

6.3.2.3 Minerals Management Service Regulated Activities: Explosive Removal of Offshore Oil and Gas Structures

There are nearly 4,000 offshore oil and gas platforms in the Gulf of Mexico and within one year of lease termination they must be removed from the outer continental shelf. The structures must be severed at least 5 m (15 ft) below the surface of the seafloor. This removal typically involves the use of explosives. In accordance with the MMPA, the ESA, and implementing regulations, NMFS has issued one year Letter of Authorizations (LOAs) to take marine mammals incidental to the explosive removal of offshore oil and gas structures in the Gulf of Mexico. The first LOA is effective from February 27, 2009 through February 26, 2010 (Federal Register, 2009f).

6.3.2.4 Minerals Management Service Regulated Activities: Alternative Energy Development (Offshore Wind, Wave, and Ocean Current Energy Capture)

The U.S. DOI, Minerals Management Service, released a final programmatic EIS in support of the establishment of a program for authorizing alternative energy and alternate use activities on the OCS, as authorized by Section 388 of the Energy Policy Act, and codified in subsection 8(p) of the Outer Continental Shelf Lands Act. The final programmatic EIS examines the potential environmental effects of the program on the OCS and identifies policies and best management practices that may be adopted for the program.

Offshore wind farms are being used in a number of countries to harness the energy of the moving air over the oceans and converting it to electricity. At present, the only wind farms worldwide are located off the coasts of Europe in waters 98 ft deep or less. These wind farms currently harness just over 600 megawatts (MW) of offshore wind energy. However, offshore wind projects proposed worldwide through 2010 would produce more than 11,000 MW. Of these proposed projects, wind farm energy production in the United States would amount to roughly 500 MW (MMS, 2007b). With the passage of the EPAct, the MMS was given jurisdiction over offshore alternative energy projects, including wind farms (MMS, 2007b).

Construction and everyday operation of offshore wind farms have the potential to affect several environmental resources, especially biological resources. Potential effects might include bird collisions with rotors or towers, increases in underwater noise due to construction and operational vibrations, creation of underwater electromagnetic fields, and sea floor alterations due to installation (MMS, 2007b).

6.3.2.4.1 Eastern Gulf of Mexico

There are currently no proposed wind farm activities in this area.

6.3.2.4.2 Western Gulf of Mexico

Galveston-Offshore Wind, LLC Wind Farm, Galveston, Texas - The Texas coast in the GOMEX is estimated to have a fair wind resource potential. Given this potential and the support in communities for the energy industry in general, two companies have proposed offshore wind farm projects in waters offshore of the Texas coast. They include a 150 MW wind farm located about 11 km (5.9 NM) off of Galveston Island, Texas and a 500 MW wind farm located between 4 and 13 km (2.2 and 7 NM) off the coast of Padre Island. MMS would regulate the proposal submitted by Galveston-Offshore Wind, LLC, while the State of Texas would regulate the proposal submitted by Superior Renewable Energy, LLC. The 30-year lease at the Galveston site would include 50 turbines over approximately 46 km^2 (18 mi^2). This site would produce electricity equivalent to the amount of energy produced by 20.7 million barrels of oil. The wind farm off of Padre Island is expected to have more than 100 turbines over 161 km^2 (62 mi^2) and would generate the energy equivalent to burning 69 million barrels of oil. An EIS for this particular project is currently being developed (DoN, 2008a).

Superior Renewables Wind Farm, Padre Island, Texas - Superior Renewable Energy LLC has proposed the construction of a wind farm 3 to 8 mi off the coast of Padre Island, south of Baffin Bay. Superior Renewable Energy LLC was granted a 30-year land lease from the State of Texas for 39,900 offshore acres (Texas General Land Office [TGLO], 2006). Because the wind farm would be located in State waters, the State of Texas would regulate all activities, not the MMS. It is estimated that over 100 turbines will be installed to produce 500 MW of electricity (Washington Post, 2006). The amount of energy produced over the course of the 30-year lease by this wind farm would be equivalent to the amount of energy produced by burning 69 million barrels of oil. Due to the proposed wind farm location within state-regulated waters, it would be regulated by the State of Texas, not the MMS. Environmental concerns raised in regard to development of this wind farm have dealt with the possibility of bird strikes and effects on bird migration patterns (TGLO, 2006).

6.4 DISCUSSION OF CUMULATIVE IMPACTS RELATIVE TO THE PROPOSED ACTION

6.4.1 Assessing Proposed Action Impacts

Where feasible, the cumulative impacts were assessed using quantifiable data. However, quantifiable data were not always available; this analysis utilized qualitative information where necessary. For example, commercial shipping, commercial and recreational fishing except for the Fishery Management Plans (FMPs) that are developed by the Regional Fishery Management Councils (RFMCs) and implemented by NMFS, boating, and other activities occurring are not required to comply with NEPA or analyze potential impacts; therefore, there is little to no analysis data available for these activities. Since a quantitative analysis of potential impacts for these areas is not possible; qualitative information, such as known marine species injuries or deaths was used as appropriate. In addition, since an analysis of potential environmental impacts for future actions (identified in Section 6.3) has not been completed, assumptions based on past actions were used.

Cumulative impacts resulting from sonar training were assessed using the conclusions from the AFAST Final EIS/OEIS. Potential impacts to resources are identified in the following sections. All past, present, and reasonably foreseeable future military activities described in this chapter are grouped together under Military Operations. It should be noted that the individual military actions tend to impact different resources, and when grouped together should not be interpreted to mean that each military activity would impact all resources.

6.4.2 Bathymetry and Sediments

In the marine environment, bathymetry is the water depth and ocean bottom topography. This section also reviewed impacts to marine sediments (sand, organic matter, and minerals that accumulate at the bottom of a body of water).

6.4.2.1 GOMEX Final EIS/OEIS Conclusions

The primary effect of the Navy's training activities in the GOMEX Study Area would be the deposition of expended training materials and their accumulation over time.

- No explosive filled ordnance is currently authorized for the McMullen County Range. Training consists of dropping approximately 2,636 non-explosive practice munitions and expending 25,000 cannon rounds annually at the Yankee Target. The entire Yankee Target configuration is contained within a 1,000-ft diameter circle. On the Dixie Target approximately 1,433 non-explosive practice munitions would be dropped. The entire Dixie Target configuration is contained within a 600-ft diameter circle. About 29,069 training items would be expended under the No Action Alternative (see Table 2.2-8). This results in localized soil disturbance at the target areas. Expended munitions are cleared as part of range maintenance. This clearance of expended materials is considered "low disturbance" as only the surface expended munitions are removed. Because of this range maintenance, the concentration of expended munitions would have a less than significant effect on soil.
- No explosive-filled ordnance is currently authorized for the SEARAY Target at the Noxubee County Range. Training consists of dropping approximately 21,045 non-explosive practice munitions at the target per year (see Table 2.2-8). The entire target configuration is contained within a 750-ft diameter circle. This results in localized soil disturbance at the target. Expended munitions are cleared as part of range maintenance. This clearance is considered "low disturbance" as only the expended munitions are removed. Because of this range maintenance, the concentration of expended munitions would have a less than significant effect on soil.
- Basic flight instruction and mission training occur in Meridian, Pine Hill, Pensacola, Kingsville, and Brownwood MOAs. Other than the expenditure of chaff and flares, no ordnance is used in these MOAs and therefore there would be no impact on soils and sediments from training in the MOAs.
- Training at the Demolition Pond consists of detonating underwater explosive charges. Localized bottom effects occur when the force of the blast wave disturbs the bottom soil and vegetation. Similar to the disturbances in the ocean OPAREAs, detonations would have localized effects.

When the potential impacts due to sonar activities (to include AFAST expended materials and Improved Extended Echo Ranging [IEER] explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there will be no significant impact to bathymetry or sediments in territorial waters due to expended material or sediment displacement. In addition, there will be no significant harm to bathymetry or sediments in non-territorial waters due to expended material or sediment displacement for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.2.2 GOMEX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Marine debris comes from a variety of land-based and ocean sources (Laist *et al.*, 1999). In addition to trash that finds its way into the marine environment, discarded or lost fishing gear is also an issue of concern for accumulating item on the ocean floor. Civilian and commercial recreational activities (e.g.,

recreational/commercial fishing, and cruise ship operations) contribute to these potential impacts to bathymetry and sediments in the Study Area by adding foreign materials to the environment that eventually accumulate on the ocean bottom. These foreign materials may not have even entered the environment in the Gulf of Mexico since ocean currents have the ability to move materials for great distances.

In the marine environment, the analysis of all current and proposed operations indicates any expending of military materials at sea, over a long period of time, can cause potential incremental impacts to sediment quality. However, the at-sea Study Area is vast and chemical releases from decaying debris would rapidly dilute in the water; thus, accumulation of chemicals in sediments is not likely to occur. Therefore, it is expected that although there would be a potential for minor incremental, but recoverable, cumulative impacts, these impacts would not be considered significant as they would be localized and temporary.

The accumulation of materials settling on the ocean bottom would be covered by sediment deposition over time. With regard to the direct, indirect, and cumulative impacts of the proposed action, impacts are expected to be temporary in the marine environment. Most of the materials would be harmless, but some would consist of metals such as lead. However none of the materials accumulating at these densities would measurably affect sediment quality. Thus, the concentration of training military expended materials in U.S. Territory would have no significant impact on bottom topography and sediment quality.

During MMS exploratory activity, platform installation and removal, discharges of drilling muds and cuttings during the drilling of exploration and development wells, pipeline installation, maintenance dredging of navigational canals, and vessel traffic temporary sediment disturbance and temporary increase of turbidity can be expected on a minor and localized scale (MMS, 2008c).

The analysis of all current and proposed operations indicates any debris at sea, over a long period of time, can cause potential incremental impacts to sediment quality. However, the Study Area where the proposed action for the Alternatives previously described in this chapter are proposed to occur is vast and chemical releases would rapidly dilute in the water; thus, accumulation of chemicals in sediments is not likely to occur. Therefore, it is expected that although there would be a potential for minor incremental, but recoverable, adverse cumulative impacts, these impacts would not be considered significant as they would be localized and temporary. No significant cumulative impacts to sediments from expended materials in territorial waters are anticipated from the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to bathymetry and sediments in non-territorial waters is expected as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.3 Hazardous Materials/Hazardous Waste

This section covered hazardous materials which include petroleum products, missiles, munitions, and targets. However, military munitions (virtually all missiles, munitions, and targets) are not considered hazardous waste when used for their intended purpose, which includes training of military personnel and research and development activities. This includes virtually all missiles, munitions, and targets used at the GOMEX Study Area.

Non-hazardous expended material were also discussed under this resource area and are defined as parts of a device that are made of non-reactive materials, including parts made of steel or aluminum, polymers (*e.g.*, nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent accumulate on the seafloor, their strong resistance to degradation and their chemical

composition mean that they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.

Military expended materials (MEM) are all the materials that the Navy uses in training and testing that are not recovered at or before the end of an event. These materials include non-explosive practice munitions, remains of high explosives, training targets, chaff, remains of flares, and other material sometimes referred to as debris.

Hazardous material, waste, and MEM used and generated during the GOMEX Study Area operations would be managed in accordance with applicable federal and state regulations, and DoD service guidelines. Any spills or mishaps would be handled pursuant to all applicable federal and state laws, and DoD regulations.

6.4.3.1 GOMEX Final EIS/OEIS Conclusions

In the marine environment, MEM that sinks to the sea floor would gradually degrade, be overgrown by marine life, and/or be incorporated into the sediments. Military munitions are not considered hazardous waste when used for their intended purpose, which includes training of military personnel and research and development activities. Floating non-hazardous expended material may be lost from target boats and would either degrade over time or wash ashore as flotsam. The combustion products from the detonation of high explosives are commonly found in sea water. Initial concentrations of explosion by-products are not expected to be hazardous to marine life and would not accumulate in the area training because exercises are spread out over time and the chemicals would rapidly disperse in the ocean.

- Underwater explosions would occur during training at the Panama City Demolition Pond, where four types of training exercises occur. The Demolition Training Pond, Naval Support Activity, Panama City is a facility that conducts underwater testing of small explosive devices (charges range from 1 ¼-lb to 5-lb TNT equivalent. Frequency of detonation will be 2 to 4 per month with 1 or 2 devices detonated per occasion. Annual Net Explosive Weights (NEW) used for the Demolition Pond are shown on Table 3.2-6, using 5-lb charges for the calculation of annual NEW (actual amounts of charges used at the Demolition Pond are slightly less than 5-lbs.). Exercises would be conducted 90 days per year. The Demolition Pond is protected on three sides by shoreline that results in a reduction of wave action. Therefore, a more rapid accumulation of component hazardous materials and other hazardous materials can be expected in the Demolition Pond than in open ocean waters. The chemical contamination effects would be negligible due to daily tides that result in some dispersal of chemicals over time and the infrequency of the exercises (90 days per year), and would result in no significant impacts or harm.
- Ground (inland) targets (Yankee, Dixie, and SEARAY targets) are used at McMullen County and Noxubee County Ranges. Practice bombs are allowed on all three targets, but strafing runs are allowed only at the Yankee Target. The facilities consist of a bull's-eye target, and practice bomb targets such as buses, tanks, convoys, aircraft engine canisters, and boxes. Most of the ranges are surrounded by ranch lands. The targets are not completely destroyed or expended, because only non-explosive practice ordnance is used at these ranges. EOD on the McMullen Bombing and Gunnery Range is the responsibility of the Navy and is conducted twice per year. EOD personnel inspect and neutralize any unspent spotting charges on the recovered practice munitions. The deactivated and spent ordnance items are stockpiled in the corresponding target Range Holding Area (RHA) for removal. Additionally, EOD personnel inspect and retrieve any cleared 20 mm and 30 mm ammunition and expended casings. Operational Range Clearance (ORC) efforts are conducted in accordance with the Navy's policy (CNO letter 3000 Ser N34/4U741226 of 2 Apr 04) and USAF's ORC policy. ORC activities will predominantly involve the (manual) collection of recoverable sub scale (less than/equal to 25 lb) NEPM.

- In 1994, an Environmental Baseline Survey performed for the U.S. Air Force at Yankee Target found "no significant concerns for soil or water contamination." (USAF, 1994). A Range Condition Assessment, performed prior to this Comprehensive Range Evaluation (CRE) found that "no environmental issues were identified that could potentially cause off-range contaminant migration or that will adversely impact the daily operations or overall sustainability of the Dixie and Yankee targets" (EnSafe, 2006). Specifically, there has been no known migration of contaminants toward offsite locations; no evidence of onsite or offsite impact to air, soil, surface water, groundwater, vegetation, wildlife, or people; and no reports or complaints by offsite residents and visitors of environmentally-related impacts.
- The ORC Plan, December 2007, calls for annual and 5-year expanded clearances of the McMullen Range. The plan includes procedures for removal and disposal or recycling of range scrap and expended materials (e.g., munitions, munitions residue, and target residue). The range scrap and expended material processing and recycling procedures contained in the ORC Plan are taken from the guidelines and requirements for management of hazardous material generated by the Navy, which are contained in DoD Directive 4160.21-M, "Defense Material Disposition Manual," Chapter 4, 14 February 1995 and DoD INST 4140.62, as updated by Section 13-15, NAVSEA OP5, June 2006.

- The SEARAY Target also only allows inert bombs, and its Range Clearance Plan contains similar range management practices as the McMullen County Range. Due to these routine range clearance activities, long term soil contamination is not expected. As stated above, ORC policy requires the removal of all UXO and range scrap/expended material within and 100 ft out from the target area. Furthermore, ORC policy at Section 4b(4) requires the annual removal of all UXO and range scrap/expended material within and 100 ft out from the perimeter of strafe target run-in lines. The loose soil at the Yankee Target strafing locations reduces the potential for expended rounds to remain on the ground surface. Furthermore, due to the loose soil in the target area and the typical round penetration into the subsurface, there is minimal potential for surface ricochet hazards. The regular inspection of the strafing target area surface conditions by Range Management should minimize the potential for ricochets, since clearance activities would be planned and implemented when triggered by the presence of surface debris posing a potential ricochet hazard.
- It is unlikely that Munition Constituents (MCs) would be released to the environment at either the Dixie or Yankee Targets because they only receive practice munitions that do not contain high explosives. Normally practice bomb spotting charge materials are fully consumed following the impact of the bomb and there are no MC marker compounds (TNT, RDX, HMX, DNT, and perchlorate) in residual or unfired spotting charges.
- The only potential for MCs at the Dixie and Yankee Targets would be related to the small amounts C4 high explosives used to neutralize and deactivate the isolated practice bomb spotting charges that failed to completely function or did not activate on contact with the ground (RCA Report, Ensafe, 2006).
- Based the operational history of the Dixie and Yankee Targets at the McMullen Bombing and Gunnery Range, there is no significant concern of an MC release into the environment or an MC source that could pose an imminent and substantial threat to human health or the environment.

- When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impacts in territorial waters due to hazardous material. In addition, there would be less than

significant harm in non-territorial waters due to hazardous material for the No Action Alternative, Alternative 1, or Alternative 2.

When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impacts in territorial waters due to hazardous material. In addition, there would be less than significant harm in non-territorial waters due to hazardous material for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.3.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Expended material would introduce small amounts of potentially hazardous chemicals into the marine environment. The water quality analysis of all current and proposed events indicates that concentrations of constituents of concern associated with material expended in the GOMEX Range Complex are well below water quality criteria established to protect aquatic life (see Section 3.3, Water Resources). The combustion products from the detonation of high explosives are commonly found in sea water Carbon Monoxide, carbon dioxide, hydrogen, water, and ammonia. The primary contaminants that would be released from explosives used in MIW training are nitroaromatic compounds such as TNT (trinitrotoluene), cyclotrimethylenetrinitramine (Royal Demolition Explosive or RDX), and octogen (High Melting Explosive or HMS) (URS, *et al.*, 2000). Initial concentrations of explosion by-products are not expected to be hazardous to marine life (DoN, 2001) and would not accumulate in the training area because exercises are spread out over time and the chemicals would rapidly disperse in the ocean. Therefore, no adverse impacts from chemical by-products would be expected.

The analysis of all current and proposed operations indicates any expending of military materials at sea, over a long period of time, can cause potential incremental impacts to sediment and water quality. However, the Study Area where the proposed action and actions previously described in this chapter are occurring is vast and chemical releases would rapidly dilute in the water; thus, accumulation of chemicals in sediments and water is not likely to occur. Therefore, it is expected that although there would be a potential for minor incremental, but recoverable, adverse cumulative impacts, these impacts would not be considered significant as they would be localized and temporary. No significant cumulative impacts to sediments or water quality from expended materials are anticipated from the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to water quality from expended materials in non-territorial waters is expected as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.4 Water Resources

Water quality in the marine environment is affected by Gulf Stream currents, temperature and salinity, sediment transport and deposition, and water and air pollutants from inland streams and emission sources. Water quality was evaluated with respect to the possible release of hazardous constituents from the aircraft, vessels, and munitions used in the GOMEX Study Area.

6.4.4.1 GOMEX Final EIS/OEIS Conclusions

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in releases of hazardous constituents in violation of state or federal water quality standards; therefore, unavoidable significant adverse effects to water resources would not occur. The analysis of environmental stressors and alternatives indicated no significant impact to water resources in U.S. territorial waters; likewise, no significant harm in non-territorial

waters would be expected. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there will be no significant impact to water quality in territorial waters. In addition, there will be no significant harm to water quality in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.4.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Other federal and state actions such as dredging operations for channel maintenance, oil and gas leases, other Department of Defense activities, increases the potential for fuel spills and other contaminants that may contribute to potential impacts water resources. Commercial activities like fishing and cruise ships also have the capacity to impact water resources with fuel spills and leaving debris at sea (trash and lost fishing gear). Water quality in terrestrial environments includes the Yankee and Dixie Targets at the McMullen County Range (R-6312), and the SEARAY Target (R-4414A) within the Meridian, Mississippi MOA. An Operational Range Clearance Plan calls for annual and five-year expanded clearances of the McMullen Range and SEARAY Targets. The plan includes procedures for removal and disposal or recycling of range scrap and expended materials (*e.g.*, munitions, munitions residue, and target residue). As there is no known migration or fate transport of contaminants associated with bombs or strafing exercises, continued bombardment using inert ordnance and airborne strafing will not significantly impact water quality in terrestrial environments.

It is expected that although there would be a potential for minor incremental, but recoverable, adverse cumulative impacts by Navy actions, these impacts would not be considered significant as they would be localized, temporary, and quickly dispersed. The analysis of environmental stressors and alternatives indicated no significant impacts to water resources in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected. As such, any incremental contribution of Navy training to existing stressors would be nominal.

The routine activities associated with MMS activities in the Study Area that would impact coastal water quality includes installation of pipelines in coastal waters, maintenance dredging of navigational canals, service vessel discharges, and nonpoint-source runoff from onshore facilities. Turbidity, service vessel, onshore facility discharges, pipeline installation impacts, and maintenance dredging impacts would be temporary and localized if all existing regulatory requirements are met (MMS, 2008c).

Effects to water quality from past, present, and reasonably foreseeable future activities would most likely occur from the degradation of expended materials and increased turbidity due to localized disturbances of ocean bottom sediments caused by construction, dredging, and oil and gas industry activities. However, these effects would most likely be minor and temporary and would not have a significant impact on marine water quality. Moreover, water quality conditions would most likely return to normal after project completion. Therefore, when combined with construction, dredging, and oil and gas industry actions, alternative energy development, activities under the No Action Alternative, Alternative 1, Alternative 2, or Alternative 3 are not expected to significantly impact marine water quality. Cumulative impacts in territorial waters would be minor, but recoverable and would not be significant. No significant cumulative harm to water resources in non-territorial waters is expected as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.5 Air Quality

The air quality of the GOMEX Study Area is considered very good and is reflective of the pollutant concentrations, size and topography, and prevailing meteorological conditions. Emission sources

associated with warfare areas and distances from shore where the exercises take place and the percentage of training events which take place below 3,000 feet were considered for the analysis. Emissions occurring or that would occur above 3,000 feet are considered to be above the atmospheric inversion layer and are, therefore, without impact on the local air quality. Because training and testing event emissions are variable in altitude, variable in trajectory, and transitory, any potential for cumulative air quality impacts is greatly reduced.

The potential effects of proposed greenhouse gas (GHG) emissions are by nature global and cumulative impacts, as individual sources of GHG emissions are not large enough to have an appreciable effect on climate change. Therefore, an appreciable impact on global climate change would only occur when proposed GHG emissions combine with GHG emissions from other man-made activities on a global scale. Currently, there are no formally adopted or published NEPA thresholds of significance for GHG emissions. Formulating such thresholds is problematic, as it is difficult to determine what level of proposed emissions would substantially contribute to global climate change.

On 18 February 2010, the CEQ provided a draft guidance memorandum for public consideration on the ways in which Federal agencies can improve their consideration of the effects of GHG emissions and climate change in their evaluation of proposals under the NEPA. This draft guidance was intended to help explain how agencies of the Federal government should analyze the environmental effects of GHG emissions and climate change when they describe the environmental effects of a proposed agency action. The draft guidance affirmed the requirements of NEPA and its implementing regulations and their applicability to GHGs and climate change impacts. CEQ proposes to advise Federal agencies that they should consider opportunities to reduce GHG emissions caused by proposed Federal actions and adapt their actions to climate change impacts throughout the NEPA process. The CEQ provided draft guidance memorandum has yet to be finalized.

