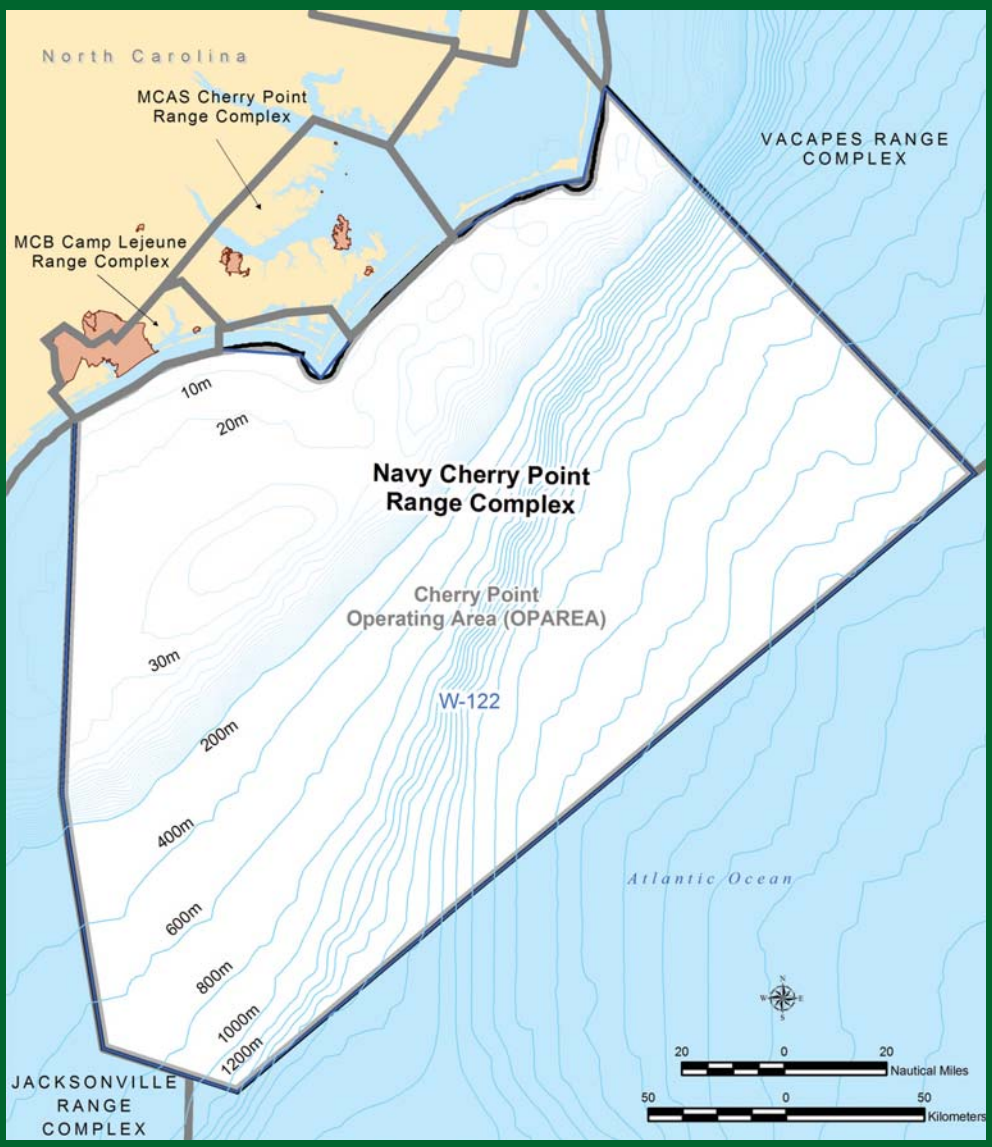
Navy Cherry Point Range Complex Final Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) Volume 1



Prepared by:

United States Fleet Forces

April 2009

NAVY CHERRY POINT RANGE COMPLEX FINAL ENVIRONMENTAL IMPACT STATEMENT/ OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