The important topic of global climate change warrants discussion of the Department of the Navy's broad-based programs to reduce energy consumption and shift to renewable and alternative fuels, thereby reducing emissions of carbon dioxide and other greenhouse gases. The Secretary of the Navy has established several goals for reducing the Navy's consumption of fossil fuels, including:

- Mandate that energy usage, efficiency, life-cycle costs and other such factors be part of the Navy's decision when acquiring new equipment or systems, as well as vendors' efficiency or energy policies.
- Cut petroleum use by half in the Navy's fleet of commercial vehicles by 2015, by phasing in new hybrid trucks to replace older ones.
- Procure half the power at Navy shore installations from alternative energy sources – including wind or solar - by 2020, and where possible, supply energy back to the grid, as the Navy does today at Naval Air Weapons Station China Lake, California.
- Reach the point that half the energy used throughout the Navy Department, including in ships, aircraft, vehicles and shore stations, comes from alternative fuel or alternative sources by 2020. Today that percentage is about 17 percent.

These examples illustrate the leadership role that the DoN plays in achieving energy reductions that will contribute to the national effort to mitigate global climate change.

6.4.5.1 GOMEX Final EIS/OEIS Conclusions

Emissions associated with implementation of Alternatives 1 and 2 would result in minor increases in air emissions above baseline (No Action Alternative) conditions. Within U.S. Territory, emissions are mainly associated Bombing Exercise (BOMBEX) (Air-to-Ground) and Gunnery Exercise (GUNEX) (Air-to-Ground) training at the McMullen County Range and the Noxubee County Range. Outside U.S. Territory, emission increases are mainly associated with surface vessel events, with additional contributions from aircraft events. In conclusion, although Alternatives 1 and 2 would result in increases in emissions of air pollutants, all air impacts would be less than significant in scope and intensity for the following reasons:

- All training and testing events analyzed in this GOMEX Final EIS/OEIS occur within areas designated by the U.S. Environmental Protection Agency (USEPA) as being in attainment for all criteria pollutants. Therefore, the General Conformity Rule does not apply (See Appendix G, *Non-Applicability of the General Conformity Rule*).
- Many analyzed training events occur more than 12 nm from the shore and would not affect air quality for human receptors.
- Nearly all aircraft training emissions occur above 3,000 ft (above the atmospheric inversion layer), and would have no impact on local air quality.
- Aircraft operations associated with the Texas and Mississippi inland ranges would not increase the likelihood of exceeding the air quality standards. Emissions from the proposed action are not regionally significant when compared to permitted stationary sources in the area.

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant adverse impacts to regional air quality. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to the air quality of the global commons.

6.4.5.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, and planned projects in the GOMEX Range Complex include various construction projects occurring onshore. Periodically, sand replenishment projects approved by the Minerals Management Service and USACE occur along the beaches of the GOMEX Range Complex. Routine activities associated with offshore Minerals Management Service activities that could potentially affect air quality include platform construction and emplacement, platform operations, drilling activities, flaring, seismic-survey and support-vessel operations, pipeline laying and burial operations, evaporation of volatile petroleum hydrocarbons during transfers and from surface oil slicks, and fugitive emissions. Emmisions from proposed action activities are expected to be well within the NAAQS. MMS activities would have only a small effect on ozone levels in ozone nonattainment areas and would not interfere with the States' schedule for compliance with the NAAQS. Emissions of pollutants into the atmosphere from the activities associated with the OCS Program are not projected to have significant effects on onshore air quality because of the prevailing atmospheric conditions, emission rates and heights, and the resulting pollutant concentrations. Onshore impacts on air quality from emissions from OCS activities are estimated to be within Class II PSD allowable increments. Ozone levels are on a declining trend because of air pollution control measures that have been implemented by the States. This downward trend is expected to continue as a result of local as well as nationwide air pollution control efforts (MMS, 2008c). Offshore barges and involved in the sand replenishment projects produce minor emissions, as do onshore sand-moving bulldozers. Construction activities or sand replenishment projects would be temporary and would not, in combination with air emissions associated with the

GOMEX Range Complex events, be anticipated to cause a significant cumulative impact. Past, present, and planned projects also include short-term testing of weapons systems which would also be temporary.

Additional past, present, and planned projects include training exercises based at onshore military installations. These training exercises would be required to demonstrate conformity with applicable State Implementation Plan (SIP) (unless conducted within an attainment area), which would involve a demonstration that the emissions would not result in a cumulatively significant impact for nonattainment pollutants.

According to the Federal Energy Regulatory Commission, there are approximately 19 existing or proposed LNG terminals near the GOMEX Final EIS/OEIS Study Area. These projects and other future terminals require air permits to operate, and would therefore be required to demonstrate that they would not cause or contribute to a violation of an air quality standard. Construction of these structures would produce temporary emissions. However, upon operation, the structures would generate clean electric power in comparison with coal-burning power generation.

The OCS Land Act (43 USC 1334(a)(8)) requires the Secretary of the Interior to promulgate and administer regulations that comply with the NAAQS pursuant to the Clean Air Act (42 USC 7401, et seq.) and to the extent that authorized activities significantly affect the air quality of any State. Under provisions of the Clean Air Act Amendments of 1990, USEPA's Administrator, in consultation with the Secretary of the Interior and the Commandant of the Coast Guard, will establish the requirements to control air pollution in OCS areas eastward of 87º30'W longitude in the Gulf of Mexico. For OCS sources located within 25 mi of the States' seaward boundaries, the requirements are the same as the requirements that would be applicable if the source were located in the corresponding onshore area. For sources located beyond 25 mi of the States' boundaries, the sources are subject to federal requirements for Prevention of Significant Deterioration promulgated pursuant to Part C of Title 1 of the Act.

For sources located in areas under MMS jurisdiction regulations are promulgated by 30 CFR 250.44, 250.45, and 250.46 and are applicable to post-sale activities. The regulated pollutants include carbon monoxide, suspended particulates, sulphur dioxide, nitrogen oxides, total hydrocarbons, and volatile organic compounds. In areas where hydrogen sulfide may be present, operations are regulated by 30 CFR 250.67, as discussed in Section I.B.3.d.(1)(d). Emissions data concerning new or modified onshore facilities (directly associated with offshore activities) are required to enable each affected State to make a determination of the effects on its air quality. Exploration Plans (EPs) and Development Operations Coordination Documents (DOCDs) address activities determined by the Secretary as activities regulated under 30 CFR 250.44, 250.45, and 250.46. All new or supplemental EPs and DOCDs must include air emissions information sufficient to make an air quality determination. The Letter to Lessees dated October 12, 1988, outlines air emissions data that must be submitted by operators to MMS. The Clean Air Act Amendments of 1990 also required that MMS conduct and complete a study to assess the potential onshore air quality impacts from the development of OCS petroleum resources in the Gulf of Mexico.

MMS completed the air quality study and concluded that the contribution of the OCS Petroleum Development emission sources on onshore ozone concentrations is small. The photochemical modeling analysis conducted with the variable grid Urban Airshed Model (UAM-V) indicates that the maximum impact form OCSPD sources for 1993 and 1999 is in the range of 25-35 parts per billion (ppb), in offshore locations of the central Gulf of Mexico. The maximum simulated onshore impacts from OCSPD sources are in the range of 6-8 ppb when onshore concentrations are low. During the time of maximum measured onshore ozone concentrations, the simulated impacts from OCSPD sources were generally less than 2 ppb.

Considering the OCS activities, and other past, present and reasonably foreseeable future activities within or near the GOMEX Study Area, no significant cumulative impacts to air quality would occur as a result of the Navy training activities under the No Action Alternative, Alternative 1, or Alternative 2.

6.4.6 Airborne Noise

Increases in operational activity in the GOMEX Study Area will increase airborne noise levels. However, because Navy training and testing takes place in remote and cleared areas, airborne noise levels will primarily affect military personnel operating the equipment/weapon systems producing the noise. Military personnel wear personal protective equipment and are not considered sensitive receptors as such term is used in this Final EIS/OEIS analysis. Underwater noise impacts to aquatic life are addressed in Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), 3.9 (Fish), and 3.10 (Seabirds and Migratory Birds). There are not expected to be any unavoidable significant environmental effects associated with proposed action-generated noise.

6.4.6.1 GOMEX Final EIS/OEIS Conclusions

Airborne noise impacts may be cumulative in the sense that the average ambient noise of an area could increase from several independent actions and the increased number of noise events of a particular kind (e.g., an explosion) from unrelated actions could result in an increased sensitivity of human receptors and therefore an increase in the number of complaints. Alternative energy development in the form of wind farms, oil and gas production and harnessing wave energy could all contribute to the anthropogenic noise environment. Commercial and recreational fishing and vessels, commercial shipping vessels, vessels associated with dredging operations contribute to the total anthropogenic airborne noise environment in the GOMEX Study Area. Commercial aircraft departing and arriving at airports adjacent to the GOMEX Study Area can also contribute to the overall Study Area airborne noise levels.

Due to the vast size of the Study Area and the flight altitudes at which many of the Navy training and testing operations take place, the average ambient airborne noise contributed by these current and proposed Navy events are negligible. Furthermore, the analysis of all current and proposed operations indicates Alternatives 1 and 2 would produce noise similar to ongoing activities within the GOMEX Range Complex plus noise that is unique, particularly along some land-water interfaces.

Current Standard Operating Procedures for the proposed action involving aircraft noise and live bombs would minimize potential direct and indirect impacts so there would be no adverse impacts on the human noise environment in the Study Area over either land or sea. No significant cumulative impacts to airborne noise quality or the human noise environment would occur as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to airborne noise quality or the human noise environment in non-territorial waters is expected as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.6.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Noise impacts may be cumulative in the sense that the average ambient noise of an area could increase from several independent actions and the increased number of noise events of a particular kind (*e.g.*, an explosion) from unrelated actions could result in an increased sensitivity of human receptors and therefore an increase in the number of complaints. The analysis of all current and proposed training activity indicates Alternatives 1 and 2 would produce noise similar to ongoing activities within the GOMEX Range Complex plus airborne noise that is unique, particularly along some land-water interfaces.

Current Standard Operating Procedures for the proposed action involving aircraft noise and live bombs would minimize potential direct and indirect impacts so there would be no adverse impacts. No significant cumulative impacts to airborne noise, human receptors or the human noise environment would occur because of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.7 Marine Communities

This section of the Final EIS/OEIS addresses plankton and macroalgae, benthic communities, and artificial habitats within the GOMEX Study Area. Plankton include phytoplankton (plant-like/algae), zooplankton (animals), ichthyoplankton (fish eggs and larvae, a form of zooplankton), and bacterioplankton (bacteria). Benthic communities analyzed include live/hard bottom communities, corals and coral reefs, and soft bottom communities.

6.4.7.1 GOMEX EIS/OEIS Conclusions

Short-term and localized disturbances to the water column and soft bottom communities may occur. Localized mortality to plankton and benthic organisms may result from operations of amphibious vessels. No long-term population or community-level effects are expected. Training activities within the Demolition Pond are conducted in accordance with a Wetland Resource Permit issued by the Florida Department of Environment Protection. The permit covers charges up to 5-lb NEW. Based on the small size of the pond and the frequent use (90 days per year), it is possible that some bottom areas would be repeatedly exposed to impacts from explosions and that benthic communities would not fully recover after an explosion. Therefore, underwater detonations could result in long-term impairment of Demolition Pond's benthic community. Habitat quality could be degraded and reductions in species richness and abundance could occur; however, the effects would be localized and limited to the pond or a portion of the pond. Given the small size of the pond and the abundance of similar soft bottom habitats in the immediate area, the effects of underwater detonations would not be significant from a community or population perspective. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there will be no significant impact to marine communities in territorial waters. In addition, there will be no significant harm to marine communities in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.7.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions which would most likely have the greatest effect on marine communities are dredging, beach nourishment, and commercial fishing. Other activities described earlier in Chapter 6 within the GOMEX Study Area contributing to effects on marine communities include commercial transportation, dredging, coastal development, oil/gas exploration and development, sand and mineral mining, cooling water intake and discharge, wastewater discharge, mariculture, and recreational fishing. MMS activities that can result in impacts to marine communities include infrastructure emplacement and removal, anchoring, drilling discharges, produced waters, oil spills, blowouts, chemical spills, and vessel collisions. OCS activities undertaken by MMS that are long-term in nature are not anticipated to result in adverse impacts to marine communities (MMS, 2008c). Additional potential disturbances to marine communities include degradation of water quality, habitat modification, pollution (chemicals, marine debris, etc.), introduction of exotic species, disease, natural events, and global climate change. Although the analysis of alternatives indicated no

significant impacts in U.S. territorial waters and no significant harm in non-territorial waters are expected to marine communities, there would be a potential for minor incremental, but recoverable, adverse cumulative impacts when these impacts are consider with other projects and actions in the area. However, because Navy and Marine Corps training activities would be relatively isolated due to the large expanses of area between activity locations, these impacts would not be considered significant because they are localized and temporary.

6.4.8 Marine Mammals

Marine mammal species that have confirmed or potential occurrence in the GOMEX Study Area include six whale species and one sirenian (West Indian manatee, *Trichechus manatus*) identified as federally endangered, as well as 22 non-listed marine mammal species. General descriptions, status and management, habitat, and distribution are discussed for each species in Chapter 3.

Endangered Species Act

The Navy consulted (Appendix C) with NMFS regarding its determination of effect for federally listed marine mammals and critical habitat. Table 3.7-31 provides a summary of the Navy's determination of effect for federally listed marine mammals that potentially occur in the GOMEX Study Area.

Marine Mammal Protection Act

The analysis presented above indicates that the Atlantic spotted dolphin, bottlenose dolphin, Clymene dolphin, pantropical spotted dolphin, pilot whales, and Risso's dolphin could be exposed to impacts associated with underwater detonations and explosive ordnance use under Alternative 2 (Preferred Alternative) that could result in Level A or Level B harassment as defined by MMPA provisions applicable to the Navy. Exposure estimates are provided in Table 3.7-11. Other stressors associated with Alternative 2 are not expected to result in Level A or Level B harassment. Accordingly, the Navy is working with NMFS through the MMPA permitting process to ensure compliance with the MMPA.

6.4.8.1 Summary and Significance of Past Cetacean Stranding Events Related to Military Use of Sonar

Cetaceans face challenges from a multitude of man-made sources (Geraci *et al.*, 1999, NMFS 2007a), including intentional hunting, fishing gear entanglement, ship strikes (Laist *et al.*, 2001), ensonification, pollution, habitat modification, gunshots, and toxic algal blooms. During the past 11 years, Navy sonar has been linked to only 5 stranding events, with a total of 51 stranded animals and 38 mortalities. The 38 mortalities equate to an average of approximately 3 cetacean mortalities per year over the past 11 years.

The majority of these five strandings are unique from other strandings because the stranding of whales occurred over a short period of time, stranded individuals were spatially co-located, traumas in stranded animals were consistent between events, and active sonar was known or suspected to be in use. Moreover, in several of these strandings, activities involved multiple ships operating in the same area over extended periods of time in close proximity. Furthermore, operations occurred across a relatively short horizontal distance, in areas surrounded by landmasses, and of at least 3,281 feet (ft) (1,000 meters [m]) in depth near a shoreline with a rapid change in bathymetry. In these cases, unique conditions may have existed in the active sonar activity area that, in their aggregate, may have contributed to the marine mammal strandings. However, these conditions are not present in the majority of other documented marine mammal strandings, and current science suggests that multiple factors, both natural and man-made, may be acting alone or in combination to cause marine mammals to strand.

Overall, the number of deaths during stranding events associated with mid-frequency active sonar exposure is small in comparison to the number of marine mammals killed annually through fishing by-

catch and whaling operations. For example, a 2006 report by scientists from Duke University and the University of St. Andrews estimated that approximately 3,030 cetaceans die annually in U.S. waters as a result of by-catch (Read *et al.*, 2006). When extrapolated to consider global impacts, the number increases to 308,000 deaths annually. In addition to by-catch, some countries still engage in whaling operations, whether under the guise of research or for commercial purposes. Such operations led to the death of approximately 560 cetaceans annually from 1986 through 2007 (International Whaling Commission, 2008). Thus, the overall contribution of cetaceans' stranding resulting in death associated with exposure to naval mid-frequency sonar is relatively small when compared to all the other non-military activity related to marine mammal stranding and effects, as shown in Figure 6.1-1.

The Navy has made the protection of marine mammals a top priority and in conjunction with the National Oceanic and Atmospheric Administration (NOAA), has developed mandatory science-based mitigation measures that allow the Navy to conduct active sonar activities with the utmost care for the ocean environment. Refer to Chapter 5, Mitigation Measures, for additional information.

6.4.8.2 GOMEX Final EIS/OEIS Conclusions

The analysis of potential effects on marine mammals included modeling of explosions, acoustic effects analysis, disturbance analysis associated with vessel movements, analysis of vessel strikes on marine mammals, analysis of disturbance associated with aircraft overflights, and analyses of other training activities conducted in the GOMEX EIS/OEIS Study Area. The Final AFAST EIS/OEIS also analyzed the effects to marine mammals due to exposure to small explosives during deployment of the AN/SSQ-110A IEER sonobuoy. The Final AFAST EIS/OEIS used the same small explosives criteria (for single explosions) presented in Section 3.7.3.2 of this Final EIS/OEIS.

To estimate the number of exposures of marine mammals to sound that would result in regulatory levels of harassment, sonar activities were acoustically modeled for the GOMEX Study Area. By analyzing both the acoustic propagation of each source and the estimates of marine mammal presence, annual marine mammal exposures were calculated (Table 6.4-1). When interpreting the modeling results, it is important to recognize the limitations of the model. The model does not reflect implementation of protective measures (such as reducing power levels or ceasing sonar use in the presence of marine mammals) and it assumes the acoustic footprint extends to the seafloor regardless of the operating environment (in reality the zone of influence for physiological effects is shaped like a bubble in deeper waters). Sonar power reduction would reduce the likelihood of hearing impairment due to close aboard exposure, but some animals could be missed or could surface within the safety zone. Others could receive multiple pings that cause TTS due to added energy of multiple exposures over a short time period.

TABLE 6.4-1
ESTIMATED ANNUAL TAKES OF MARINE MAMMALS
UNDER THE AFAST SELECTED ALTERNATIVE

Species	Mortality	PTS	TTS	Risk-Function (Behavioral)
Bryde's whale	0	0	0	25
Sperm whale*	0	0	5	370
Kogia spp.	0	0	5	330
Beaked whale	0	0	2	161
Rough-toothed dolphin	0	0	10	974
Bottlenose dolphin	0	2	225	24014
Pantropical spotted dolphin	0	5	695	49445
Atlantic spotted dolphin	0	3	124	14583
Spinner dolphin	0	2	289	20624
Clymene dolphin	0	1	114	8145
Striped dolphin	0	0	58	4133
Fraser's dolphin	0	0	5	341
Risso's dolphin	0	0	21	1465
Melon-headed whale	0	0	23	1620
Pygmy killer whale	0	0	3	233
False killer whale	0	0	7	487
Killer whale	0	0	1	62
Short-finned pilot whale	0	0	16	1121

**Denotes species listed in accordance with the Endangered Species Act.*
PTS=Permanent Threshold Shift
TTS=Temporary Threshold Shift

In addition, the exposure estimates rely on the best available information from marine mammal surveys. Marine species density models rely on limited survey data, and for some species data are insufficient to estimate densities (blue whale, white-beaked dolphin, hooded seal, and harp seal throughout the AFAST Study Area; harbor porpoise, gray seal, harbor seal, sei whale in the GOMEX OPAREA).

Due to the above reasons, quantitative exposure estimates should be used in conjunction with a qualitative analysis to assess potential impacts.

Explosive modeling analysis, acoustic effects analysis, disturbance analysis associated with vessel movements, analysis of vessel strikes on marine mammals, analysis of disturbance associated with aircraft overflights, and analyses of other training activities conducted in the GOMEX Study Area were conducted to identify potential effects on marine mammals. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to marine mammals. The proposed action may affect listed species, but is not anticipated to displace animals or alter the function of the habitat. The Navy consulted (Appendix C) with NMFS under Section 7 of the ESA regarding its determination of effect for federally listed marine mammals under Alternative 2 (Preferred Alternative). The GOMEX Study Area does not contain designated critical habitat for any listed marine mammal species.

The analysis indicates that several species of marine mammals could be exposed to impacts associated with underwater detonations and HE ordnance use under the No Action Alternative, Alternative 1, and Alternative 2 that could result in Level A or Level B harassment as defined by the MMPA provisions applicable to the Navy. Other stressors associated with the alternatives are not expected to result in

Level A or Level B harassment. Accordingly, the Navy is working with NMFS through the MMPA permitting process to ensure compliance with the MMPA.

The No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on marine mammals in territorial waters in accordance with NEPA. Furthermore, in accordance with Executive Order 12114, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to marine mammals in non-territorial waters.

6.4.8.3 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The combination of potential impacts resulting from the proposed action in addition to prior and future Navy activities, oil/gas exploration and development activities, dredge-and-fill operations, water quality degradation, pollution (chemicals, marine debris, noise), recreational and commercial fishing, vessel traffic, as well as whale-watching, may affect the blue, fin, humpback, North Atlantic right, sei and sperm whales found in the proposed Study Area. Activities considered have the potential to harm marine mammals and their habitats. Chronic sublethal impacts (*e.g.*, stress) resulting in persistent physiological or behavioral changes and/or avoidance of impacted areas could cause declines in survival or productivity, resulting in either acute or gradual population declines (Fair and Becker, 2000).

The major impact-producing factors of oil/gas exploration, alternative energy development (MMS, 2007c), and other development activities include degradation of water quality resulting from operational discharges; noise from helicopter and vessel traffic, operating platforms, and drillships; explosive platform removals; seismic surveys; oil spills; oil spill response activities; and discarded debris (reviewed by MMS, 2007c). A formal ESA consultation with NMFS was concluded with receipt of the BO on July 3, 2007 and the conclusion that proposed lease sales and associated activities in the Gulf of Mexico in the 2007-2012 OCS Leasing Program are not likely to jeopardize the continued existence of threatened and endangered species under NMFS jurisdiction or destroy or adversely modify designated critical habitat (MMS, 2008c).

A wide variety of debris is commonly observed off the coast of the United States. Marine debris comes from a variety of land-based and ocean sources (Laist *et al.*, 1999). Both entanglement in and ingestion of debris has caused the death or serious injury of large whales (Laist, 1997; Laist *et al.*, 1999). Because of their buoyancy and persistence, plastic items contribute disproportionately to the overall impacts of marine debris (Laist *et al.*, 1999). In addition to trash that finds its way into the marine environment, discarded or lost fishing gear is also a concern for marine mammals (Laist, 1997; Spellman, 1999).

The fishing industry has a profound effect on marine mammals. Commercial fisheries may accidentally entangle and drown or injure cetaceans during fishing operations by lost and discarded fishing gear, or compete with cetaceans for the same fishery resources (Northridge and Hofman, 1999). Entanglement in fishing gear accounts for a significant portion of baleen whale mortality in U.S. waters (NMFS, 2007f). Entanglement in fixed fishing gear, in particular in sink gillnets and a variety of pot and trap fisheries, is one of the most important factors depressing the growth rate of the North Atlantic right whale population (Katona and Kraus, 1999; Kenney, 2002; Johnson *et al.*, 2007). Humpback whales, perhaps because of their abundance in coastal waters where nets are commonly used or because of the many barnacles they carry, seem to be extremely vulnerable to entanglement in fishing gear (Lien, 2002). Trites *et al.* (1997) suggested that fisheries might indirectly compete with cetaceans by reducing the amount of primary production accessible to cetaceans, thereby negatively affecting their numbers.

Insufficient information is available to determine how, or at what levels and in what combinations, environmental contaminants may affect cetaceans (MMC, 2002; 2003). There is growing evidence that high contaminant burdens are associated with several physiological abnormalities, including skeletal deformations, developmental impacts, reproductive and immunological disorders, and hormonal alterations (Reijnders and Aguilar, 2002). It is possible that anthropogenic chemical contaminants initially cause immunosuppression, rendering whales susceptible to opportunistic bacterial, viral, and parasitic infection (De Swart *et al.*, 1995).

Several mortality events (die-offs) have been reported for cetaceans in the western North Atlantic. Biotoxins, viruses, bacteria, or El Niño events have been implicated (Geraci *et al.*, 1999; Domingo *et al.*, 2002; MMC, 2004; Hohn *et al.*, 2006).

Habitat loss and degradation is now acknowledged to be a significant threat to marine mammal populations (Kemp, 1996). The impact of coastal development on whales has not been thoroughly investigated. Habitat alteration has the potential to disrupt the social behavior, food supply, and health of whales. Such activities may stress the animals and cause them to avoid traditional feeding and breeding areas or migratory routes. The most serious threat to cetacean populations from habitat destruction may ultimately prove to be its impact on the lower trophic levels in their food chains (Kemp, 1996).

Migrating baleen whales may be affected by whale-watching activities on the east coast, as well as in the Caribbean (Katona and Kraus, 1999; Hoyt and Hvenegaard, 2002). Impacts of whale watching on cetaceans may be measured in a short time-scale (*i.e.*, startle reaction) or as a long-term effect on reproduction or survivability (IFAW, 1995). There is little evidence to show that short-term impacts have any relation to possible long-term impacts on cetacean individuals, groups, or populations (IFAW, 1995). Whale watching could have an effect on whales by distracting them, displacing them from rich food patches, or be dispersing food patches with wake or propeller wash (Katona and Kraus, 1999).

Climatic fluctuations have produced a growing concern about the impacts of climate change on marine mammal populations (Learmonth *et al.*, 2006). Responses of marine mammals to climate change are difficult to interpret due to the confounding impacts of natural responses and human influences. Additionally, the time scale on which marine mammals respond to direct or indirect impacts of climate change may be diluted or muted. Large-scale climatic events may affect the distribution and abundance of marine mammal species, either directly or indirectly, through alterations of habitat characteristics and distribution (Harwood, 2001; Forcada *et al.*, 2005; Keiper *et al.*, 2005; MacLeod *et al.*, 2005; Shelden *et al.*, 2005; Simmonds and Isaac, 2007).

In the North Atlantic region, climate variability has been directly linked to the North Atlantic Oscillation (NAO), which influences the abundance of marine mammal prey such as zooplankton and fish. In years when the NAO Index was positive, the average Sea Surface Temperature (SST) increased and was followed by increases in copepod (*Calanus finmarchicus*) abundance which is the principal prey of North Atlantic right whales (Conversi *et al.*, 2001). In the 1970s and 1980s, NAO conditions were generally positive; they were favorable to *Calanus* abundance and, in principal, to North Atlantic right whale calving rates. However, this cannot be verified because the North Atlantic right whale data series does not begin until 1982 (Greene *et al.*, 2003). In the late 1980s and 1990s, the NAO Index was mainly positive but exhibited two substantial, multi-year reversals to negative values. This was followed by two major, multi-year declines in copepod prey abundance (Pershing *et al.*, 2001; Drinkwater *et al.*, 2003). Subsequently, the North Atlantic right whale calving rate declined for two periods, mirroring the copepod trend with a time lag (Greene *et al.*, 2003). Although the NAO Index has been essentially positive for the past 25 years, models indicate that greenhouse warming and the

subsequent rise in ocean temperature may lead to increased climatic variability and more severe fluctuations in the NAO Index. Such fluctuations would be expected to cause dramatic shifts in the reproductive rate of critically endangered North Atlantic right whales (Drinkwater *et al.*, 2003; Greene *et al.*, 2003) and possibly a northward shift in the location of right whale calving grounds (Kenney, 2002).

Ocean acidification may occur from an increase of CO^2 dissolved in ocean water that creates carbonic acid. The CO^2 emissions are the result of human activitiy and have resulted in the ocean pH droping from 8.16 to 8.05 since the late 1980s (SD, 2009). Ocean acidification potentially could result in the ability of sound in the water to travel greater distances, thereby increasing the amount of energy to which marine mammals and sea turtles may be exposed. In response to a petition from the Center for Biological Diversity, EPA stated on January 16, 2009, that it will initiate an evaluation of ocean acidification impacts to determine whether the current water-quality criterion for pH should be modified to address ocean acidification (EPA, 2009).

It is possible that harassment in any form may cause a stress response (Fair and Becker, 2000). Cetaceans can exhibit similar stress symptoms as found in terrestrial mammals (Curry, 1999). It is important to recognize that disturbance from ship traffic, ships, aircraft, and drilling rigs and/or exposure to sub lethal levels of biotoxins and anthropogenic contaminants may stress animals, weakening their immune systems, making them more vulnerable to parasites and diseases. Chronic stress may cause damage to the heart muscle and vasculature (Curry, 1999). Stressed animals may also fail to reproduce at normal rates or have been found with significantly high fetotoxicity and malformations in the young, as evidenced in some small laboratory mammals. Marine mammals may stay in an area despite disturbance (such as noise) if no alternative areas meet the requirements of the animals.

In the AFAST Final EIS/OEIS, an acoustic analysis was performed in order to estimate the effects associated with active sonar use. Chapter 4 of the AFAST Final EIS/OEIS discusses the methodology used to measure these effects in detail. The results of acoustic analysis indicate that 16,521 ESA-listed marine mammals may be exposed to levels of sound likely to result in Level B harassment under the AFAST Selected Alternative. It also indicates that one ESA-listed marine mammal may be exposed to levels of sound likely to result in Level A harassment under the AFAST Selected Alternative. The exposure estimates represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. In the AFAST Final EIS/OEIS, the Navy found that ESA-listed species may experience a cumulative impact from AFAST activities; however, they are not expected to adversely affect the populations of ESA-listed species. As part of the environmental documentation for the AFAST Final EIS/OEIS, the Navy has completed consultation with NMFS in accordance with Section 7 of the ESA. See the AFAST website (http://afasteis.gcsaic.com) for additional information on the BO.

The AFAST Final EIS/OEIS acoustic analysis indicates that 1,911,195 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level B harassment under the AFAST Selected Alternative. This acoustic analysis also indicates that 126 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment under the AFAST Selected Alternative. No mortalities are predicted due to AFAST active sonar activities. The exposure estimates represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. The Navy has determined that AFAST activities will have a negligible impact on marine mammal species or stock. The Navy has completed consultation with NMFS in accordance with the

MMPA for concurrence. See the AFAST website (http://afasteis.gcsaic.com) for additional information on the LOA.

With regard to the direct, indirect, and cumulative impacts of the proposed action, impacts are expected to be limited to temporary behavioral impacts. Mitigation measures (discussed in Chapter 5) would be implemented during the proposed exercises to minimize any potential adverse impacts to marine mammals and to avoid any significant or long-term adverse impacts to threatened and endangered species. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant cumulative impacts to marine mammals in U.S. territorial waters; likewise no significant cumulative harm in non-territorial waters would be expected.

6.4.9 Sea Turtles

The ESA established protection over and conservation of threatened and endangered species. All five species of sea turtles that potentially occur in the Study Area are listed as threatened or endangered. Therefore, the ESA requirements discussed in Section 3.7.1.1 are applicable to the analysis of sea turtles. The Navy completed the ESA Section 7 consultation process with NMFS. Critical habitat for listed species has not been designated under the ESA in the Study Area.

6.4.9.1 GOMEX Final EIS/OEIS Conclusions

The analysis of potential effects on sea turtles included modeling of explosions, acoustic effects analysis, disturbance analysis associated with vessel movements, analysis of vessel strikes on sea turtles, analysis of disturbance associated with aircraft overflights, and analyses of other training activities conducted in the GOMEX Study Area. The Navy is working with NMFS through the ESA Section 7 consultation process to ensure that unavoidable significant effects to sea turtles do not result from implementation of the proposed action. The Navy is consulting with NMFS regarding its determination of effect for federally listed sea turtles from the analysis of environmental stressors and alternatives in U.S. territorial waters and in non-territorial waters.

The Final AFAST EIS/OEIS evaluated potential direct and indirect effects to sea turtles as a result of exposure to in-water sound and non-acoustic interactions during sonar activities in Section 4.5.

Assessing whether a sound may disturb or injure a sea turtle involves understanding the characteristics of the acoustic sources, the presence of sea turtles in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those animals. Little is known about the role of sound and hearing in sea turtles; however, their greatest sensitivity appears to be at frequencies below the frequencies used by sonar systems during Atlantic fleet sonar activities. Use of these systems, therefore, is not expected to acoustically affect sea turtles. Sea turtles are, however, expected to be physiologically or behaviorally affected by use of explosive source sonobuoys. Effects to sea turtles were analyzed in the Final AFAST EIS/OEIS using the same methods and criteria presented for small explosive impacts (single explosions) to sea turtles in the GOMEX EIS/OEIS (Section 3.8).

Table 6.4-2 shows that no acoustic exposures resulting in a physiological effect are anticipated in the GOMEX Study Area. In the case of single explosions, behavioral effects are expected to be limited to short-term startle effects.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to sea turtles in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected. The proposed action may affect listed species, but it is not anticipated to displace animals. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities for the No Action

Alternative, Alternative 1, or Alternative 2, there would be no significant impact to sea turtles in territorial waters. In addition, there will be no significant harm to sea turtles in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

TABLE 6.4-2
ESTIMATED SEA TURTLE ACOUSTIC EXPOSURES FROM EXPLOSIVE SOURCE SONOBUOYS

Species	Mortality	PTS	TTS
Loggerhead sea turtle	0	0*	1
Kemp's ridley sea turtle**	0	0	0
Leatherback sea turtle	0	0	0*
Hardshell sea turtles***	0	0*	1

** Indicates an exposure greater than or equal to 0.05, therefore is considered a "may affect" for ESA listed species*
*** This category does not include Kemp's ridley sea turtles in the Gulf of Mexico. They are included in the hardshell sea turtle class.*
**** This category includes green, hawksbill, and unidentified hardshell species for all regions. It also includes Kemp's ridley sea turtles in the Gulf of Mexico, and may include extralimital occurrences of olive ridley turtles along the Atlantic coast.*

Explosive modeling analysis, acoustic effects analysis, disturbance analysis associated with vessel movements, analysis of vessel strikes, analysis of disturbance associated with aircraft overflights, and analyses of other training activities conducted in the GOMEX Study Area were conducted to identify potential effects on sea turtles. The Navy worked with NMFS through the ESA Section 7 consultation process to ensure that unavoidable significant effects to sea turtles do not result from implementation of the proposed action. The Navy consulted with NMFS regarding its determination of effect for federally listed sea turtles from the analysis of environmental stressors and alternatives in U.S. territorial waters and in non-territorial waters (Appendix C).

6.4.9.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The combination of potential impacts resulting from the proposed action in addition to prior and future Navy activities, oil/gas exploration and development activities, dredge-and-fill operations, water quality degradation, natural catastrophes, pollution (chemicals, marine debris, noise), recreational and commercial fishing, vessel traffic, beach nourishment, beach lighting, power plant entrainment, and human consumption, affect the loggerhead, Kemp's ridley, hawksbill, green, leatherback, and olive ridley turtles that might be found in the proposed Study Area. Activities considered under this analysis have the potential to harm sea turtles and their nesting and foraging habitats. Chronic sublethal impacts (*e.g.*, stress) resulting in persistent physiological or behavioral changes and/or avoidance of impacted areas could cause declines in survival or productivity, resulting in either acute or gradual population declines (Milton and Lutz, 2003).

Sea turtles face harm from human activities throughout their migratory ranges, both in their foraging habitats and on their nesting beaches. Sea turtles are particularly vulnerable because of their wide ranging movements in coastal waters (National Research Council [NRC], 1990). Demographic analyses suggest that a reduction of human-induced mortality in juvenile, subadult, or adult life stages will have a significantly greater effect on population growth than reduction of human-induced mortality of eggs and hatchlings (NRC, 1990).

Incidental catch in fisheries is widely recognized as a major mortality factor for sea turtles. A major source of mortality for loggerhead and Kemp's ridley turtles is incidental capture and drowning in

shrimp trawls (Henwood and Stuntz, 1987; Frazier, 2001). Other fisheries and fishery-related activities are also important sources of mortality (Witzell, 1992), but collectively only one-tenth as important as shrimp trawling (NRC, 1990).

Man-made debris (from offshore and coastal sources) has become an increasing concern (Laist, 1997). Both entanglement in and ingestion of debris has caused the death or serious injury of sea turtles (Lutcavage *et al.* 1997; Laist *et al.* 1999). Because of their buoyancy and persistence, plastic items contribute disproportionately to the overall impacts of marine debris. Most of the debris that either entangles animals or is found in their stomachs is made of plastic (Laist, 1997). Leatherback turtles that mistake plastics for jellyfish may be more vulnerable to marine debris than other turtle species.

Dredge-and-fill activities occur in many of the coastal seasonal habitats of sea turtles in the southeastern United States and other locales. Dredging operations affect turtles through incidental take and by degrading the habitat. In addition to direct take, channelization of the inshore and nearshore areas can degrade foraging and migratory habitat through spoil dumping, degraded water quality/clarity, and altered current flow (NRC, 1990).

Sea turtles can become entrained in intake pipes for cooling water at coastal power plants (NRC, 1990). An offshore intake structure may look like a reef to some turtles, suitable for resting, and these turtles are subsequently drawn into the cooling system (Witham, 1995). Feeding leatherbacks probably follow large numbers of jellyfish into the intake (Witham, 1995). Thermal effluents from power plants may cause hatchlings to become disoriented and reduce their swimming speed (O'Hara, 1980) and degrade seagrass and reef habitats (Coston-Clements and Hoss, 1983).

Sea turtles frequent coastal areas such as algae and seagrass beds to seek food and shelter (Carr and Caldwell, 1956). Submerged vegetated areas may be lost or damaged by activities that alter salinity, increase turbidity, or disturb natural tidal and sediment exchange (Gibson and Smith, 1999). Natural catastrophes, including storms, floods, droughts, and hurricanes, can also substantially damage sea turtle habitats and nesting beaches (Martin, 1996). In addition, the hurricane season for the Caribbean and western North Atlantic (June to November) overlaps closely with the sea turtle nesting season (March through November) (NRC, 1990). Hurricanes cause mortality to turtle nests in two ways: immediate drowning from ocean surges and after hatching as a result of radically altered beach topography. Species that have limited nesting ranges, such as the Kemp's ridley, would be highly impacted if a hurricane hit its nesting beach (Milton *et al.*, 1994). Indirect impacts (contamination of food or poisoning of reef-building communities) on the marine and coastal habitats of sea turtles include pollution of coastal waters from storm-associated runoff.

Construction, vehicle traffic, beachfront erosion, and artificial lighting are activities that disturb sea turtles or their nesting beaches. Traffic may cause compression damage to nests, and beach cleaning may destroy nests or cause compaction, lowering hatching success (Coston-Clements and Hoss, 1983). Physical obstacles, such as tire tracks and sand piles, may slow the rate of sea-approach for hatchling turtles and increase their susceptibility to stress and predation (Witham, 1995). Obstructions to the high water mark prevent nesting, and breakwalls are the most common and drastic type of obstruction. Erosion of nesting beaches results in the loss of nesting habitat. Human interference has hastened erosion in many places. Artificial lighting from buildings, streetlights, and beachfront properties has a disorienting effect on hatchlings, as well as adults (Witherington and Martin, 2003). Females tend to avoid areas where beachfront lighting is most intense; turtles also abort nesting attempts more often in lighted areas. Hatchlings are attracted to lights, and any delay for them to make it to the water increases vulnerability to terrestrial predators. Condominiums block sun on turtle nesting beaches, which could presumably affect sex ratios of hatchlings (the sex of a turtle is dependent on egg temperature) by increasing the number of males produced (Mrosovsky *et al.*, 1995). Increased human activities,

including organized turtle watches, on nesting beaches may affect nesting activity, specifically, a female turtle not spending as much time camouflaging nest sites (Johnson *et al*. 1996). Nest depredation by predators such as raccoons, snakes, and fire ants is also a great concern (Boulon, 1999).

Sand mining, beach renourishment, and oil-spill cleanup operations may remove sand from the littoral zone and temporarily disturb onshore sand transport, potentially disturbing sea turtle nesting activities (Witherington, 1999). The main causes of permanent nesting beach loss are the reduction in sediment transport, rapid rate of relative sea-level rise, coastal construction, and development, and recreational use of accessible beaches near large population centers. Crain *et al.* (1995) reviewed the literature on sea turtles and beach nourishment and found certain problems repeatedly identified.

Chronic pollution, including industrial and agricultural waste and urban runoff, threatens sea turtles worldwide. Some turtle species have lifespans greater than 50 years and have a high trophic level in the marine ecosystem, creating the potential for bioaccumulation of heavy metals and pesticides (Davenport *et al*., 1990). Organochlorine pollutants have been documented in eggs, post-yearlings, and adult turtles (Rybitski *et al.*, 1995). Not all species accumulate residues at the same rate; loggerheads consistently have higher levels of both polychlorinated biphenyls and dichlorodiphenyldichloroethylene than green turtles, and it has been hypothesized that the variation is due to dietary differences (George, 1997). Contaminants could stress the immune system of turtles or act as co-carcinogens indirectly by disrupting neuroendocrine functions (Colborn *et al.*, 1993; Milton and Lutz, 2003). In some marine mammals, chronic pollution is linked with immune suppression, which raises a similar concern for sea turtles.

Green turtle fibropapillomatosis (GTFP) (debilitating tumors occurring primarily in green turtles) is a growing threat to the survival of green turtle populations worldwide (Herbst, 1994). This disease may cause an increased susceptibility to marine parasites and anemia, as well as obstructed feeding and swimming, greater vulnerability to fishing net entanglement, disorientation, and impaired vision or blindness (Norton *et al.* ,1990). Similar lesions have been reported in loggerhead turtles (Herbst, 1994). Studies suggest that turtles in nearshore habitats with nearby human disturbance have a higher incidence of GTFP (Herbst and Klein, 1995). Turtles with GTFP are chronically stressed and suffer from immunosuppression (Aguirre *et al.*, 1995).

Climatic fluctuations have produced a growing concern about the impacts of climate change on various marine species, including sea turtles. Responses of sea turtles to climate change are difficult to interpret due to the confounding impacts of natural responses and human influences. Additionally, the time scale on which sea turtles respond to direct or indirect impacts of climate change may be diluted or muted. Global warming will likely increase the foraging range of leatherback turtles farther into temperate and boreal waters as isotherms shift (James *et al.*, 2006; McMahon and Hays, 2006). Large-scale climatic events may affect turtles by loss of nesting beaches as sea levels rise (Vagg and Hepworth, 2006). Nesting biology of sea turtles is strongly affected by temperature, both in timing and in the sex-ratio of hatchlings; the impacts of climate change may upset the natural ratio of male to female hatchlings, as higher temperatures during incubation tend to produce more females (Hays *et al.*, 2003; Hawkes *et al.*, 2007). Earlier nesting and longer nesting seasons are being correlated with warmer sea surface temperatures (Weishampel *et al*,. 2004; Hawkes *et al.*, 2007).

All of the turtles species found in the AFAST Study Area are ESA-listed species. As such, the Navy has completed consultation with NMFS in accordance with Section 7 of the ESA. Acoustic analysis for mid- and high-frequency active sonar activities was not performed for sea turtles due to the fact that sea turtles appear to be most sensitive only to low frequencies. Acoustic effects on sea turtles from explosive source sonobuoys (AN/SSQ-110A) were analyzed in Chapter 4 of Final AFAST Final EIS/OEIS. Acoustic analysis in the Final AFAST Final EIS/OEIS indicates that a total of five sea turtles may be exposed to levels of sound likely to result in Level B harassment under the AFAST Selected

Alternative. Acoustic analysis also indicates that a total of one sea turtle may be exposed to levels of sound likely to result in Level A harassment under the AFAST Selected Alternative. Included in the Level A exposure numbers, acoustic analysis indicates that no sea turtles may be exposed to levels of sound likely to result in mortality under AFAST Selected Alternative. The exposure estimates represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. See Section 4.5.2 of Final AFAST Final EIS/OEIS for additional information.

With regard to the direct, indirect, and cumulative impacts of the proposed action, impacts are expected to be limited to temporary behavioral impacts. Oil spills and oil-spill-response activities are potential disturbances that may be expected to cause turtle deaths through contact with and consumption of oil and oil contaminated prey (MMS, 2008c). Protection and conservation measures will be implemented during the proposed actions to minimize any potential adverse impacts to sea turtles and to avoid any significant or long-term adverse impacts to threatened and endangered species. Impacts from this proposed action are not reasonably likely to affect the species, population, or stock through impacts on annual rates of recruitment or survival, and therefore impacts of the proposed action would be negligible. Thus, the direct, indirect, and cumulative impacts of the proposed actions may affect but would not adversely affect threatened and endangered sea turtle species. The Navy consulted with NMFS regarding its determination of effects on sea turtles from the analysis of environmental stressors and alternatives in U.S. territorial waters and in non-territorial waters (Appendix C).

6.4.10 Fish and Essential Fish Habitat

The affected environment for fish and essential fish habitat (EFH) includes the marine habitats in the Gulf of Mexico and the brackish habitat of the NSA Panama City Demolition Pond. The primary sources of information used to describe the affected environment for fish and EFH were in the Navy's Marine Resources Assessment (MRA) report for Gulf of Mexico Operating Area. Approximately 752 species of fish, including the over 200 species of deep-sea fish, and over 650 species of benthic invertebrates (over 250 of which are crustaceans) have been recorded in the Gulf of Mexico. The distribution of fish and invertebrate species in the Study Area is influenced primarily by temperature, benthic habitat, and physiography.

In accordance with the Magnuson-Stevenson Fisheries Conservation and Management Act (16 U.S.C. §1802 [10]) essential fish habitat EFH has been designated in the Study Area for 66 species of finfish, three species of shrimp, two species of crab, and numerous species of coral. While habitat areas of particular concern have been designated in the Gulf of Mexico for numerous species, none are located in the GOMEX Study Area. All estuarine systems of the Gulf of Mexico are designated as EFH for five Fishery Management Plans. Therefore, the Demolition Pond, located in St. Andrew Bay, contains designated EFH.

Two ESA-listed fish (Gulf sturgeon [*Acipenser oxyrinchus desotoi*] and smalltooth sawfish [*Pristis pectinata*]) were analyzed in the Final EIS/OEIS because of current or historic ranges within the GOMEX Study Area. USFWS and NMFS listed Gulf sturgeon as a threatened species under the ESA in 1991. Within the GOMEX Study Area, only the Panama City OPAREA is located within Gulf sturgeon critical habitat Unit 11. Unit 11 (Florida Nearshore Gulf of Mexico) encompasses Florida nearshore Gulf of Mexico waters within Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf Counties in Florida. The U.S. smalltooth sawfish population was listed as endangered under the ESA on April 1, 2003. Currently, no critical habitat is designated for this species, but it is anticipated that NMFS will designated critical habitat in the near future. Current information suggests that high habitat suitability areas for this species are located in northwestern Florida nearshore waters. Smalltooth sawfish may occur in or near the Demolition Pond.

Potential disturbances to fish include fishing, vessel traffic, degradation of water quality, habitat modification, pollution (chemicals, marine debris, etc.), and introduction of exotic species, disease, natural events, and global climate change (South Atlantic Fishery Management Council [SAFMC], 1998; Field *et al*., 2003; Jackson *et al*., 2001; IEF, 2006).

Fishing and non-fishing activities, individually or in combination, can adversely affect EFH and Managed Species (NOAA, 1998). Potential impacts of commercial fishing include over-fishing of targeted species and bycatch, both of which negatively affect fish stocks (NRC, 2002). Mobile fishing gears such as bottom trawls disturb the seafloor and reduce structural complexity. Indirect effects of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (lost or snagged and abandoned gear that catches fish), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats. Recreational fishing also poses a threat because of the large number of participants and the intense, concentrated use of specific habitats.

Natural stresses include storms and climate-based environmental shifts, such as harmful algal blooms and hypoxia. Disturbance from ship traffic and exposure to biotoxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them vulnerable to parasites and diseases that would not normally compromise natural activities or be fatal.

Potential cumulative impacts of Navy training exercises include release of chemicals into the ocean, introduction of MEMs into the water column and onto the seafloor, mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives, and physical and acoustic impacts of vessel activity. The incremental contribution by the proposed action (or alternatives) to impacts on the marine environment is expected to be insignificant.

6.4.10.1 GOMEX Final EIS/OEIS Conclusions

Given the limited extent, duration, and magnitude of potential impacts of Navy operations, it has been concluded that there would be no adverse effects to managed species and EFH under the No Action Alternative, Alternative 1, or Alternative 2. Therefore, EFH consultation with NMFS is not required. The Preferred Alternative may affect the Gulf sturgeon and would not adversely modify Gulf sturgeon critical habitat. The Preferred Alternative may affect the smalltooth sawfish. Critical habitat has not been designated for the smalltooth sawfish. The Navy consulted with NMFS regarding its determination of effect for the Preferred Alternative and federally listed fish. The No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on fish populations or habitat in territorial waters in accordance with NEPA. Furthermore, in accordance with EO 12114 the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to fish populations or habitat in nonterritorial waters.

Endangered Species Act

Table 3.9-4 provides a summary of the Navy's determination of effect for Alternative 2 (the Preferred Alternative) and federally listed fish that potentially occur in or near the Study Area. Alternative 2 may affect the Gulf sturgeon and smalltooth sawfish, but the effects would be considered insignificant or discountable. Alternative 2 is not expected to result in injury or mortality to ESA-listed species of fish and would not adversely modify Gulf sturgeon critical habitat. Critical habitat has not yet been designated for the smalltooth sawfish. NMFS concluded ESA Section 7 formal consultation with Navy for listed and proposed fish (Appendix C).

Magnuson-Stevens Fishery Conservation and Management Act

The Study Area covers a vast area encompassing more than 50,000 nm^2. The wide dispersion in time and space of Navy training events superimposed on the variable temporal and seasonal distributions of the fish species present, minimizes the potential for interaction with local populations. As described in Section 3.9.1.2, for managed species and EFH an adverse effect is: 1) more than minimal, 2) not temporary, 3) causes significant changes in ecological function, and 4) does not allow the environment to recover without measurable impact. Given the limited extent, duration, and magnitude of potential impacts of Navy activity, it is concluded that there would be no adverse effects to managed species and EFH under the No Action Alternative, Alternative 1, or Alternative 2. Therefore, EFH consultation with NMFS is not required.

6.4.10.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area include Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing.

Potential disturbances to fish include fishing, vessel traffic, degradation of water quality, habitat modification, pollution (chemicals, marine debris, etc.), and introduction of exotic species, disease, natural events, and global climate change (South Atlantic Fishery Management Council [SAFMC], 1998; Field *et al.*, 2003; Jackson *et al.*, 2001; IEF, 2006).

Fishing and non-fishing activities, individually or in combination, can adversely affect EFH and Managed Species (NOAA, 1998). Potential impacts of commercial fishing include over-fishing of targeted species and bycatch, both of which negatively affect fish stocks (NRC, 2002). Mobile fishing gears such as bottom trawls disturb the seafloor and reduce structural complexity. Indirect effects of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (*e.g.*, snagged or lost gear and torn fragments of net that continue to catch fish), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats. Recreational fishing also poses a threat because of the large number of participants and the intense, concentrated use of specific habitats.

Natural stresses include storms and climate-based environmental shifts, such as harmful algal blooms and hypoxia. Disturbance from ship traffic and exposure to biotoxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them vulnerable to parasites and diseases that would not normally compromise natural activities or be fatal.

Impacts of the OCS Program could result from petroleum spills, subsurface blowouts, pipeline trenching, and offshore discharges of drilling muds and produced waters are expected to be negligible (MMS, 2008c).

Potential cumulative impacts of Navy training exercises include release of chemicals into the ocean, introduction of MEMs into the water column and onto the seafloor, mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives, and physical and acoustic impacts of vessel activity. The incremental contribution by the proposed action (or alternatives) to impacts on the marine environment is expected to be insignificant.

The overall effect on fish stocks would be negligible compared to the impact of commercial and recreational fishing in the GOMEX Study Area. Past, present, planned, and reasonably foreseeable

actions within the GOMEX Study Area includes commercial and recreational vessel traffic, coastal development, oil/gas exploration and development, sand and mineral mining, dredging and fill operations, beach nourishment, cooling water intake and discharge, and wastewater discharge. Potential disturbances to fish include ship and boat traffic, degradation of water quality, habitat modification, pollution (chemicals, marine debris, *etc*.), introduction of exotic species, disease, natural events, and global climate change (SAFMC, 2007).

With respect to the cumulative effects from the Navy's use of active mid and high frequency sonar, the acoustic analysis from the Final AFAST EIS/OEIS is incorporated here to provide a basis for analyzing the cumulative effects from active sonar use. The data used in this analysis includes the effects associated with active sonar use throughout the entire AFAST Study area (not just those inside the GOMEX Study Area as discussed in section 3.19 of this document).

The overall effect on fish stocks would be negligible compared to the impact of commercial and recreational fishing in the AFAST Study Area. After completion of an active sonar activity, repopulation of an area by fish should take place within a matter of hours. Even for fish that are able to detect mid-frequency sounds, both the fish and vessels are moving. Therefore, the exposure to mid-frequency sounds is transient in nature. As such, the exposure would be temporary and not considered significant. As such, no long-term changes to species abundance or diversity, loss or degradation of sensitive habitats, or effects to threatened and endangered species are expected. There is the potential for minor, but recoverable cumulative impacts to marine fish under the Final AFAST EIS/OIS Selected Alternative.

Since the majority of AFAST activities are short-term and occur underwater, interaction with EFH during active sonar activities is not expected to be significant. Any impacts would be temporary and localized and as such, there is the potential for minor, but recoverable cumulative effects to EFH. No significant cumulative impacts are anticipated.

The analysis of effects of explosives on fish and fish habitat discussed in the GOMEX Range Complex EIS/OEIS indicates that while serious injury and/or mortality to individual fish would be expected if they were present in the immediate vicinity of an explosion, no Alternative would result in significant impacts to fish populations based on the low number of fish that would be affected. Explosive disturbances to EFH in the Gulf of Mexico would be limited to the water column and would be short-term and localized.

No significant cumulative impacts to fish or fish habitat would occur as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to fish or fish habitat in non-territorial waters is expected from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.11 Seabirds and Migratory Birds

Potential disturbances to seabirds include: (1) fisheries interactions, (2) exposure to oil and hazardous materials, (3) debris ingestion and entanglement, and (4) collisions with lighted ships, platforms, and wind energy turbines (Hunter *et al*., 2006). As discussed in the analysis in Chapter 3, the impacts of the No Action Alternative, Alternative 1, and Alternative 2 on seabirds and migratory birds would be minor and localized. No long-term, population impacts would occur. As such, the potential for the No Action Alternative, Alternative 1, or Alternative 2 to contribute incrementally or synergistically to the impacts of other actions on seabirds or migratory birds is very low. The No Action Alternative, Alternative 1, or Alternative 2 would not make a significant contribution to the impacts of other past, present, planned, and reasonably foreseeable actions on seabirds and migratory birds within the GOMEX Range Complex Study Area.

6.4.11.1 GOMEX Final EIS/OEIS Conclusions

A total of 28 seabirds could potentially occur in the OPAREAs. The area from the beach to about 10 nautical miles (nm) offshore provides foraging areas for breeding terns, gulls, skimmers, and pelicans; a migration corridor and winter habitat for terns, gulls, skimmers, pelicans, loons, cormorants, and gannets; and supports non-breeding and transient pelagic seabirds. Offshore pelagic waters support non-breeding and transient pelagic seabirds, loons, gannets, and several tern species. Critical habitat for roseate tern has not been designated in the OPAREAs. The brown pelican is listed under the ESA and could potentially occur in the GOMEX Study Area. Critical habitat for listed birds has not been designated under the ESA within the Study Area. While not listed under the ESA, others species potentially occurring in the Study Area are of management concern based on relatively low or declining populations, including the masked booby, sooty shearwater, and northern gannet.

Vessel movements, aircraft overflights, analyses of other training activities in the GOMEX Study Area were conducted to identify potential effects on seabirds and migratory birds. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to seabirds and migratory birds. The analysis of environmental stressors and alternatives indicated no significant impact to seabirds and migratory birds in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

Endangered Species Act

Table 3.10-3 provides a summary of the Navy's determination of effect for Alternative 2 (the Preferred Alternative) and the federally listed Brown pelican. Alternative 2 may affect the brown pelican, but the effects would be considered insignificant or discountable. Alternative 2 is not expected to result in injury or mortality to the brown pelican. Critical habitat has not been designated for the brown pelican. The Navy requested consultation with USFWS regarding its determination of effect for federally-listed birds on January 7, 2009. On March 09, 2009 the USFWS provided concurrence that Alternative 2 (the Preferred Alternative) will have no effect on, or is not likely to adversely affect the federally-listed species or designated critical habitat as determined in the Navy's consultation request of January 7, 2009 (see Appendix C)..

Migratory Bird Treaty Act

As discussed in the analysis presented in Section 3.10.3 and summarized in Table 3.10-3, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required to confer with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects to migratory birds not listed under the ESA.

Analyses of vessel movements, aircraft overflights, and other training activities in the GOMEX Study Area were conducted to identify potential effects on seabirds and migratory birds. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be no significant impact to sea birds in territorial waters. In addition, there would be no significant harm to sea birds in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.11.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The overall cumulative effect on seabirds and migratory birds would be minor in the GOMEX Study Area. MMS activities that have the potential to impact marine birds (although sublethel) in the offshore environment include OCS related helicopter and service vessel traffic and noise, air emissions, degradation of water quality, habitat degradation, discarded trash and debris and structure lighting and presence (MMS, 2008c). Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area includes commercial and recreational fishing, commercial and general aviation traffic, alternative energy development and coastal development. As discussed in the analysis presented in Section 3.10.3 and summarized in Table 3.10-4, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required to confer with the USFWS on development and implementation of conservation measures to minimize or mitigate adverse impacts to migratory birds not listed under the ESA. Therefore, there is the potential for minor, but recoverable, cumulative impacts to seabirds and migratory birds under the No Action Alternative, Alternative 1, and Alternative 2.

6.4.12 Terrestrial Biological Resources

This section addresses biological resources at McMullen County Range (Dixie and Yankee Targets) and Noxubee County Range (SEARAY Target), including vegetation, wetlands, wildlife, and threatened and endangered species. The regulatory framework that governs and protects these resources is described in Appendix K and includes Section 404 of the CWA (wetlands), the Migratory Bird Treaty Act (MBTA), and the ESA.

6.4.12.1 GOMEX Final EIS/OEIS Conclusions

This section addresses biological resources at McMullen County Range (Dixie and Yankee Targets) and Noxubee County Range (SEARAY Target), including vegetation, wetlands, wildlife, and threatened and endangered species. Land within the property boundary and lands adjacent to the ranges were included in the analysis. The impact area at Dixie Target is maintained for operational and safety purposes and lacks native vegetation communities. The flora of the buffer zone consists of several natural plant communities in addition to areas modified by livestock or game management practices. The Dixie Target impact area contains no areas that should be considered as jurisdictional wetlands. While some of the stock ponds may have small clusters of cattails there has been no hydric soil discovered within the area. Areas along the Nueces River to the north support marshy vegetation. Activities associated with past and current land uses (*e.g.*, military use, livestock grazing, and root-plowing) have resulted in substantial surface disturbance at Yankee Target, and dominant vegetation generally consists of weedy species well-suited for invasion of disturbed land. Common plants include honey mesquite (*Prosopis glandulosa*), salt cedar (*Tamarix aphylla*), and rough cocklebur (*Xanthium strumarium*). A wetlands survey conducted at Yankee Target in July 1994 identified approximately 1.88 acres of wetlands at six sites.

The impact area at Noxubee County range consists of 442 acres of semi-improved grounds surrounding the target and 212 acre of unimproved grounds. The semi-improved grounds consist of vegetation routinely maintained for operational and safety purposes. Portions of the approach paths, the main target circle, and firebreak roads within the maintained area are kept free of vegetation. Wetland mapping provided in the NAS Meridian Integrated Natural Resources Management Plan shows five small areas

identified as wetlands in the impact area, three within the maintained portion and two areas in the approach path. No wetlands are located within the actual target circle. A review of National Wetland Inventory maps indicates that forested wetlands occur in portions of the buffer zone.

McMullen County is within the expected range of about 25 mammals. At least 84 bird species are known to be resident, migratory, or transients of the Dixie Target from surveys completed in October 1995. At least fourteen species of reptiles and amphibians are expected to occur in McMullen County. The open areas, forests, and wetlands at the Noxubee County Range provide habitat for a variety of wildlife. The only federally listed species that may occur at Dixie Target is the American alligator (*Alligator mississippiensis*). The alligator is not biologically threatened and ESA Section 7 consultation requirements do not apply to this species. Other federally listed species that may occur in McMullen County include the two endangered species of big cats, the ocelot (*Leopardus pardalis*) and jaguarondi (*Herpailurus yagouaroundi cacomitli*). No federally listed species have been observed at Noxubee County Range. The only federally listed species known to occur in Noxubee County is the red-cockaded woodpecker *(Picoides borealis)*. A red-cockaded woodpecker colony existed next to Navy property at Noxubee County Range. However, the colony is no longer active and the stand where the colony occurred has been clearcut. In addition, 20 Texas state-listed species may potentially occur within the McMullen County Range, while 36 Mississippi species of greatest conservation need may potentially occur at the Noxubee County Range. These species were also included in the analysis.

Endangered Species Act

As discussed in Section 3.11.3, aircraft overflights may affect the ocelot at Dixie and Yankee Targets and the red-cockaded woodpecker at Noxubee County Range. Non-explosive practice munition (NEPM) and military expended materials would have no effect on the ocelot at Dixie and Yankee Targets or the red-cockaded woodpecker at Noxubee County Range. The Navy consulted with USFWS regarding its determination of effects for Alternative 2 and the ocelot and red-cockaded woodpecker. On March 9, 2009 the USFWS provided concurrence that Alternative 2 (the Preferred Alternative) will have no effect on, or is not likely to adversely affect the federally-listed species or designated critical habitat as determined in the Navy's consultation request of January 7, 2009 (see Appendix C).

Migratory Bird Treaty Act

As discussed in the analysis presented above in Section 3.11.3, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required to confer with the USFWS on development and implementation of conservation measures to minimize or mitigate adverse effects to migratory birds.

6.4.12.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area include Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing. Based on analysis, federally listed species are not expected to occur in the McMullen County Range (Dixie Target and Yankee Target) and Noxubee County Range Study Area. Therefore, the No Action Alternative, Alternative 1, and

Alternative 2 would have no effect on listed species. Critical habitat has not been designated at the Dixie Target, Yankee Target, or Noxubee County Range.

The No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required confer with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects to migratory birds. The No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on biological resources within the McMullen County Range and Noxubee County Range Study Areas.

There are no unavoidable significant environmental impacts to terrestrial biological resources as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2.

6.4.13 Land Use

Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section. This section assesses potential impacts to land use from proposed activities on the inland ranges.

6.4.13.1 GOMEX Final EIS/OEIS Conclusions

No offshore events associated with the proposed activities are associated with land encroachment or land forms and soil. Land-based modes of transportation and utility systems are not associated with offshore events. No changes to existing real estate use or agreements are proposed as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2. Additionally, the scenic quality of the offshore area is not affected by proposed activities. Therefore, the proposed activities associated with the No Action Alternative, Alternative 1, or Alternative 2 would have no impact on land use.

6.4.13.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Coordination with the Department of the Interior through environmental planning in the Gulf of Mexico, specifically relating to the effects of OCS oil and gas development serves as an avenue for early identification, avoidance, and resolution of potential conflicts. This is accomplished through coordination with federal, state, and local agencies (to include the Navy) when developing plans for oil and gas development within the Study Area for this Final EIS/OEIS. Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area include Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing. There are no unavoidable significant environmental impacts to land use as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2.

6.4.14 Cultural Resources

Shipwrecks are vulnerable to the impacts of time, tides, storm surges, and marine organisms, damage from boats, wakes, anchor drops, and looting. Over time, elements of the ship deteriorate, break apart, and are covered by sand and marine organisms. Any future damage from mine warfare or mine neutralization efforts would contribute to the cumulative damage over time.

Materials such as shells and mine fragments expended during the proposed events would sink to the ocean bottom. It is unlikely these materials would come into contact with a shipwreck. However, if expended materials were to sink onto a shipwreck, or in the near vicinity, it would not affect the historic properties of the shipwreck. Eventually, the expended materials would provide a substrate for benthic colonization and would likely be covered by shifting sediments.

Preplanning and implementation of described mitigation measures (especially avoidance) would result in no significant adverse impacts (negligible to minor impacts) for shipwrecks in the GOMEX OPAREAs (*no adverse effect* under Section 106).

6.4.14.1 GOMEX Final EIS/OEIS Conclusions

Expended training materials would be deposited in offshore areas, most of which would become buried in the sea floor sediment, and would have no substantial environmental effects. There is a remote possibility that expended training materials would settle on or near offshore shipwrecks. The overall volume of expended training items would increase in Alternative 1 and the Preferred Alternative (Alternative 2) in correlation to changes in events. Mine warfare activities would be limited to the existing underwater detonation areas within the New Orleans OPAREA. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to cultural resources. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to cultural resources in territorial waters. In addition, there would be less than significant harm to cultural resources in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2. The analysis of environmental stressors and alternatives indicated no significant impact to cultural resources in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.14.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Most past, present, and reasonably foreseeable future ocean activities such as commercial ship traffic, fishing, energy exploration, or scientific research, would not substantially affect underwater cultural resources. This is most likely due to lack of physical contact with shipwrecks since their locations are cataloged. Impacts from OCS activities have likely resulted in the loss of significant or unique historic archaeological information; however, such impacts would have occurred prior to 1973. The current impact to cultural resources due to OCS activities is likely to be very small due to requirement for remote-sensing surveys and an archaeological report prior to commencement of activity (MMS, 2008c).Moreover, any activities with the potential for significant impacts on cultural resources will require Section 106 consultation, and would be mitigated as required by law. Where avoidance was practiced, no cumulative impact would result since there would be no contact with the cultural resource. Where cultural resources could not be avoided, Section 106 consultation would mitigate any potential adverse affects to the cultural resources. Therefore, there is the potential for minor, but recoverable cumulative impacts to cultural resources under the No Action Alternative, Alternative 1 or Alternative 2.

6.4.15 Transportation

Military and civilian use of the offshore sea and air areas is generally compatible. Where naval vessels and aircraft conduct operations that are not compatible with commercial or recreational transportation (*e.g.*, weapons firing), they are confined to OPAREAs away from shipping lanes and inside designated

Special Use Airspace (SUA). Dangerous operations are communicated to all vessels and aircraft by use of Notice to Mariners (NOTMAR), issued by the United States Coast Guard (USCG), and Notice to Airmen (NOTAM), issued by the Federal Aviation Administration (FAA).

Advance notice of scheduled operation times are made available to the public via NOTMARs and NOTAMs. NOTMARs and NOTAMs provide recreational boaters and aircraft pilots and other users notice that the military will be operating in a specific area, and allow them to plan their own activities accordingly. Schedules are updated when changes occur up until the date of the operation. If operations are cancelled at any time, this information is posted and the area is again identified as clear for public use. NOTMARs advise the public, fishermen, divers, and aircraft pilots in advance of ongoing military activities that may temporarily relocate civilian/recreational activities. NOTAMs are available on the internet at https://www.notams.jcs.mil and NOTMARs can be found on the internet at www.nga.mil/portal/site/maritime.

Implementation of the proposed action would not produce any significant regional transportation impacts. Impacts on commercial and recreational transportation would be short term in nature and produce some temporary access limitation. Some offshore events, especially if coincident with peak fishing locations and periods, could cause temporary displacement to individual travelers. However, most offshore events are of short duration and have a small activity footprint.

6.4.15.1 GOMEX Final EIS/OEIS Conclusions

The Navy can accomplish the proposed activities associated with the No Action Alternative, Alternative 1, or Alternative 2 without modifications or need for additional designated ocean or airspace. The proposed events will not require either: (1) a change to an existing or planned instrumented flight rules minimum flight altitude, a published or special instrument procedure, or an instrumented flight rules departure procedure; or (2) a visual flight rules activity to change from a regular flight course or altitude. As such, the increased training events do not conflict with any airspace use plans, policies, and controls. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to transportation resources in territorial waters. In addition, there would be less than significant harm to transportation resources in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.15.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area include Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing. Considering the scope of other actions in the geographic region and their interrelationship with the No Action Alternative, Alternative 1, and Alternative 2 and the lack of transportation assets impacts proposed in this Final EIS/OEIS, no further analysis of cumulative impacts is relevant.

6.4.16 Demographics

Demographics were assessed through the identification and evaluation of socioeconomic factors, including population trends, age structure, race and ethnicity, and educational achievement. Impacts to demographics are assessed in terms of their direct impacts on the local economy and related impacts on population and expenditure within the Study Area. Demographic impacts would be considered

important if the alternative chosen for implementation resulted in a substantial shift in population trends, spending and earning patterns, or community resources (notably housing and education).

6.4.16.1 GOMEX Final EIS/OEIS Conclusions

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in a change in the demographics within the Study Area. There would be no changes to the local population or economy as a result of the proposed offshore training activities under the No Action Alternative. Therefore, if the No Action Alternative were selected for implementation, there would not be any impacts to demographics.

6.4.16.2 GOMEX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area include Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing. Impacts of OCS activities are not anticipated to impact demographics in the Study Area as demographics would remain unchanged (MMS, 2008c). Considering the scope of other actions in the geographic region and their interrelationship with the No Action Alternative, Alternative 1, and Alternative 2 and the lack of demographic impacts proposed in this Final EIS/OEIS, no further analysis of cumulative impacts is relevant.

6.4.17 Regional Economy

Regional economy is assessed through evaluation of economic factors including industry, commercial fishing, tourism, and recreational fishing. The Study Area for assessment of the regional economy includes the States of Texas, Louisiana, Mississippi, Alabama, and Florida. Specific data for regional economic indicators on industry, commercial fishing, tourism, and recreational fishing were assessed in the Final EIS/OEIS.

6.4.17.1 GOMEX Final EIS/OEIS Conclusions

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to the regional economy. None of the alternatives would have a significant impact to the regional economy. None of the alternatives in non-territorial waters would cause significant harm to the regional economy. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to regional economy in territorial waters. In addition, there would be less than significant harm to regional economy in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.17.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions or events within the GOMEX Study Area include Navy activities, navigation, transportation, hurricanes, installation of production platforms, underwater OCS obstruction, production platform removals, seismic surveys, petroleum spills, subsurface blowouts, pipeline trenching, offshore discharges of drilling muds and produced waters (MMS, 2008c), coastal development, oil/gas exploration and development, sand and mineral mining,

dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing. Considering the scope of other actions in the geographic region and their interrelationship with the No Action Alternative, Alternative 1, and Alternative 2 and the lack of regional economic impacts proposed in this Final EIS/OEIS, no significant cumulative impacts to the regional economy is expected.

6.4.18 Recreation

Water-based recreation occurs throughout the Study Area, but most activities are conducted in bays or nearshore ocean waters in small boats (less than 25 ft). Fishing is probably the most common activity. Boating and diving is also popular.

Where naval vessels and aircraft are conducting operations that are not compatible (*e.g.*, hazardous weapons firing), they are confined to away from shipping lanes and inside Special Use Airspace. Advanced notice of hazardous operations is communicated to all vessels and operators by use of Notices-to-Mariners (NOTMARs), issued by the USCG, and Notices-to-Airmen (NOTAMs), issued by the Federal Aviation Administration (FAA). These provide recreational boaters and other users notice that the military will be operating in a specific area, and will allow them to plan their own activities accordingly. Implementation of the proposed action would not produce any significant recreational employment or income impacts.

6.4.18.1 GOMEX Final EIS/OEIS Conclusions

If the No Action Alternative, Alternative 1, or Alternative 2 were chosen for implementation, vessel movement stressors are precluded due to the fact that when safety clearance of the OPAREA is required, a NOTMAR that allows boats to select an alternate destination without substantially affecting their activities is provided in advance. Training activities are required to avoid recreational boaters in the range.

Potential stressors of aircraft overflights and their associated training activities are confined to designated special use airspace designed for that purpose. Training events are communicated to the public by use of NOTAMs. Navy aircraft training activities are typically at altitudes over 10,000 ft in specified areas within the Study Area.

The stressor of military expended materials interfering with recreational activities potentially caused by: mine neutralization, at-sea bombing, exercises in which ship gun crews firing against surface at sea, IMPASS training exercises, electronic combat training activities that include the use of chaff and flares, and amphibious assault and raid exercises that are currently conducted in the Study Area would remain and continue to have no impact on recreational interests in the Study Area due to the limited amount of materials (See Sections 3.1 and 3.2 for a more detailed analysis of military expended materials).

The stressor of mine warfare deployment/recovery impacting recreational activities potentially caused by mine countermeasures and neutralization exercises that are currently conducted in the Study Area would remain and continue to have no impact on recreational activity in the Study Area.

When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to recreational resources in territorial waters. In addition, there would be less than significant harm to recreational resources in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

The No Action Alternative, Alternative 1, or Alternative 2 would not have an impact on recreational activities as they are currently proposed because the Navy's policy of avoidance ensures that conflicts between military and recreational activities are minimized. The increase of activity proposed under

Alternative 1 and Alternative 2 are not anticipated to result in impacts to the recreation in the Study Area as they will occur in areas where current military training exists and recreational activities are already restricted or notified of naval activity before the activity takes place.

6.4.18.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions or events within the GOMEX Study Area include Navy activities, navigation, transportation, hurricanes, installation of production platforms, underwater OCS obstruction, production platform removals, seismic surveys, petroleum spills, subsurface blowouts, pipeline trenching, offshore discharges of drilling muds and produced waters (MMS, 2008c), coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing.

In the marine environment, other federal and state actions such as oil and gas leases, dredging operations for channel maintenance, other Department of Defense activities, as well as their associated vessel traffic, increases the potential for encounter with recreational activities that may disrupt a users' enjoyment of an area. Commercial activities like fishing and cruise ships also have the capacity to disrupt the more individual recreational activities as well.

It is expected that although there would be a potential for minor incremental, but recoverable, cumulative impacts by Navy actions at sea, these impacts would not be considered significant as they would be temporary and advanced notice is given. The analysis of environmental stressors and alternatives indicated no significant impacts to recreational use of U.S. territorial waters or significant harm to use of non-territorial. As such, any incremental and cumulative contribution of Navy training to existing stressors would be nominal.

6.4.19 Environmental Justice

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not produce any impact on Environmental Justice.

6.4.19.1 GOMEX Final EIS/OEIS Conclusions

The No Action Alternative would comprise the continuation of current Navy and Marine Corps training. Because current events would occur entirely in open water areas with no permanent populations, no disproportionate impacts would occur to land-based populations unless they obtained a living from fishing or other uses of open water areas. The fishing industries in Florida and Texas are unlikely to be impacted as the No Action Alternative is the continuation of current training activities. With unlikely impacts to open water-related industries, the proposed actions would not result in a finding of any disproportional impacts to minorities, low-income populations, or children.

The stressors from existing training activities that would likely impact environmental justice components are activities that stem from vessel movements, aircraft overflights, and military expended materials; however, military activities are either scheduled or announced ahead of execution or take place in an area that is designated for exclusive military use. Land activities are minimal and are not anticipated to increase or change; therefore, activities associated with the No Action Alternative, Alternative 1, or Alternative 2 (Preferred Alternative) will have no effect on transportation resources at the McMullen County and Noxubee County Ranges, or at the NSA Panama City Demolition Pond Area.

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in a change in the demographics within the Study Area of the States of Texas, Louisiana, Mississippi, Alabama, and Florida. Therefore, there would not be any impacts to demographics.

Alternative 1 and Alternative 2 comprise the incremental tempo changes of activities that occur in the No Action Alternative. There are no anticipated disproportional impacts to minorities, low-income populations, or children.

6.4.19.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area include Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, and recreational and commercial fishing. Effects of the OCS Program in the Study Area are minimal upon minority populations, low-income populations, or children since the effects are widely distributed and extensive (MMS, 2008c). Considering the scope of other actions in the geographic region and their interrelationship with the No Action Alternative, Alternative 1, and Alternative 2 and the lack of impacts to minority populations, low-income populations, or children proposed in this Final EIS/OEIS, no further analysis of cumulative impacts is relevant.

6.4.20 Public Health and Safety

Public health and safety issues include potential hazards inherent in flight operations, vessel movements, mine laying and clearance, and underwater detonations and high-explosive ordnance. It is the policy of the Navy to observe every possible precaution in the planning and execution of all of its activities to prevent injury to people or damage to property. Potentially, health and safety risks could be posed to the military, commercial, institutional, and recreational activities that take place in the GOMEX Study Area.

6.4.20.1 GOMEX Final EIS/OEIS Conclusions

Public Health

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to public health and safety. The analysis of environmental stressors and alternatives indicated no significant impact to public health and safety in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.20.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The overall cumulative effect of the proposed actions on public health and safety would be minor in the GOMEX Study Area. Past, present, planned, and reasonably foreseeable actions within the GOMEX Study Area includes military operations, commercial and recreational fishing, commercial and general aviation traffic, and coastal development. There are no past, present, or foreseeable actions that would potentially compromise public health and safety. Therefore, there are no significant cumulative impacts to public health and safety in territorial waters as a result of No Action Alternative, Alternative 1, and Alternative 2. No significant cumulative harm to public health and safety in non-territorial waters is expected as a result of the No Action Alternative, Alternative 1, or Alternative 2.

6.4.21 Atlantic Fleet Active Sonar Training

In January 2009, the Navy, after carefully weighing the operational and environmental consequences of the proposed action, announced its decision to designate areas along the East Coast of the United States and in the Gulf of Mexico where MFA and HFA sonar and the IEER system training; RDT&E activities will occur, and to conduct these activities (DoN, 2009b). The Navy's decision regarding MFA sonar activities includes the advanced extended echo ranging system as a replacement for the IEER system. These activities are collectively described as "active sonar activities" in the Final EIS/OEIS for AFAST.

6.4.21.1 GOMEX Final EIS/OEIS Conclusions

The active sonar activities that are described in this Final EIS/OEIS are not new and do not involve significant changes in systems, tempo, or intensity from past events. Moreover, there will be no significant effects to geology, water resources, marine habitat, airspace management, cultural resources, or socioeconomics within the Study Area under the No Action Alternative, Alternative 1, or Alternative 2. As such, implementation of the proposed action will not pose disproportionate high or adverse effects to minority or low-income populations, or environmental health and safety risks to children.

6.4.21.2 GOMEX Final EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The Navy published the Record of Decision for the Final AFAST EIS/OEIS in January 2009 (DoN, 2009b) and determined that the Selected Alternative, the No-Action Alternative, best meets the requirements for the proposed AFAST active sonar activities. Since the proposed action will not pose disproportionate high or adverse effects to minority or low-income populations, or environmental health and safety risks to children, the proposed action will not result in any cumulative impacts.

6.5 ASSESSING INDIVIDUAL PAST, PRESENT, AND FUTURE IMPACTS

In this chapter, past and present actions, as well as reasonably foreseeable future action, are identified. In Table 6.5-1 a value of "NE" through "***" was assigned to each action based on its potential to cause an adverse effect to a specific resource area. An example of each value is as follows:

- A "NE" value would be given to an action that has no adverse impacts to a particular resource.
- A "*" would be given to an action that has the potential for minor, but recoverable, adverse impacts to a particular resource. Examples include negligible or less than significant effect to a resource.
- A "**" would be given to an action that has the potential for moderate, but recoverable, adverse impacts to a particular resource. Examples include a measurable effect to a resource, but an effect that would be recoverable.
- A "***" would be given to an action that has the potential for major, non-recoverable, adverse impacts to a particular resource. Examples include a significant effect to a resource, including impacts that are not recoverable.

Once a value was assigned to each resource for an individual action, as assessment was conducted to determine whether there would be cumulative impacts to the resource area in relation to the proposed action. Cumulative impacts were considered likely to occur for the following actions:

- Actions occurring at the same or overlapping areas at the same or similar time.
- Actions occurring in the vicinity at the same or similar time.
- Actions occurring at the same or overlapping areas at some other time.

The same valuation process was used to determine the overall cumulative impact to a resource. It is important to note that even if a resource was given a value of "**" or "***" for an individual action, it

does not automatically generate a cumulative impact of "**" or "***". This is due to difference in space and time from other actions or the resource that is potentially affected. For instance, regulatory permits can be granted for certain actions that involve the likely "taking" of protected species, such as marine mammals, sea turtles, or migratory birds. Even though these individual impacts would be considered moderate to severe (depending on the action and species affected), regulations are in place to ensure the continued survival of the respective species. Moreover, the implementation of mitigation and mitigation measures for individual actions has the potential to further reduce the cumulative impact. Table 6.5-1 summarizes the results of the cumulative impacts analysis for each resource area identified previously in this Final EIS/OEIS that could potentially be affected by the proposed action; other past, present and reasonably expected future actions potentially affecting the same resources; and the magnitude of each individual action.

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TABLE 6.5-1
SUMMARY OF CUMULATIVE IMPACTS BY RESOURCE AREA

		Bathymetry/Sediments	Hazardous Waste/Materials	Water Resources	Air Quality	Airborne Noise	Marine Communities	Marine Mammals	Sea Turtles	Fish and Essential Fish Habitat	Seabirds/Migratory Birds	Biological Resources at McMullen and Noxubee Co Ranges	Land Use	Cultural Resources	Transportation	Demographics	Regional Economy	Recreation	Environmental Justice	Public Health and Safety
Past and Present Actions	Military Training Activity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	*
	MMS: Oil and Gas	**	*	**	**	*	*	**	**	*	**	NE	NE	*	NE	NE	NE	NE	NE	NE
	State Oil and Gas	**	*	**	**	*	*	**	**	*	**	NE	NE	*	NE	NE	*	*	NE	NE
	Dredging	**	**	**	**	*	**	NE	**	**	NE	NE	NE	*	NE	NE	NE	NE	NE	NE
	Commercial and Recreational Fishing	*	**	NE	NE	*	**	**	***	**	**	NE	NE	*	NE	NE	NE	NE	NE	NE
	Maritime Traffic	*	*	*	NE	*	NE	**	*	NE	NE	NE	NE	*	*	NE	*	*	NE	NE
	Scientific Research	NE	*	NE	NE	NE	*	*	*	*	*	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Military Expended Materials	---	---	*	NE	NE	**	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Environmental Contamination and Biotoxins	---	---	**	NE	NE	**	**	**	**	**	**	NE	NE	NE	NE	NE	NE	NE	NE
	Marine Ecotourism	NE	*	*	NE	*	NE	*	*	NE	NE	NE	NE	NE	NE	NE	*	*	NE	NE
Future Actions	Military Training Activity	*	*	*	*	*	*	*	*	*	*	*	NE	*	NE	NE	NE	NE	NE	*
	MMS	NE	*	NE	NE	*	NE	NE	NE	NE	*	NE	NE	NE	NE	*	NE	NE	NE	NE
	USCOE	**	**	**	*	*	**	**	**	**	**	**	**	*	NE	NE	NE	NE	NE	NE
	Offshore LNG	*	NE	*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
GOMEX Proposed Action		*	*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	NE	*	NE	NE
Cumulative Impacts		*	*	*	*	*	*	**	**	*	*	*	NE	*	*	NE	NE	*	NE	NE

NE= No Adverse Impacts; NASA=National Aeronautics and Space Administration; **=Potential for minor, but recoverable, adverse impacts; **=Potential for moderate, but recoverable, adverse impacts; ***=Potential for major, non-recoverable, adverse impacts*

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CHAPTER 8 GLOSSARY OF TERMS

Access—the right to transit to and from and to make use of an area.

Accretion—growth by gradual external addition.

Activity—an individual scheduled training function or action such as missile launching, bombardment, vehicle driving, or Field Carrier Landing Practice.

Advisory Council on Historic Preservation—a 19-member body appointed, in part, by the President of the United States to advise the President and Congress and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (Public Law 89-655; 16 United States Code 470).

Aeronautical Chart—a map used in air navigation containing all or part of the following: topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports.

Aesthetic—a pleasing appearance, effect, or quality that allows appreciation of character-defining features, such landscape.

Air Basin—a region within which air quality is determined by the meteorology and emissions within it with minimal influence on and impact by contiguous regions.

Air Defense Identification Zone—the area of airspace over land or water, extending upward from the surface, within which the ready identification, location, and control of aircraft are required in the interest of national security.

Air Route Traffic Control Center (ARTCC)—a facility established to provide air traffic control service to aircraft operating on Instrument Flight Rules flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to aircraft operating under Visual Flight Rules.

Air Traffic Control—a service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

Air Traffic Control Assigned Airspace (ATCAA)—Federal Aviation Administration-defined airspace not over an Operating Area (OPAREA) within which specified activities, such as military flight training, are segregated from other Instrument Flight Rules air traffic.

Airfield—usually an active and/or inactive airfield, or infrequently used landing strip, with or without a hard surface, without Federal Aviation Administration-approved instrument approach procedures. An airfield has no control tower and is usually private.

Airport—usually an active airport with hard-surface runways of 3,000 feet or more, with Federal Aviation Administration-approved instrument approach procedures regardless of runway length or composition. An airport may or may not have a control tower. Airports may be public or private.

Airspace, Controlled—airspace of defined dimensions within which air traffic control service is provided to Instrument Flight Rules flights and to Visual Flight Rules flights in accordance with the airspace classification. Controlled airspace is divided into five classes, dependent upon location, use, and degree of control: Class A, B, C, D, and E.

Airspace, Special Use (SUA)—airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon non-participating aircraft.

Airspace, Uncontrolled—uncontrolled airspace, or Class G airspace, has no specific definition but generally refers to airspace not otherwise designated and operations below 1,200 feet above ground level. No air traffic control service to either Instrument Flight Rules or Visual Flight Rules aircraft is provided other than possible traffic advisories when the air traffic control workload permits and radio communications can be established.

Airspace—the space lying above the earth or above a certain land or water area (such as the Atlantic Ocean); more specifically, the space lying above a nation and coming under its jurisdiction.

Airway—Class E airspace established in the form of a corridor, the centerline of which is defined by radio navigational aids.

Alert Area—a designated airspace in which flights are not restricted but there is concentrated student training or other unusual area activity of significance.

Alkaline—basic, having a pH greater than 7.

Alluvium—a general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a maintained slope.

Altitude Reservation—altitude reservation procedures are used as authorization by the Central Altitude Reservation Function, an air traffic service facility, or appropriate air route traffic control center, under certain circumstances, for airspace utilization under prescribed conditions.

Aluminum Oxide (Al_2O_3)—a common chemical component of missile exhaust. Under natural conditions, the chemical is not a source of toxic aluminum; the U.S. Environmental Protection Agency has determined that nonfibrous Al_2O_3, as found in solid rocket motor exhaust, is nontoxic.

Ambient Air Quality Standards—legal limitations on pollutant concentration levels allowed to occur in the ambient air established by the U.S. Environmental Protection Agency or state agencies. Primary ambient air quality standards are designed to protect public health with an adequate margin of safety. Secondary ambient air quality standards are designed to protect public welfare-related values including property, materials, and plant and animal life.

Ambient Air—that portion of the encompassing atmosphere, external to buildings, to which the general public has access.

Amplitude—the maximum departure of the value of a sound wave from the average value.

Anthropogenic—human-related.

Applications of Offensive Military Power—the ability to employ various means of destructive and/or disruptive force which a naval unit/Strike Group can apply against an opponent at a given time.

Aquaculture—the cultivation of the natural produce of water, such as fish or shellfish.

Archaeology—a scientific approach to the study of human ecology, cultural history, prehistory, and cultural processes, emphasizing systematic interpretation of material remains.

Area of Potential Effect—the geographic area within which direct and indirect impacts generated by the proposed action and alternatives could reasonably be expected to occur and thus cause a change in historic, architectural, archaeological, or cultural qualities possessed by the property.

Artifact—any thing or item that owes its shape, form, or placement to human activity. In archaeological studies, the term is applied to portable objects (*e.g.*, tools and the by-products of their manufacture).

Attainment Area—an air quality control region that has been designated by the U.S. Environmental Protection Agency and the appropriate state air quality agency as having ambient air quality levels as good as or better than the standards set forth by the National Ambient Air Quality Standards, as defined in the Clean Air Act. A single geographic area may have acceptable levels of one criteria air pollutant, but unacceptable levels of another; thus, an area can be in attainment and non-attainment status simultaneously.

Average Daily Traffic (ADT)—the total volume of traffic passing a given point or segment of a roadway in both directions divided by a set number of days.

A-weighted Sound Level—a number representing the sound level which is frequency-weighted according to a prescribed frequency response established by the American National Standards Institute (ANS1.4-19711) and accounts for the response of the human ear.

Azimuth—a distance in angular degrees in a clockwise direction from the north point.

Backyard Range—a range within a radius of one hour's drive (50-65 miles) of a unit, such that training there can be considered non-deployed for personnel tempo (PERSTEMPO) purposes.

Benthic Communities—of or having to do with populations of bottom-dwelling flora or fauna of oceans, seas, or the deepest parts of a large body of water.

Benthopelagic—living and feeding near the sea floor as well as in midwaters or near the surface.

Benthos—the sea floor.

Bioaccumulation—building up of a substance, such as polychlorinated biphenyls, in the systems of living organisms (and thus, a food web) due to ready solubility in living tissues.

Biological Diversity—the complexity and stability of an ecosystem, described in terms of species richness, species evenness, and the direct interaction between species such as competition and predation.

Biological Resources—a collective term for native or naturalized vegetation, wildlife, and the habitats in which they occur.

Booster—an auxiliary or initial propulsion system that travels with a missile or aircraft and that may not separate from the parent craft when its impulse has been delivered; may consist of one or more units.

Brackish—slightly salty; applicable to waters where saline content is intermediate between that of fresh water and sea water.

Calcareous—containing calcium carbonate.

Candidate Species—a species of plant or animal for which there is sufficient information to indicate biological vulnerability and threat, and for which proposing to list as "threatened" or "endangered" is or may be appropriate.

Carbon Dioxide (CO_2)—a colorless, odorless, incombustible gas which is a product of respiration, combustion, fermentation, decomposition and other processes, and is always present in the atmosphere.

Carbon Monoxide (CO)—a colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; it is one of the six pollutants for which there is a national ambient standard (see Criteria Pollutants).

Carrier Strike Group Composite Training Unit Exercise (CSG COMPTUEX) —an Integrated Phase, at-sea, major range event that integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging environment. Commander Strike Force Training Atlantic schedules and conducts the CSG COMPTUEX in accordance with a schedule of events plan. It is nominally 26

days long with two scenario-driven "mini" multi-threat battle problems, one that is about 24 hours long and the other about 18 hours long. Typically, live-fire operations that take place during COMPTUEX include long-range air strikes, naval surface fire support, and other surface gunnery and missile exercises.

CATM—Captive Carry Training Missile (e.g., CATM-9 for AIM-9 Sidewinder). Used for pilot training in aerial target acquisition and use of aircraft controls/displays. All components are inert and no missile actually leaves the aircraft.

Cetacean—an order of aquatic, mostly marine, animals including the whales, dolphins, porpoise, and related forms with large head, fishlike nearly hairless body, and paddle-shaped forelimbs.

Class A Airspace (also Positive Controlled Area)—airspace designated in Federal Aviation Administration Regulation Part 71 within which there is positive control of aircraft.

Coastal Zone—a region beyond the littoral zone occupying the area near the coastline in depths of water less than 538.2 feet. The coastal zone typically extends from the high tide mark on the land to the gently sloping, relatively shallow edge of the continental shelf. The sharp increase in water depth at the edge of the continental shelf separates the coastal zone from the offshore zone. Although comprising less than 10 percent of the ocean's area, this zone contains 90 percent of all marine species and is the site of most large commercial marine fisheries. This may differ from the way the term "coastal zone" is defined in the State Coastal Zone Management Programs.

Community—an ecological collection of different plant and animal populations within a given area or zone.

Component (Cultural Resources)—a location or element within a settlement or subsistence system. Archaeological sites may contain several components that reflect the use of the locality by different groups in different time periods.

Continental Shelf—a shallow submarine plain of varying width forming a border to a continent and typically ending in a steep slope to the oceanic abyss.

Continental Slope—the steep slope that starts at the shelf break about 492 to 656 feet and extends down to the continental rise of the deep ocean floor.

Continental United States (CONUS)—the United States and its territorial waters between Mexico and Canada, but excluding overseas states.

Control Area (CTA)—a controlled airspace extending upwards from a specified limit above the earth.

Controlled Access—area where public access is prohibited or limited due to periodic training operations or sensitive natural or cultural resources.

Controlled Airspace—airspace of defined dimensions within which air traffic control service is provided to Instrument Flight Rules flights and to Visual Flight Rules flights in accordance with the airspace classification. Controlled airspace is divided into five classes, dependent upon location, use, and degree of control: Class A, B, C, D, and E.

Controlled Firing Area (CFA)—airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to non-participating aircraft and to ensure the safety of persons and property on the ground.

Copepod—a small, shrimp-like crustacean.

Coral Reef—a calcareous organic area composed of solid coral and coral sand.

Council on Environmental Quality (CEQ)—established by the National Environmental Policy Act, the CEQ consists of three members appointed by the President. A CEQ regulation (Title 40 Code of Federal Regulations 1500-1508, as of July 1, 1986) describes the process for implementing the National Environmental Policy Act, including preparation of environmental assessments and environmental impact statements, and the timing and extent of public participation.

Co-Use—Scheduled uses that safely allow other units to transit the area or conduct activities.

Criteria Pollutants—pollutants identified by the U.S. Environmental Protection Agency (required by the Clean Air Act to set air quality standards for common and widespread pollutants); also established under state ambient air quality standards. There are standards in effect for six criteria pollutants: sulfur dioxide, carbon monoxide, particulate matter, nitrogen dioxide, ozone, and lead.

Cultural Resources—prehistoric and/or historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered of importance to a culture, subculture, or community for scientific, traditional, religious, or any other reason.

Culture—a group of people who share standards of behavior and have common ways of interpreting the circumstances of their lives.

Cumulative Impact—the impact of the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Current—a horizontal movement of water or air.

C-weighted—utilized to determine effects of high-intensity impulsive sound on human populations, a scale providing unweighted sound levels over a frequency range of maximum human sensitivity.

Danger Area—(1) In air traffic control, an airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times; (2) (DoD only) A specified area above, below, or within which there may be potential danger.

Decibel (dB)—the accepted standard unit of measure for sound pressure levels. Due to the extremely large range of measurable sound pressures, decibels are expressed in a logarithmic scale.

Degradation—the process by which a system will no longer deliver acceptable performance.

Demersal—living close to the seafloor.

Direct Effects—immediate consequences of program activities.

Direct Impact—effects resulting solely from program implementation.

District—National Register of Historic Places designation of a geographically defined area (urban or rural) possessing a significant concentration, linkage, or continuity of sites, structures, or objects united by past events (theme) or aesthetically by plan of physical development.

Diurnal—active during the daytime.

Dunes—hills and ridges of sand-size particles (derived predominantly from coral and seashells) drifted and piled by the wind. These dunes are actively shifting or are so recently fixed or stabilized that no soil horizons develop; their surface typically consists of loose sand.

Easement—a right of privilege (agreement) that a person or organization may have over another's property; an interest in land owned by another that entitles the holder of the easement to a specific limited use; a recorded right of use by the United States over property of a State to limit exposure to safety hazards.

Ecosystem—all the living organisms in a given environment with the associated non-living factors.

Effects—a change in an attribute, which can be caused by a variety of events, including those that result from program attributes acting on the resource attribute (direct effect); those that do not result directly from the action or from the attributes of other resources acting on the attribute being studied (indirect effect); those that result from attributes of other programs or other attributes that change because of other programs (cumulative effects); and those that result from natural causes (for example, seasonal change).

Effluent—an outflowing branch of a main stream or lake; waste material (such as smoke, liquid industrial refuse, or sewage) discharged into the environment.

Electromagnetic Radiation (EMR)—waves of energy with both electric and magnetic components at right angles to one another.

Electronic Countermeasures (ECM)—includes both active jamming and passive techniques. Active jamming includes noise jamming to suppress hostile radars and radios, and deception jamming, intended to mislead enemy radars. Passive ECM includes the use of chaff to mask targets with multiple false echoes, as well as the reduction of radar signatures through the use of radar-absorbent materials and other stealth technologies.

En Route Airways—a low-altitude (up to, but not including 18,000 feet mean sea level) airway based on a center line that extends from one navigational aid or intersection to another navigational aid (or through several navigational aids and intersections) specified for that airway.

En Route Jet Routes—high altitude (above 18,000 feet mean sea level) airway based on a center line that extends from one navigational aid or intersection to another navigational aid (or through several navigational aids and intersections) specified for that airway.

Encroachment—the placement of an unauthorized structure or facility on someone's property or the unauthorized use of property.

Endangered Species—a plant or animal species that is threatened with extinction throughout all or a significant portion of its range.

Endemic—plants or animals that are native to an area or limited to a certain region.

Environmental Justice—an identification of potential disproportionately high and adverse impacts on low-income and/or minority populations that may result from proposed federal actions (required by Executive Order 12898).

Epibenthic—living on the ocean floor.

Epipelagic—living in the ocean zone from the surface to 109 fathoms (656 feet).

Erosion—the wearing away of a land surface by water, wind, ice, or other geologic agents.

Estuary—a water passage where the tide meets a river current; an arm of the sea at the lower end of a river; characterized by brackish water.

Event—a significant operational employment during which training is accomplished. "Event" is a Navy approved employment schedule term. The event may be primarily designated as operational, such as TRANSIT, MIO, or STRIKEOPS, during which training may take place. Training events may be periods of operational employment that are also considered major training events such as Composite Training Unit Exercise (COMPTUEX), Joint Training Fleet Exercise (JTFEX), or other exercises such as BRIGHT STAR, COBRA GOLD, or UNIFIED ENDEAVOR.

Exclusive Use—scheduled solely for the assigned unit for safety reasons.

Exotic—not native to an area.

Expanded Warfare Mission—conducting training in a mission area not previously conducted in the range complex, either because it is a new mission area (training associated with MS SSG and OAMCM) or it is a pre-existing mission area not previously conducted in a particular range complex but because of force structure changes, will start up in the foreseeable future.

Expeditionary Strike Group Composite Training Unit Exercise (ESG COMPTUEX) —an Integrated Phase, at-sea, major range event that is a standard part of every Marine Expeditionary Unit (MEU)'s pre-deployment training program and lasts for about 18 days. The exercise centers on situational training exercises in which the MEU is issued a series of orders designed to replicate the types of missions likely to be faced during real world deployment. The MEU then quickly plans and executes the missions to test their rapid-response capabilities. Typically, the first half of the ESG COMPTUEX focuses on preparing the amphibious ships of the ESG for the missions it will perform while on deployment. The embarked Marines normally launch ship-to-shore raids and conduct urban-combat training at areas ashore. Over the next several days, the MEU's equipment and its ground combat element are loaded into the amphibious ships of the ESG by landing craft from the beach.

Explosive Ordnance Disposal (EOD)—the process of recovering and neutralizing domestic and foreign conventional, nuclear and chemical/biological ordnance and improvised explosive devices; a procedure in Explosive Ordnance Management.

Explosive Safety Quantity-Distance (ESQD)—the quantity of explosive material and distance separation relationships providing defined types of protection based on levels of risk considered acceptable.

Facilities—physical elements that can include roads, buildings, structures, and utilities. These elements are generally permanent or, if temporary, have been placed in one location for an extended period of time.

Fathom—a unit of length equal to 6 feet; used to measure the depth of water.

Feature—in archaeology, a non-portable portion of an archaeological site, including such facilities as fire pits, storage pits, stone circles, or foundations.

Federal Candidate Species—taxa for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.

Fee Simple Land—land held absolute and clear of any condition or restriction, and where the owner has unconditional power of disposition.

Feral—having escaped from domestication and become wild.

Fleet Area Control and Surveillance Facility (FACSFAC)—Navy facility that provides air traffic control services and controls and manages Navy-controlled offshore operating areas and instrumented ranges.

Fleet Response Training Plan (FRTP)—the 27-month cycle that replaces the Interdeployment Training Cycle. The FRTP includes four phases prior to deployment: Maintenance, Unit Level Training, Integrated Training, and Sustainment.

Fleet Response Plan/Fleet Readiness Program (FRP)—the Fleet Response Plan was the Navy's response to the 2002/2003 international situations in Afghanistan and Iraq. The Fleet Readiness Program was later developed by the Fleet commanders. Both names refer to the same operational construct. The FRP is designed to more rapidly develop and then sustain readiness in ships and

squadrons so that, in a national crisis or contingency operation, the Navy can quickly surge significant combat power to the scene.

Flight Information Region (FIR)—an airspace of defined dimensions within which flight information service and alerting service are provided. Flight information service is provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights, and alerting service is provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and to assist such organizations as required.

Flight Level—a level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255 represents an indication of 25,500 feet.

Flight Termination—action taken in certain post-launch situations, such as a missile veering off its predicted flight corridor; accomplished by stopping the propulsive thrust of a rocket motor via explosive charge. At this point, the missile continues along its current path, falling to earth under gravitational influence.

Floodplain—the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands; includes, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year (100-year floodplain).

Force Structure Changes—improvements and/or modifications to naval operational forces based on personnel changes, equipment/platform upgrades and weapons modernization.

Free Flight—a joint initiative of the aviation industry and the Federal Aviation Administration to allow aircraft to take advantage of advanced satellite voice and data communication to provide faster and more reliable transmission to enable reductions in vertical, lateral, and longitudinal separation of aircraft, more direct flights and tracts, and faster altitude clearance. It allows pilots, whenever practicable, to choose their own route and file a flight plan that follows the most efficient and economical route, rather than following the published preferred instrument flight rules routes.

Frequent User—a unit that conducts training and exercises in the training areas on a regular basis but does not maintain a permanent presence.

Fugitive Dust—any solid particulate matter that becomes airborne, other than that emitted from an exhaust stack, directly or indirectly as a result of the activities of man. Fugitive dust may include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed.

Ground Hazard Area—the land area contained in an arc within which all debris from a terminated launch will fall. For example, the arc for a Strategic Target System launch is described such that the radius is approximately 10,000 feet to the northeast, 9,100 feet to the east, and 9,000 feet to the south of the launch point.

Groundwater Table—the highest part of the soil or underlying rock material that is wholly saturated with water.

Groundwater—water within the earth that supplies wells and springs; specifically, water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table.

Habitat—the area or type of environment in which a species or ecological community normally occurs.

Hazardous Air Pollutants—other pollutants, in addition to those addressed by the NAAQS, that present the threat of adverse effects to human health or to the environment as covered by Title III of the

Clean Air Act. Incorporates, but is not limited to, the pollutants controlled by the National Emissions Standards for Hazardous Air Pollutants program.

Hazardous Material—generally, a substance or mixture of substances capable of either causing or significantly contributing to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; it may pose a threat or a substantial present or potential risk to human health or the environment. Hazardous materials use is regulated by the U.S. Department of Transportation, the Occupational Safety and Health Administration, and the Emergency Right-to-Know Act.

Hazardous Waste—a waste, or combination of waste, which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either cause or significantly contribute to an increase in mortality or an increase in serious irreversible illness or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Hertz (Hz)—the standard radio equivalent of frequency in cycles per second of an electromagnetic wave. Kilohertz (kHz) is a frequency of 1,000 cycles per second. Megahertz (MHz) is a frequency of 1 million cycles per second.

High Explosive (HE)—used when describing explosive ordnance, i.e., ordnance typically used in combat or possessing same or similar explosive-filler as combat ordnance; example – 20mm through 2,000LB MK-80 series HE.

Historic Properties—under the National Historic Preservation Act, these are properties of national, state, or local significance in American history, architecture, archaeology, engineering, or culture, and worthy of preservation

Host—the Facilities Host holds plant account of all Class I (Land) and most Class II (Buildings) property. The Operational Host determines and executes operational policy for the range/range complex.

Hydraulic Conductivity—the rate in gallons per day water flow through a cross section of one square foot under a unit hydraulic gradient, at the prevailing temperature.

Hydrocarbons—any of a vast family of compounds containing hydrogen and carbon, including fossil fuels.

Hydrochloric Acid—(HCl)a common chemical component of missile exhaust believed to injure plant leaves and affect wildlife.

Hydrology—the science dealing with the properties, distribution, and circulation of water on the face of the land (surface water) and in the soil and underlying rocks (groundwater).

Hydrophone—an instrument for listening to sound transmitted through water.

Impact Area—the identified area within a range intended to capture or contain ammunition, munitions, or explosives and resulting debris, fragments, and components from various weapon system employments.

Impacts (effects)—an assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique. In this Environmental Impact Statement, as well as in the Council on Environmental Quality regulations, the word impact is used synonymously with the word effect.

Implementing Enhanced Range Complex Capabilities—warfare training and doctrine improvements that result from the modernization and replacement of range support infrastructure and instrumentation at Naval air, sea and subsurface tactical ranges.

Indurated—rendered hard, as in dunes where surface sand is loose, but subsurface areas become increasingly compact (see lithified).

Infrastructure—the system of public works of a country, state, or region, such as utilities or communication systems; physical support systems and basic installations needed to operate a particular area or facility.

In-Shore—lying close to the shore or coast.

Instrument Flight Rules (IFR)—rules governing the procedures for conducting instrument flight; it is a term used by pilots and controllers to indicate type of flight plan.

Interdeployment Readiness Cycle—the period by which naval units progress through maintenance/unit level training, integrated training, and sustainment training stages prior to being deployed with the Fleet.

Intermittent User—a unit that conducts training and exercises in the training areas throughout the year, but not on a regularly scheduled basis, and does not maintain a permanent presence.

International Waters—sea areas beyond 12 nm of the U.S. shoreline.

Intertidal Zone—occupies the space between high and low tide, also referred to as the littoral zone; found closest to the coastal fringe and thus only occurring in shallow depths.

Ionizing Radiation—particles or photons that have sufficient energy to produce direct ionization in their passage through a substance. X-rays, gamma rays, and cosmic rays are forms of ionizing radiation.

Isobath—the line on a marine map or chart joining points of equal depth, usually in fathoms below mean sea level.

Jet Routes—a route designed to serve aircraft operating from 18,000 feet (5,486 meters) up to and including flight level 450, referred to as J routes with numbering to identify the designated route.

Joint National Training Capability (JNTC)-The Navy is a participant in the Joint National Training Capability (JNTC) and, through its Navy Continuous Training Environment (NCTE), provides units with the capability to train as a part of a large, multi-platform group while saving time, manpower, and additional costs by constructing the battle problem with a mix of live, virtual, and constructive elements. Live in this context means real people and real systems in a live environment, virtual meaning real people, simulated systems; for example, manned flight simulators, and constructive meaning simulated people in a simulated environment using simulated equipment; for instance, computer war games.

Joint Task Force Exercise (JTFEX) —a scenario-driven, sea control, power projection exercise with the purpose of evaluating the readiness of naval forces and testing the interoperability and proficiency of these forces in realistic scenarios ranging from military operations other than war to armed conflict. JTFEX typically encompasses operations from in port to sea-air-land combat, to special warfare, to humanitarian assistance operations. JTFEX is a dynamic and complex major range event that is the culminating exercise in the Sustainment Phase training for the Carrier Strike Group (CSG) or Expeditionary Strike Group (ESG). JTFEX is nominally 10 days long, not including a three-day in port Force Protection Exercise, and can be the last at-sea exercise for the CSG prior to deployment.

Land/Sea Use—the exclusive or prioritized commitment of a land/sea area, and any targets, systems, and facilities therein, to a continuing purpose that could include a grouping of operations, buffer zone,

environmental mitigation, *etc*. The land/sea area may consist of a range/range complex, grouping of similar facilities, or natural resource-based area with no facilities.

Lead—(Pb) a heavy metal that can accumulate in the body and cause a variety of negative effects; one of the six pollutants for which there is a national ambient air quality standard (see Criteria Pollutants).

Lead-based Paint—paint on surfaces with lead in excess of 1.0 milligram per square centimeter as measured by X-ray fluorescence detector, or 0.5 percent lead by weight.

Leptocephalic—small, elongate, transparent, planktonic.

Level of Service (LOS)—describes operational conditions within a traffic stream and how they are perceived by motorists and/or passengers; a monitor of highway congestion that takes into account the average annual daily traffic, the specified road segment's number of lanes, peak hour volume by direction, and the estimated peak hour capacity by a roadway's functional classification, area type, and signal spacing.

Lithified—the conversion of newly deposited sediment into indurated rock.

Littoral—species found in tide pools and near-shore surge channels.

Incidental Take Statement (ITS)—specifies the impact of any incidental taking of endangered or threatened species. Incidental take statements also provide reasonable and prudent measures that are necessary to minimize impacts, and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

Loam—a loose soil composed of a mixture of clay, silt, sand, and organic matter.

Long-Term Sustainability of Department of Defense Ranges—the ability to indefinitely support national security objectives and the operational readiness of the Armed Forces, while still protecting human health and the environment.

Major Exercise—a significant operational employment of live, virtual, and/or constructive forces during which live training is accomplished. A Major Exercise includes multiple training objectives, usually occurring over an extended period of days or weeks. An exercise can have multiple training operations (sub-events each with its own mission, objective and time period. Examples include C2X and JTFEX. Events (JTFEX) are composed of specific operations (e.g., Air-to-Air Missile), which consist of individual activities (*e.g.*, missile launch).

Maneuver Area—range used for maneuver element training.

Maneuver Element—basic element of a larger force independently capable of maneuver. Normally, a Marine Division recognizes its infantry battalions, tank battalion, and light armored reconnaissance (LAR) battalion as maneuver elements. A rifle (or tank/LAR) battalion would recognize its companies as maneuver elements. A rifle (or tank/LAR) company would recognize its platoons as maneuver elements. Maneuver below the platoon level is not normally possible since fire and movement can be combined only at the platoon level or higher. The Army and National Guard recognize a squad and platoon as maneuver elements.

Maneuver—employment of forces on the battlefield through movement in combination with fire, or fire potential, to achieve a position of advantage with respect to the enemy to accomplish the mission.

Marine Corps Ground Unit—Marine Expeditionary Unit Ground Combat Element, or Battalion Landing Team, composed of an infantry battalion of about 1,200 personnel reinforced with artillery, amphibious assault vehicles, light armored reconnaissance assets and other units as the mission and circumstances require. (The analysis will scale units of different size or composition from this Battalion Landing Team standard unit to include a 12-man Special Operations platoon.)

Maritime—of, relating to, or bordering on the sea.

Material Safety Data Sheet (MSDS)—presents information, required under Occupational Safety and Health Act standards, on a chemical's physical properties, health effects, and use precautions.

Medical Evacuation—emergency services, typically aerial, designed to remove the wounded or severely ill to medical facilities.

Mesopelagic—the oceanic zone from 109 to 547 fathoms (656 to 3,280 feet).

Migration—repeated departure and return of individuals and their offspring to and from an area.

Migratory Birds—birds characterized by their practice of passing, usually periodically, from one region or climate to another.

Military Expended Material (MEM) —refers to those munitions, items, devices, equipment and materials that are uniquely military in nature, and are used and expended in the conduct of the military training and testing mission, such as: sonobuoys, flares, chaff, drones, targets, bathymetry measuring devices and other instrumentation, communications devices, and items used as training substitutes. This definition may also include materials expended (such as propellants, weights, guidance wires) from items typically recovered, such as aerial target drones and practice torpedoes.

Military Expended Material Constituent (MEMC)—any constituent released into the environment from the use of MEM. This definition also includes constituents from explosive and non-explosive materials and the emission, degradation, or breakdown products from such MEM.

Military Operating Area (MOA)—airspace below 18,000 feet used to separate or segregate certain non-hazardous military flight activities from Instrument Flight Rules traffic and to identify for Visual Flight Rules traffic where these activities are conducted.

Military Training Route (MTR)—an airspace corridor established for military flight training at airspeeds in excess of 250 nautical miles/hour.

Minority—minority populations, as reported by the 2000 Census of Population and Housing, includes Black, American Indian, Eskimo or Aleut, Asian or Pacific Islander, Hispanic, or other.

Mitigation—a method or action to reduce or eliminate adverse environmental impacts. Such measures may avoid impacts by not taking a certain action or parts of an action; minimize impacts by limiting the magnitude of an action; rectify impacts by restoration measures; reduce or eliminate impacts over time by preservation or maintenance measures during the action; or compensate for impacts by replacing or providing substitute resources or environments.

Mobile Sources—any movable source that emits any regulated air pollutant.

Mortality—the number of deaths in a given time or place.

National Airspace System—the common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

National Ambient Air Quality Standards (NAAQS)—as set by the U.S. Environmental Protection Agency under Section 109 of the Clean Air Act, nationwide standards for limiting concentrations of certain widespread airborne pollutants to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility and materials (secondary standards). Currently, six pollutants are regulated by primary and secondary

NAAQS: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide (see Criteria Pollutants).

National Environmental Policy Act (NEPA)—Public Law 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities, such as population growth, high-density urbanization, or industrial development, on the natural environment. NEPA procedures require that environmental information be made available to the public before decisions are made. Information contained in NEPA documents must focus on the relevant issues to facilitate the decision-making process.

National Register of Historic Places Eligible Property—property that has been determined eligible for the National Register of Historic Places listing by the Secretary of the Interior, or one that has not yet gone through the formal eligibility determination process but which meets the National Register of Historic Places criteria for section review purposes; eligible properties are treated as if they were already listed.

National Register of Historic Places—a register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2 (b) of the Historic Sites Act of 1935 and Section 101 (a)(1) of the National Historic Preservation Act of 1966, as amended.

National Wildlife Refuge—a part of the national network of refuges and wetlands managed by the U.S. Fish and Wildlife Service to provide, preserve, and restore lands and waters sufficient in size, diversity and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available. This includes 504 wildlife refuges nationwide encompassing 92 million acres and ranging in size from one-half acre to thousands of square miles. Dedicated to protecting wildlife and their habitat, U.S. refuges encompass numerous ecosystems and are home to a wide variety of fauna, including large numbers of migratory birds and some 215 threatened or endangered species.

Native Americans—used in a collective sense to refer to individuals, bands, or tribes who trace their ancestry to indigenous populations of North America prior to Euro-American contact.

Native Species—plants or animals living or growing naturally in a given region and often referred to as indigenous.

Native Vegetation—often referred to as indigenous, these are plants living or growing naturally in a given region without agricultural or cultivational efforts.

Navigational Aid—any visual or electronic device, airborne or on the surface, which provides point-to-point guidance information or position data to aircraft in flight.

Near-Shore—an indefinite zone that extends seaward from the shoreline.

Neritic—relating to the shallow ocean waters, usually no deeper than 109 fathoms (656 feet).

Nitrogen Dioxide—(NO_2) gas formed primarily from atmospheric nitrogen and oxygen when combustion takes place at high temperatures.

Nitrogen Oxides—(NO_x) gases formed primarily by fuel combustion and which contribute to the formation of acid rain. In the presence of sunlight, hydrocarbons and nitrogen oxides combine to form ozone, a major constituent of photochemical smog.

Nitrogen Tetroxide—(N_2O_4)a dark brown, fuming liquid or gas with a pungent, acrid odor, utilized in rocket fuels.

Nonattainment Area—an area that has been designated by the U.S. Environmental Protection Agency or the appropriate state air quality agency as exceeding one or more of the national or state ambient air quality standards.

Non-directional Radio Beacon—a radio beacon transmitting non-directional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine the aircraft's bearing to or from the radio beacon and "home" on or track to or from the station.

Non-explosive, Practice Munitions (NEPM)—used when describing most common types of practice ordnance. However, non-explosive, practice munitions may contain spotting charges or signal cartridges for impact locating purposes (smoke charges for daylight spotting, flash charges for night spotting); example - MK-76, BDU-45. Some non-explosive, practice munitions may also contain unburned propellant (such as rockets).

Non-ionizing Radiation—electromagnetic radiation at wavelengths whose corresponding photon energy is not high enough to ionize an absorbing molecule. All radio frequency, infrared, visible, and near ultraviolet radiation are non-ionizing.

Non-Point Source Pollution—diffuse pollution; that is, from a combination of sources; typically originates from rain and melted snow flowing over the land (runoff). As runoff contacts the land's surface, it picks up many pollutants in its path: sediment, oil and grease, road salt, fertilizers, pesticides, nutrients, toxics, and other contaminants. Runoff also originates from irrigation water used in agriculture and on landscapes. Other types of non-point pollution include changes to the natural flow of water in stream channels or wetlands.

Notice to Airmen (NOTAM)—a notice containing information, not known sufficiently in advance to publicize by other means, the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System), the timely knowledge of which is essential to personnel concerned with flight operations.

Notice to Mariners (NOTMAR)—a periodic notice regarding changes in aids to navigation, dangers to navigation and other information essential to mariners.

OffShore—open-ocean waters over the continental slope deeper than 656 feet, beyond the continental shelf break.

Operating Area (OPAREA)—ocean area not part of a range used by military personnel or equipment for training and weapons system Research, Development, Test & Evaluation.

Operation—a combination of activities accomplished together for a scheduled period of time for an intended military mission or task. An operation can range in size from a single unit exercise to a Joint or Combined event with many participants (*e.g.*, aircraft, ships, submarines, troops).

Operational Range—a range under the jurisdiction, custody, or control of the Secretary of Defense and used for range activities; or although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities.

Ordnance—military supplies including weapons, ammunition, combat vehicles, and maintenance equipment.

OTTO Fuel—a torpedo fuel.

Ozone (O_3)—a highly reactive form of oxygen that is the predominant component of photochemical smog and an irritating agent to the respiratory system. Ozone is not emitted directly into the atmosphere

but results from a series of chemical reactions between oxidant precursors (nitrogen oxides and volatile organic compounds) in the presence of sunlight.

Ozone Layer—a naturally occurring layer of ozone 7 to 30 miles above the earth's surface (in the stratosphere) which filters out the sun's harmful ultraviolet radiation. It is not affected by photochemical smog found in the lower atmosphere, nor is there any mixing between ground level ozone and ozone in the upper atmosphere.

Paleontological Resources—fossilized organic remains from past geological periods.

Paleontology—the study of life in the past geologic time, based on fossil plants and animals.

Participant—an individual ship, aircraft, submarine, amphibious vehicle, or ground unit.

Particulate Matter, Fine Respirable—finely divided solids or liquids less than 10 microns in diameter which, when inhaled, remain lodged in the lungs and contribute to adverse health effects.

Particulate Matter, Total Suspended—finely divided solids or liquids ranging from about 0.1 to 50 microns in diameter which comprise the bulk of the particulate matter mass in the atmosphere.

Particulate Matter—particles small enough to be airborne, such as dust or smoke (see Criteria Pollutants).

Payload—any non-nuclear and possibly propulsive object or objects, weighing up to 600 pounds, which are carried above the Strategic Target System third stage.

Pelagic Zone—commonly referred to as the open ocean.

Pelagic—of the ocean waters.

Peninsula—a portion of land nearly surrounded by water and generally connected with a larger body by an isthmus, although the isthmus is not always well defined.

Per Capita—per unit of population; by or for each person.

Permeability—a quality that enables water to penetrate.

Pesticide—any substance, organic, or inorganic, used to destroy or inhibit the action of plant or animal pests; the term, thus, includes insecticides, herbicides, fungicides, rodenticides, miticides, fumigants, and repellents. All pesticides are toxic to humans to a greater or lesser degree. Pesticides vary in biodegradability.

pH—a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity.

Photosynthesis—the plant process by which water and carbon dioxide are used to manufacture energy-rich organic compounds in the presence of chlorophyll and energy from sunlight.

Physiography—geography dealing with the exterior physical features and changes of the earth (also known as physical geography).

Phytoplankton—plant-like organisms that drift with the ocean currents, with little ability to move through the water on their own. Predominately one-celled, phytoplankton float in the photic zone (sunlit surface waters of the ocean, which extends to only about 330 feet below the surface), where they obtain sunlight and nutrients, and serve as food for zooplankton and certain larger marine animals.

Pinniped—having finlike feet or flippers, such as a seal or walrus.

Plankton—free-floating, usually minute, organisms of the sea; includes larvae of benthic species.

Pliocene—of, relating to, or being the latest epoch of the Tertiary Period or the corresponding system of rocks; following the Pleistocene and prior to the Miocene.

$PM_{2.5}$ and PM_{10}—standards for measuring the amount of solid or liquid matter suspended in the atmosphere; refers to the amount of particulate matter less than or equal to 2.5 and 10 micrometers in diameter, respectively. The $PM_{2.5}$ and PM_{10} particles penetrate to the deeper portions of the lungs, affecting sensitive population groups such as children and people with respiratory or cardiac diseases.

Point Source—a distinct and identifiable source, such as a sewer or industrial outfall pipe, from which a pollutant is discharged.

Population Density—the average number of individuals or organisms per unit of space or area.

Potable Water—water that is safe to drink.

Potentially Hazardous Debris—inert debris impacting the earth with a kinetic energy equal to or greater than 11 foot-pounds.

Prehistoric—literally, "before history," or before the advent of written records. In the old world, writing first occurred about 5,400 years ago (the Sumerians). Generally, in North America and the Pacific region, the prehistoric era ended when European explorers and mariners made written accounts of what they encountered. This time will vary from place to place.

Prohibited Area—designated airspace where aircraft are prohibited, except by special permission. Can also apply to surface craft.

Radar—a radio device or system for locating an object by means of radio waves reflected from the object and received, observed, and analyzed by the receiving part of the device in such a way that characteristics (such as distance and direction) of the object may be determined.

Range—a land or sea area designated and equipped for any or all of the following reasons:

> **Range Activity**—an individual training or test function performed on a range or in an Operating Area. Examples include missile launching, bombardment, and vehicle driving. Individual Research, Development, Training, and Evaluation functions are also included in this category.
>
> **Range Complex**—a geographically integrated set of ranges, operational areas, and associated special use airspace, designated and equipped with a command and control system and supporting infrastructure for freedom of maneuver and practice in munitions firing and live ordnance use against scored and/or tactical targets and/or Electronic Warfare tactical combat training environment.
>
> **Range Operation**—a live training exercise, Research, Development, Training, and Evaluation, or field maneuver conducted for a specific strategic, operational or tactical military mission, or task. A military action. Operations may occur independently, or multiple operations may be accomplished as part of a larger event. One operation consists of a combination of activities accomplished together. The type of operation can include air, land, sea, and undersea warfare training or testing. Participants can include a specific number and type of aircraft, ships, submarines, amphibious or other vehicles and personnel. Ordnance broadly encompasses all weapons, missiles, shells, and expendables (chaff and flares). An individual operation occurs over a given geographic footprint for a scheduled period of time. An example is a Mining Operation. Each Mining Operation is discrete and relatively short in duration, but may be combined with other operations in a single, larger exercise, like a JTFEX, which lasts for several days or weeks.

Range Safety Zone—area around air-to-ground ranges designed to provide safety of flight and personnel safety relative to dropped ordnance and crash sites. Land use restrictions can vary depending on the degree of safety hazard, usually decreasing in magnitude from the weapons impact area (including potential ricochet) to the area of armed over flight and aircraft maneuvering.

Readiness—the ability of forces, units, weapon systems, or equipment to deliver the outputs for which they were designed (includes the ability to deploy and employ without unacceptable delays).

Region of Influence—the geographical region that would be expected to be affected in some way by the proposed action and alternatives.

Relative Humidity—the ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

Relief—the difference in elevation between the tops of hills and the bottoms of valleys.

Remediation—all necessary actions to investigate and clean up any known or suspected discharge or threatened discharge of contaminants, including without limitation: preliminary assessment, site investigations, remedial investigations, remedial alternative analyses, and remedial actions.

Restricted Area—a designated airspace in which flights are prohibited during published periods of use unless permission is obtained from the controlling authority.

Runoff—the portion of precipitation on land that ultimately reaches streams, often with dissolved or suspended materials.

Safety Zone—administratively designated/implied areas designated to limit hazards to personnel and the public, and resolve conflicts between operations. Can include range safety zones, surface danger zones, special use airspace, etc.

Saline—consisting of or containing salt.

Sampling—the selection of a portion of a study area or population, the analysis of which is intended to permit generalization of the entire population. In archaeology, samples are often used to reduce the amount of land area covered in a survey or the number of artifacts analyzed from a site. Statistical sampling is generally preferred since it is possible to specify the bias or probability of error in the results, but judgmental or intuitive samples are sometimes used.

Scoping—a process initiated early during preparation of an Environmental Impact Statement to identify the scope of issues to be addressed, including the significant issues related to the proposed action. During scoping, input is solicited from affected agencies as well as the interested public.

Seamount—a peaked, underwater mountain that rises at least 3,281 feet above the ocean floor.

Seawall—a wall or embankment to protect the shore from erosion or to act as a breakwater.

Security Zone—area where public or non-operational support access is prohibited due to training operations of a classified or hazardous nature.

Seduction Chaff—radar confusion reflectors, consisting of thin metallic strips, which are used to reflect electronic signals for confusion purposes. A defensive electronic countermeasures system designed/intended to hide or obscure the launch platform from air-to-surface or surface-to-surface attack.

Sensitive Habitats—areas of special importance to regional wildlife populations or protected species that have other important biological characteristics (for example, wintering habitats, nesting areas, and wetlands).

Sensitive Receptor—an organism or population of organisms sensitive to alterations of some environmental factor (such as air quality or sound waves) that undergo specific effects when exposed to such alteration.

Short-Term Public Exposure Guidance Level—an acceptable concentration for unpredicted, single, short-term, emergency exposure of the general public, as published by the National Research Council.

Site—in archaeology, any location where human beings have altered the terrain or have discarded artifacts.

Solid Waste—municipal waste products and construction and demolition materials; includes non-recyclable materials with the exception of yard waste.

Sonobuoy—hydrophones, or floating sensors, that also contain a radio transmitter to relay acoustic data to an aircraft or ship. Sonobuoys may be active in which signals are generated from the sonobuoys, or passive, in which the buoy is silent. Sonobuoys were designed for anti-submarine warfare, but are also used to acoustically score bomb drops and firing exercises during a training exercise from the sound where a bomb or gun shell impacts the surface of the ocean.

Sortie—a single operational training or Research, Development, Training, and Evaluation event conducted by one aircraft in a range or operating area. A single aircraft sortie is one complete flight (*i.e.*, one take-off and one final landing).

Special Use Airspace (SUA)—consists of several types of airspace used by the military to meet its particular needs. Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of these activities, or both. Special use airspace, except for Control Firing Areas, are chartered on instrument flight rules or visual flight rules charts and include hours of operation, altitudes, and the controlling agency.

Species—a taxonomic category ranking immediately below a genus and including closely related, morphologically similar individuals which actually or potentially interbreed.

Specific Absorption Rate—the time rate at which radio frequency energy is absorbed per unit mass of material, usually measured in watts per kilogram.

Stakeholder—those people or organizations that are affected by or have the ability to influence the outcome of an issue. In general this includes regulators, the regulated entity, and the public. It also includes those individuals who meet the above criteria and do not have a formal or statutorily defined decision-making role.

State Historic Preservation Officer (SHPO)—the official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

State Jurisdictional Waters—sea areas within 3 nm of a state's continental and island shoreline.

Stationary Source—any building, structure, facility, installation, or other fixed source that emits any regulated air pollutant.

Stormwater—runoff produced during storms, generally diverted by rain spouts and stormwater sewerage systems. Stormwater has the potential to be polluted by such sources as yard trimmings and pesticides. A storm water outfall refers to the mouth of a drain or sewer that channels this runoff.

Strafe—the practice of attacking ground targets from low-flying aircraft.

Subsistence Economy—a community, usually based on farming and/or fishing, that provides all or most of the basic goods required by its members for survival, usually without any significant surplus for sale.

Subsistence—the traditional harvesting of natural resources for food, clothing, fuel, transportation, construction, art, crafts, sharing, and customary trade.

Subspecies—a geographically defined grouping of local populations which differs taxonomically from similar subdivisions of species.

Substrate—the layer of soil beneath the surface soil; the base upon which an organism lives.

Sulfur Dioxide—(SO_2)a toxic gas produced when fossil fuels, such as coal and oil, are burned.

Sustainable Range Management—management of an operational range in a manner that supports national security objectives, maintains the operational readiness of the Armed Forces, and ensures the long-term viability of operational ranges while protecting human health and the environment.

Sustaining the Capability—maintaining necessary skills, readiness and abilities.

Symbiotic—living in or on the host.

System of Systems—all communications, electronic warfare, instrumentation, and systems linkage supporting the range/range complex.

Taking—to harass, harm, pursue, hunt, shout, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Taking can involve harming the habitat of an endangered species.

Targets—earthwork, materials, actual or simulated weapons platforms (tanks, aircraft, EW systems, vehicles, ships, *etc*.) comprising tactical target scenarios within the range/range complex impact areas.

Tenant—a unit that has an Inter-Service Support Agreement with the host for use of the training areas and that maintains a permanent presence.

Thermocline—a thin, narrow region in a thermally stratified body of water which separates warmer, oxygen-rich surface water from cold, oxygen-poor deep water and in which temperature decreases rapidly with depth. In tropical latitudes, the thermocline is present as a permanent feature and is located 200 to 1,000 feet below the surface.

Threatened Species—a plant or animal species likely to become endangered in the foreseeable future.

Topography—the configuration of a surface including its relief and the position of its natural and man-made features.

Traditional Resources—prehistoric sites and artifacts, historic areas of occupation and events, historic and contemporary sacred areas, material used to produce implements and sacred objects, hunting and gathering areas, and other botanical, biological, and geographical resources of importance to contemporary groups.

Transient—remaining a short time in a particular area.

Troposphere—the atmosphere from ground level to an altitude of 6.2 to 9.3 miles (see stratosphere).

Turbid—the condition of being thick, cloudy, or opaque as if with roiled sediment; muddy.

Uncontrolled Airspace—airspace of defined dimensions in which no air traffic control services to either instrument flight rules or visual flight rules aircraft will be provided, other than possible traffic advisories when the air traffic control workload permits and radio communications can be established.

Understory—a vegetal layer growing near the ground and beneath the canopy of a taller layer.

Unique and Sensitive Habitats—areas of special importance to regional wildlife populations or protected species that have other important biological characteristics (for example, wintering habitats, nesting areas, and wetlands).

Upland—an area of land of higher elevation.

Upwelling—the replenishing process of upward movement to the surface of marine often nutrient-rich lower waters (a boon to plankton growth), especially along some shores due to the offshore drift of surface water as from the action of winds and the Coriolis effect.

U.S. Territorial Waters—sea areas within 12 nm of the U.S. continental and island shoreline.

Viewshed—total area seen within the cone of vision from a single observer position, or vantage point; a collection of viewpoints with optimal linear paths of visibility.

Vista—a distant view through or along an avenue or opening.

Visual Flight Rules (VFR)—rules that govern the procedures for conducting flight under visual conditions; used by pilots and controllers to indicate type of flight plan.

Volatile Organic Compound (VOC)—one of a group of chemicals that react in the atmosphere with nitrogen oxides in the presence of heat and sunlight to form ozone; it does not include methane and other compounds determined by the U.S. Environmental Protection Agency to have negligible photochemical reactivity. Examples of volatile organic compounds include gasoline fumes and oil-based paints.

Warfare Mission—referring to one of the eight Primary Mission Areas. These include Air Warfare (AW), Amphibious Warfare (AMW), Surface Warfare (SUW), Anti-submarine Warfare (ASW), Mine Warfare (MIW), Strike Warfare (STW), Electronic Combat (EC), and Naval Special Warfare (NSW).

Warning Area—a designated airspace in which flights are not restricted but avoidance is advised during published times of use.

Wastewater—water that has been previously utilized; sewage.

Wetlands—lands or areas that either contain much soil moisture or are inundated by surface or groundwater with a frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include such areas as bogs, marshes, mud and tidal flats, sloughs, river overflows, seeps, springs, or swamps.

Wholly Inert—ordnance with no explosive, propellant, or pyrotechnic component (non-reactive); example: BDU-50, BDU-56 (both are non-reactive heavy-weights with no explosive charges).

Yearly Average Day-Night Sound Level (DNL or L_{dn})—utilized in evaluating long-term environmental impacts from noise, this is an annual mean of the day-night sound level.

Zoning—the division of a municipality (or county) into districts for the purpose of regulating land use, types of buildings, required yards, necessary off-street parking, and other prerequisites to development. Zones are generally shown on a map, and the text of the zoning ordinance specifies requirements for each zoning category.

Zooplankton—animals that drift with the ocean currents, with little ability to move through the water on their own, ranging from one-celled organisms to jellyfish up to 6 feet wide. Zooplankton live in both surface and deep waters of the ocean; crustaceans make up about 70 percent. While some float about freely throughout their lives, many spend only the early part of their lives as plankton.

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CHAPTER 10 DISTRIBUTION LIST

DISTRIBUTION LIST

The individuals, agencies, and organizations listed below received a copy of the GOMEX Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). Please note that not all states have a clearinghouse. For states not having a clearinghouse, a copy of the GOMEX Final EIS/OEIS was sent to the most relevant state agency. Following this list is a list of stakeholders: individuals, agencies, and organizations which received notification of the availability of the GOMEX Final EIS/OEIS. At the end of the list are the names of the attendees of the public hearings.

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Postcards were disseminated to individuals, agencies, and organizations listed below. The postcards acted as formal notification of the availability of the GOMEX Draft EIS/OEIS and announcement of public hearings. A representative example of the postcard is located at the end of this list.

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Councilman Larry B Johnson Pensacola City Council District 4 P.O. Box 12910 Pensacola, FL 32521	Commissioner Marie Young, Chair Escambia County Commissioner District 3 P.O. Box 1591 Pensacola, FL 32591
Commissioner Grover Robinson Escambia County Commissioner District 4 P.O. Box 1591 Pensacola, FL 32591	Commissioner Gene M. Valentino Escambia County Commissioner District 2 P.O. Box 1591 Pensacola, FL 32591
Commissioner Kevin White Escambia County Commissioner District 5 P.O. Box 1591 Pensacola, FL 32591	Commissioner Wilson Robertson Escambia County Commissioner District 1 P.O. Box 1591 Pensacola, FL 32591
Mayor Gayle Oberst Panama City Beach 110 S. Arnold Road Panama City Beach, FL 32413	Mr. Richard Jackson, City Manager Panama City Beach 110 S. Arnold Road Panama City Beach, FL 32413
Mr. John Reichard Panama City Beach City Council, Ward 1 110 S. Arnold Road Panama City Beach, FL 32413	Mr. Rick Russell Panama City Beach City Council, Ward 2 110 S. Arnold Road Panama City Beach, FL 32413
Ms. Josie B. Strange Panama City Beach City Council, Ward 3 110 S. Arnold Road Panama City Beach, FL 32413	Mr. Ken Nelson Panama City Beach City Council, Ward 4 110 S. Arnold Road Panama City Beach, FL 32413
Mr. Scott Wells Clemons, Mayor Panama City 9 Harrison Avenue Panama City, FL 32402	Mr. Kenneth Hammons, City Manager Panama City 9 Harrison Avenue Panama City, FL 32402

Commissioner Jonathan Wilson, Sr. Panama City, Ward II 9 Harrison Avenue Panama City, FL 32402	Commissioner Bill Rader Panama City, Ward III 9 Harrison Avenue Panama City, FL 32402
Commissioner Nancy Wengel Panama City, Ward IV 9 Harrison Avenue Panama City, FL 32402	Commissioner Mike Nelson Bay County Board of Commissioners, District 1 P.O. Box 1818 Panama City, FL 32401
Commissioner George Gainer Bay County Board of Commissioners, District 2 P.O. Box 1818 Panama City, FL 32401	Commissioner William Dozier Bay County Board of Commissioners, District 3 P.O. Box 1818 Panama City, FL 32401
Commissioner Guy M. Tunnell Bay County Board of Commissioners, District 4 P.O. Box 1818 Panama City, FL 32401	Commissioner Mike Thomas Bay County Board of Commissioners, District 5 P.O. Box 1818 Panama City, FL 32401
Mayor Guy Thompson Milton City P.O. Box 909 Milton, FL 32572	Commissioner Lane Lynchard Santa Rosa County Commissioners, District 5 6051 Old Bagdad Highway Suite 202 Milton, Fl 32570
Commissioner Jim Williamson Santa Rosa County Commissioners, District 1 6495 Caroline St. Suite M Milton, Fl 32570	Commissioner W.D. Salter Santa Rosa County Commissioners, District 3 6495 Caroline St. Suite M Milton, Fl 32570
Commissioner Robert Cole Santa Rosa County Commissioners, District 2 6495 Caroline St. Suite M Milton, Fl 32570	Ms. Brian Watkins Milton City, City Manager P.O. Box 909 Milton, FL 32572
Commissioner Jim Melvin Santa Rosa County Commissioners, District 4 6051 Old Bagdad Hwy, Suite 202 Milton, Fl 32570	Councilman Paul Kilmartin City of Milton Councilman, Ward I P.O. Box 909 Milton, FL 32572
Councilman Buddy Jordan City of Milton Councilman, Ward I P.O. Box 909 Milton, FL 32572	Councilman Clayton White City of Milton Councilman, Ward II P.O. Box 909 Milton, FL 32572
Councilman Patsy Lunsford City of Milton Councilman, Ward II P.O. Box 909 Milton, FL 32572	Councilman Marilyn Jones City of Milton Councilman, Ward III P.O. Box 909 Milton, FL 32572
Councilman Grady Hester City of Milton Councilman, Ward III P.O. Box 909 Milton, FL 32572	Councilman Lloyd Hinote City of Milton Councilman, Ward IV P.O. Box 909 Milton, FL 32572

Councilman R.L. Lewis City of Milton Councilman, Ward IV P.O. Box 909 Milton, FL 32572	
Alabama	
Mr. John Pafenbackh Mobile County Administrator 205 Government Street Mobile, AL 36644-1001	Mayor Samuel Jones City of Mobile P.O. Box 1827 Mobile, AL 36633-1827
Commissioner Connie Hudson Mobile County Commissioner District 2 205 Government Street Mobile, AL 36644-1001	Commissioner Mike Dean Mobile County Commissioner District 3 205 Government Street Mobile, AL 36644-1001
Councilman Reggie Copeland President Mobile City Council, District 5 P.O. Box 1827 Mobile, AL 36633-1827	Councilman Frederick Richardson Vice President Mobile City Council District 1 P.O. Box 1827 Mobile, AL 36633-1827
Councilman William Carroll Mobile City Council District 2 P.O. Box 1827 Mobile, AL 36633-1827	Councilman Jermaine A. Burrell Mobile City Council District 3 P.O. Box 1827 Mobile, AL 36633-1827
Councilman John Williams Mobile City Council District 4 P.O. Box 1827 Mobile, AL 36633-1827	Councilman Connie Hudson Mobile City Council District 6 P.O. Box 1827 Mobile, AL 36633-1827
Councilman Gina Gregory Mobile City Council District 7 P.O. Box 1827 Mobile, AL 36633-1827	Commissioner Tucker Dorsey Baldwin County Commissioner District 3 312 Courthouse Square Suite 12 Bay Minette, AL 36507
Mr. Michael Thompson Baldwin County Administrator 312 Courthouse Square, Suite 12 Bay Minette, AL 36507	Commissioner David E. Bishop Baldwin County Commissioner District 2 312 Courthouse Square, Suite 12 Bay Minette, AL 36507
Commissioner Frank Burt Baldwin County Commissioner District 1 312 Courthouse Square, Suite 12 Bay Minette, AL 36507	Commissioner Charles F. Gruber Baldwin County Commissioner District 4 312 Courthouse Square, Suite 12 Bay Minette, AL 36507
Louisiana	
Mayor Mitchell J. Landrieu City of New Orleans 1300 Perdido Street New Orleans, LA 70112	Councilman Arnie Fielkow City of New Orleans, Council President City Hall Room 2W40 1300 Perdido Street New Orleans, LA 70112
Councilman Kristin Gisleson Palmer City of New Orleans, Council, District C City Hall Room 2W70 1300 Perdido Street New Orleans, LA 70112	Councilman Jacquelyn Clarkson City of New Orleans, Council Vice President City Hall Room 2W50 1300 Perdido Street New Orleans, LA 70112

Councilman Cynthia Hedge-Morrell City of New Orleans, Council, District D City Hall Room 2W20 1300 Perdido Street New Orleans, LA 70112	Councilman Susan G. Guidry City of New Orleans, Council, District A City Hall Room 2W80 1300 Perdido Street New Orleans, LA 70112
Councilman John D. Johnson City of New Orleans, Council, District E City Hall Room 2W60 1300 Perdido Street New Orleans, LA 70112	Councilman Stacy S. Head City of New Orleans, Council, District B City Hall Room 2W10 1300 Perdido Street New Orleans, LA 70112
Mississippi	
Mayor Cheri M. Barry City of Meridian P.O. Box 1430 Meridian, MS 39302-1430	Councilman George Thomas City Council, Meridian MS Ward 1 P.O. Box 1430 Meridian, MS 39302-1430
Councilman Mary Perry City Council, Meridian MS Ward 2 P.O. Box 1430 Meridian, MS 39302-1430	Councilman Barbara Henson City Council, Meridian MS Ward 3 P.O. Box 1430 Meridian, MS 39302-1430
Councilman Jesse Palmer, Sr. City Council, Meridian MS Ward 4 P.O. Box 1430 Meridian, MS 39302-1430	Councilman Bobby R. Smith City Council, Meridian MS Ward 5 President P.O. Box 1430 Meridian, MS 39302-1430
Mayor Robbie Maxwell City of Pascagoula 3709 Quinn Drive Pascagoula, MS 39581	Councilman Harold Tillman, Jr. City of Pascagoula 5208 Bay Street Pascagoula, MS 39567
Councilman Robert Stallworth City of Pascagoula, Ward 1 4207 N Market Street Pascagoula, MS 39567	Councilman George Wolverton City of Pascagoula, Ward 2 3721 Warwick Street Pascagoula, MS 39581
Councilman Joe Abston City of Pascagoula, Ward 3 1306 Gallery Street Pascagoula, MS 39581	Councilman Frank Corder City of Pascagoula, Ward 4 2403 King Avenue Pascagoula, MS 39567
Councilman Jim Milstead City of Pascagoula, Ward 5 610 11th St. Pascagoula, MS 39567	
Texas	
Angel R. Escobar, City Manager City of Corpus Christi 1201 Leopard Street Corpus Christi, TX 78401	Mayor Joe Adame Mayor, City of Corpus Christi 1201 Leopard St. Corpus Christi, TX 78401
Councilman Mark Scott Corpus Christi City Council 1201 Leopard St Corpus Christi, TX 78401	Councilman Kevin Kieschnick Corpus Christi City Council, District 1 1201 Leopard St Corpus Christi, TX 78401

Councilman Priscilla Leal Corpus Christi City Council, District 3 1201 Leopard Street Corpus Christi, TX 78401	Councilman Larry Elizondo, Sr. Corpus Christi City Council, District 5 1201 Leopard Street Corpus Christi, TX 78401
Councilman Brent Chesney Corpus Christi City Council 1201 Leopard St Corpus Christi, TX 78401	Councilman Nelda Martinez Corpus Christi City Council 1201 Leopard St Corpus Christi, TX 78401
Councilman John Marez Corpus Christi City Council, District 2 1201 Leopard Street Corpus Christi, TX 78401	Councilman Chris Adler Corpus Christi City Council, District 4 1201 Leopard Street Corpus Christi, TX 78401
Judge Samuel L. Neal, Jr. Nueces County 901 Leopard Street Corpus Christi, TX 78401	Commissioner Mike Pusley Nueces County Board of Commissioners Precinct 1 901 Leopard Street Corpus Christi, TX 78401
Commissioner Betty Jean Longoria Nueces County Board of Commissioners Precinct 2 901 Leopard Street Corpus Christi, TX 78401	Commissioner Oscar Ortiz Nueces County Board of Commissioners Precinct 3 901 Leopard Street Corpus Christi, TX 78401
Commissioner Chuck Cazalas Nueces County Board of Commissioners Precinct 4 901 Leopard Street Corpus Christi, TX 78401	Commissioner Alma V. Moreno San Patricio County Board of Commissioners Precinct 3 P.O. Box 1667 Odem, TX 78370-1687
Commissioner Fred P. Nardini San Patricio County Board of Commissioners Precinct 2 900 Austin Street Portland, TX 78374-2011	Commissioner James Price, Jr. San Patricio County Board of Commissioners Precinct 4 3141 Fm 3512 Aransas Pass, TX 78336-9728
Judge Terry A. Simpson San Patricio County Judge 400 West Sinton Street, Suite 109 Sinton, TX 78387-2450	Commissioner Nina Trevino San Patricio County Board of Commissioners Precinct 1 P.O. Box 1132 Sinton, TX 78387-1132
Mayor Sam Fugate City of Kingsville P.O. Box 1265 Kingsville, TX 78364	Commissioner Charles Edward Wilson Kingsville Board of Commissioners P.O. Box 5088 Kingsville, TX 78364
Commissioner Stanley Lambert Laskowski Kingsville Board of Commissioners 1900 Kelly Drive Kingsville, TX 78364	Commissioner Arturo Pecos Kingsville Board of Commissioners 820 West Avenue I Kingsville, TX 78364

Commissioner Alfonso Garcia Kingsville Board of Commissioners P.O. Box 1823 Kingsville, TX 78364	Judge Pete De La Garza County of Kleberg P.O. Box 752 Kingsville, Texas 78364
Commissioner David Rosse County of Kleberg, Precinct 1 1910 E. Trant Rd. Kingsville, TX 78364	Commissioner Norma Alvarez County of Kleberg, Precinct 2 620 N. Third St. Kingsville, TX 78363
Commissioner Roy Cantu County of Kleberg, Precinct 3 433 E. County Rd. 2310 Riviera, TX 78379	Commissioner Romeo Lomas County of Kleberg, Precinct 4 622 N. 14th Kingsville, TX 78363
NATIVE AMERICANS	
Chief John Paul Darden Chitimacha Tribe of Louisiana Chitimacha Tribal Council P.O. Box 661Charenton, LA 70523	Chief Framon Weaver Choctaw Agency Mowa Band of Choctaw Route 1, Box 330-A, Reservation Road Mt. Vernon, AL 36560
Chairman Eddie Tullis Choctaw Agency Poarch Band of Creek HCR69A, Box 85-B Atmore, AL 36502	
STATE AGENCIES	
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Mr. Scott Stroh State Historic Preservation Officer Office of Cultural and Historical Programs Review and Compliance Section 500 S. Bronough Street Tallahassee, FL 32399-0250	Ms. Sally Mann, Director Department of Environmental Protection Florida Coastal Management Program 3900 Commonwealth Blvd Douglas Bldg; Mail Station 47 Tallahassee, FL 32399-3000
Mr. Michael W. Sole Florida Dept. of Environmental Protection Office of the Secretary 3900 Commonwealth Blvd. Tallahassee, FL 32399	Ms. Stephanie C. Kopelousos Florida Dept. of Transportation 605 Suwannee Street Tallahassee, FL 32399-0450
Mr. Thomas G. Pelham Florida Dept. of Community Affairs 2555 Shumard Oak Blvd., 260M Tallahassee, FL 32399-2100	Mr. Nick Wiley, Executive Director Florida Fish and Wildlife 620 S. Meridian St. Tallahassee, FL 32399
Ms. JuDee Dawkins Department of State Office of Cultural and Historical Programs 500 S. Bronough Street Tallahassee, FL 32399-0250	Ms. Sandy Shaughnessy Department of State Division of Cultural Affairs R.A. Gray Bldg, 3rd Floor 500 South Bronough Street Tallahassee, FL 32399-0250

Alabama	
Mr. Onis "Trey" Glenn, Director Alabama Dept of Environmental Mgmt P.O. Box 301463 1400 Coliseum Blvd. Montgomery, AL 36130-1463	Mr. Phillip Hinesley State Lands Division Coastal Management Program 5 Rivers Delta Resource Center 31115 5 Rivers Blvd Spanish Fort, AL 36527
Ms. Doni M. Ingram Alabama Department of Economic and Community Affairs Office of the Director P.O. Box 5690 Montgomery, AL 36103-5690	Mr. Frank White Executive Director Alabama Historical Commission 468 South Perry Street P. O. Box 300900 Montgomery, AL 36130-0900
Mississippi	
Ms. Trudy D. Fisher, Executive Director Mississippi Dept of Environmental Quality P.O. Box 2261 Jackson, MS 39225	Ms. Tina Shumate, Director Mississippi Coastal Program Dept. of Marine Resources 1141 Bayview Avenue, Suite 101 Biloxi, MS 39530
Mr. Jim Woodrick, Interagency Coordinator MDAH Historic Preservation Division Federal and State Project Review P.O. Box 571 Jackson, MS 39205-0571	
Louisiana	
Mr. Robert D. Harper Louisiana Dept of Natural Resources P.O. Box 94396 Baton Rouge, LA 70804-9396	Louis Buatt Assistant Secretary Louisiana Dept of Environmental Quality Coastal Management Division P.O. Box 94396 Baton Rouge, LA 70804-4487
Ms. Pam Breaux, Secretary Department of Culture, Recreation and Tourism P.O. Box 94361 Baton Rouge, LA 70804-9361	
Texas	
Ms. Susan Clewis, Regional Director Texas Commission on Environmental Quality Region 14 NRC Bldg Suite 1200 6300 Ocean Drive, Unit 5839 Corpus Christi, TX 78412-5839	Mr. Steven L. Highlander Texas Historical Commission P.O. Box 12276 Austin, TX 78711-2276
Ms. Helen Young Deputy Commissioner, Coastal Resources General Land Office Coastal Division 1700 N Congress Street Austin, TX 78701	

ORGANIZATIONS AND INDIVIDUALS	
Mr. Pat Murray Coastal Conservation Association 6919 Port West, Suite 100 Houston, TX 77024	Mr. Ed Williamson, Executive Director Coastal Conservation Association Alabama Chapter P.O. Box 16987 Mobile, AL 36616
Mr. Robert Hendricks, CEO Coastal Conservation Assoc Florida Chapter P.O. Box 568886 Orlando, FL 32856-8886	Mr. Jeff Angers, Executive Director Coastal Conservation Assoc Louisiana Chapter P.O. Box 86458 Baton Rouge, LA 70879
Mr. Rome Emmons, Executive Director Coastal Conservation Association Mississippi Chapter 109 South 27th Street, #219 Hattiesburg, MS 39401	Mr. Wayne Pacelle, Executive Director The Humane Society of the United States 2101 L Street NW Washington, DC 20037
Natural Resources Defense Council 40 West 20th Street New York, NY 10011	Mr. Larry J. Schweiger, President and CEO National Wildlife Federation 11100 Wildlife Center Drive Reston, VA 20190-5362
Ms. Susan Kaderka, Center Director National Wildlife Federation Gulf States Natural Resource Center 44 East Avenue, Suite 200 Austin, TX 78701	Center Director National Wildlife Federation Southeastern Natural Resource Center 730 Peachtree Street NE, Suite 1000 Atlanta, GA 30308
Vikki Spruill, President The Ocean Conservancy 1300 19th Street, NW Washington, DC20036	Mr. Carl Pope, Executive Director Sierra Club National Headquarters 85 Second Street, 2nd Floor San Francisco, CA 94105
Mr. John Ackerman, Chair Sierra Club Alabama Chapter, Coastal Group 1330 21st Way South, Suite 110 Birmingham, AL 35205	Ms. Pat Suter, Chair Sierra Club Coastal Bend Group P.O. Box 3512 Corpus Christi, TX 78404
Mr. Mark Muhich, Chair Sierra Club Galveston Group P.O. Box 1392 Galveston, TX 77550	Mr. Haywood Martin, Chair Sierra Club Delta Chapter P.O. Box 19469 New Orleans, LA 70179
Mr. Steve Shepherd, Chair Sierra Club Mississippi Chapter, Coastal Group P.O. Box 4335 Jackson, MS 39296-4335	Mr. John Hedrick, Chair Sierra Club Northwest Florida Group P.O. Box 15545 Panama City, FL 32406

Ms. Linda Jamison Sierra Club Big Bend Group P.O. Box 15732 Tallahassee, FL 32317	Director PETA 501 Front Street Norfolk, VA 23510
Mr. Rich D. Tuttle, Chair Texas State Aquarium Board of Trustees 2710 N Shoreline Blvd Corpus Christi, TX 78402	Dr. Quenton R. Dokken, Executive Director Gulf of Mexico Foundation PMB 51 - 5403 Everhart Corpus Christi, TX 78411- 4895
Mr. Timothy W. Wright University of West Florida Institute for Human and Machine Cognition 40 South Alcaniz Street Pensacola, FL 32502	Mr. Ed Meadows Pensacola Junior College 1000 College Blvd. Pensacola, FL 32504-8998
Mr. Evon Emerson Pensacola Chamber of Commerce 117 West Garden Street Pensacola, FL 32501	Mr. Craig Dalton Pensacola Chamber of Commerce 117 West Garden Street Pensacola, FL 32504
Ms. Carol Roberts Bay County Chamber of Commerce 235 West 5th Street Panama City, FL 32401	Mr. Larry Strain Santa Rosa County Chamber of Commerce 5247 Stewart Street Milton, FL 32570
Mr. Al McCambry Greater Panama City Beaches Chamber of Commerce 309 Beckrich Jackson Blvd. Panama City Beach, FL 32407	Mr. Wade Jones East Mississippi Business Development Corporation 1901 Front Street Meridian, MS 39302
Mr. Foster Edwards Corpus Christi Chamber of Commerce 1201 N Shoreline Blvd. Corpus Christi, TX 78401	Mr. Frederick Preis New Orleans Chamber of Commerce 1515 Poydras Street, Suite 1010 New Orleans, LA 70112
Mr. Win Hallett Mobile Chamber of Commerce 451 Government Street Mobile, AL 36602	Mr. Glenn Hayes Jefferson Chamber of Commerce Jefferson Parish 3421 N Causeway Blvd., Suite 203 Metairie, LA 70002
Mr. Lee A. Fuimian University of Texas Marine Science Institute 750 Channel View Drive Port Aransas, TX 78373	Mr. Steven Lohrenz University of Southern Mississippi Dept of Marine Science 1020 Balch Blvd. Stennis Space Center, MS 39529
Mr. Scott Quackenbush University of South Alabama Dauphin Island Sea Laboratory 101 Bienville Blvd. Dauphin Island, AL 36528	Mr. Jim Paul Escambia County 215 West Garden Street Pensacola, FL 32502

Mr. Frank Miller Pensacola Regional Airport 2430 Airport Blvd., Suite 225 Pensacola, FL 32504	Mr. Glen McDonald Bay County Military Affairs Applied Research 430 W 5th Street, #700 Panama City, FL 32401-6357
Mr. Tom Neubauer Bay Defense Alliance Neubauer ERA 740 S Tyndall Parkway Panama City, FL 32404	Mr. John P. LaRue Port of Corpus Christi P.O. Box 1541 Corpus Christi, TX 78403
Mr. Jim Lyons Alabama State Port Authority P.O. Box 1588 Mobile, TX 36633	Mr. Gary LaGrange Port of New Orleans P.O. Box 60046 New Orleans, LA 70160
Mr. H. Thomas Kornegay The Port of Houston Authority 111 East Loop North Houston, TX 77029	Mr. Clyde Mathis Port of Pensacola P.O. Box 889 Pensacola, FL 32594
Mr. Wayne Stubbs Panama City Port Authority 5321 West Highway 98 Panama City, FL 32401	

Scoping Meeting Attendees	
Diane Brown Citizens for the Bay 241 Twin Lakes Drive Laguna Beach, FL	Carmen Ferrer NSWC Panama City 110 Vernon Avenue Panama City, FL 32407
Gray W. Nelson Panama City, FL 32401	Bobby Pickels Panama City, FL
Wayne Stubbs Panama City Port Authority 5321 West Highway 98 Panama City, FL 32401	Leon Walters Lynn Haven, FL
L.N. Dantzler Panama City, FL	Christine LaRue Panama City Beach, FL
Steve Thompson Norfolk, VA	David Collins Panama City Beach, FL
Jim Rancaglione Tyndall AFB, FL	Tom Neubauer Bay Defense Alliance 740 South Tyndall Parkway Panama City, FL 32404
George C. Betz Panama City Beach, FL	Guy P. York Bay Defense Alliance 7552 Coleridge Road Panama City, FL 32404
Hal Harbeson NSA Panama City 101 Vernon Avenue Panama City Beach, FL 32407	William Dunaway Pensacola, FL
Marty Martin 7550 USS Essex Street NAS Whiting Field Milton, FL 32570	Beckie Faulkenberry Santa Rosa County 6051 Old Bagdad Highway Milton, FL 32583
Mr. and Mrs. Carol S. Williams New Orleans, LA	Joseph Laville Arlington, VA
Marion Fannaly NAS JRB New Orleans 400 Russell Avenue New Orleans, LA 70143	Rudy Neubeck Metairie, LA
Tammy L. Crosby & Audre Wehbe Marrero, LA	Joel & Linda Dalton Corpus Christi, TX
Shelby Walker Padre Island National Seashore P.O. Box 181300 Corpus Christi, TX 78480	Wade Stablein Padre Island National Seashore P.O. Box 181300 Corpus Christi, TX 78480
Blake A. Pettis Corpus Christi, TX	Priscilla Soliz Portland, TX

Josie Herro 901 Leopard Street Corpus Christi, TX 78404	Dennis & Karen Farias 3002 Shady Creek Lane Corpus Christi, TX 78414
Public Hearing Attendees	
Stacey Harter and Andy David Panama City, FL	Tom Neubauer Bay Defense Alliance 608 Shoreline Drive Panama City, FL 32404
Carmen Ferrer Panama City, FL	Sean Corsladden Bay Defense Alliance 2908 Thomas Drive Panama City, FL 32408
George C. Betz, Jr. Panama City Beach, FL	Larry Dantzler Bay Defense Alliance 7200 Fanning Bayou Drive Southport, FL 32409
Jessica Pfefferkorn Panama City Beach, FL	Ted Martin USFWS 1601 Balboa Avenue Panama City, FL 32401
Leon Walters Bay Defense Alliance 1121 Pierson Drive Lynn Haven, FL 32444	Craig Dalton Pensacola Chamber of Commerce 117 West Garden Street Pensacola, FL 32507
Donna Dugue New Orleans, LA	CDR Todd Templeton 2601 Meachum Boulevard Fort Worth, TX 76137
Marion Fannaly New Orleans, LA	Juan Garcia Corpus Christi, TX
Greg Brubeck Port of Corpus Christi Authority 128 Lake Shore Drive Corpus Christi, TX 78413	

GOMEX Range Complex EIS/OEIS

The U.S. Navy is announcing public hearings and a public comment period for the Gulf of Mexico (GOMEX) Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). This document assesses the potential environmental consequences associated with Navy Atlantic Fleet training and research, development, testing, and evaluation (RDT&E) activities, and associated range capabilities enhancements (including infrastructure enhancements) in the GOMEX Range Complex.

Public hearings will be held on the following dates:
February 2, 2009 - Panama City, FL
February 3, 2009 - Pensacola, FL
February 4, 2009 - New Orleans, LA
February 6, 2009 - Corpus Christi, TX

Copies of the draft document can be found at the following locations:
Bay County Public Library; 25 West Government Street; Panama City, FL 32401
Pensacola Public Library; 200 West Gregory Street; Pensacola, FL 32501
West Florida Public Library; 25 West Government Street; Panama City, FL 32401
Walton County Coastal Library; 437 Greenway Trail; Santa Rosa Beach, FL 32459
Meridian-Lauderdale County Public Library; 2517 Seventh Street; Meridian, MS 39301
Ben May Main Library; 701 Government Street; Mobile, AL 36602
East Bank Regional Library; 4747 West Napoleon Avenue; Metairie, LA 70001
New Orleans Public Library –Main Library; 219 Loyola Avenue; New Orleans, LA 70112
Central Library; 805 Comanche; Corpus Christi, TX 78401
Southmost Branch Library; 4320 Southmost Blvd; Southmost, TX 78522
The document is also available for download at http://www.GOMEXRangeComplexEIS.com

Each hearing will begin with an open house poster session from 5-7 p.m.
A formal presentation and public comment period will be held from 7-9 p.m.

Comments on the Draft GOMEX EIS/OEIS can be sent via U.S. mail or fax, as well as through the GOMEX Range Complex EIS/OEIS website. The mailing address is: Naval Facilities Engineering Command, Atlantic Division; Attention: Code EV22TW (GOMEX EIS/OEIS PM);
6506 Hampton Blvd; Norfolk, VA 23508-1278. Fax: (757) 322-4894.
Website: http://www.GOMEXRangeComplexEIS.com
Please submit comments by February 16, 2009

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