Lead Agency
Department of the Navy

Action Proponent:
United States Fleet Forces

For Additional Information:
NAVFAC Atlantic
6506 Hampton Boulevard, Norfolk, VA 23508-1278
Phone: (757) 322-8498

Cooperating Agency
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway, Silver Spring, Maryland 20910-3226

Published April 2009

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 Atlantic Fleet training, research, development, testing, and evaluation activities, and associated range capabilities enhancements (including infrastructure improvements) in the Navy Cherry Point Range Complex. The EIS/OEIS Study Area includes the Cherry Point Operating Area and Warning Areas. 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 EIS/OEIS.

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ACRONYMS AND ABBREVIATIONS

A-A	Air-to-Air
AAMEX	Air-to-Air Missile Exercise
AAV	Amphibious Assault vehicle
ACHP	Advisory Council on Historic Preservation
ACM	Air Combat Maneuvering
ADC	Acoustic Device Countermeasure
AEAU	Alternative Energy and Alternate Use
AEGIS	Airborne Early Warning/Ground Environment Integration Segment
AFAST	Atlantic Fleet Active Sonar Training
AFECC	Atlantic Fleet Exercise Coordination Center
AIC	Air Intercept Control
AICUZ	Air Installations Compatible Use Zone
AIM	Air Intercept Missile
AIWW	Atlantic Intercoastal Waterway
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
APNEP	Albemarle-Pamlico National Estuary Program
AQCR	Air Quality Control Region
AQM	Air-Launched Drone Missile Target
APE	Area of Potential Effect
AR	Atlantic Route
ARPA	Archaeological Resources Protection Act
ARTCC	Air Route Traffic Control Center
A-S	Air-to-Surface
A-SEL	A-weighted SEL
ASMFC	Atlantic States Marine Fisheries Commission
ASROC	Rocket-Assisted Anti-Submarine Torpedo
ASRT	Air Support Radar Team
ASTM	American Society for Testing and Materials
ASW	Anti-Submarine Warfare
ATC	Air Traffic Control
AUE	Association of Underwater Explorers
AUTEC	Atlantic Undersea Test and Evaluation
AW	Air Warfare
AWOIS	Automated Wreck and Obstruction Information System
BA	Biological Assessment
BAMS	Broad Area Maritime Surveillance
BDA	Battle Damage Assessment
BDU	Bomb Dummy Unit
BE	Biological Evaluation
BFM	Basic Fighter Maneuvers
BMP	Best Management Practice
BO	Biological Opinion
BOMBEX	Bombing Exercise
BQM	Air- or Surface-Launched Drone Missile Target
BRAC	Base Realignment and Closure
BRS	Behavioral Response Study
BT	Bombing Target
BUD	Basic Underwater Demolition
C	Centigrade or Celsius
C2W	Command and Control Warfare
CAA	Clean Air Act

CAMA	Coastal Area Management Act
CAS	Commercial Air Services (Navy); Close Air Support (USMC)
CATEX	Categorical Exclusion
CATM-9	Captive Carry Training Missile
CBFEAP	Chesapeake Bay Fisheries Ecosystem Advisory Panel
CBP	Chesapeake Bay Program
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFFC	Commander, United States Navy Fleet Forces Command
CFMTR	Canadian Forces Maritime Experimental and Test Ranges
CFR	Code of Federal Regulations
CH_4	Methane
CHAFFEX	Chaff Exercise
CHASN	Charleston
CHPT	Cherry Point
CHRIMP	Consolidated Hazardous Materials Reutilization and Inventory Management Program
CINCLANTFLT	Commander, in Chief, U.S. Atlantic Fleet
CIWS	Close-In Weapon System
CNA	Center for Naval Analysis
CNIC	Commander Naval Installations Command
CNO	Chief of Naval Operations
CO	Commanding Officer or Carbon Monoxide
CO_2	Carbon Dioxide
COMAR	Code of Maryland Regulations
COMNAVREG SE	Commander, Navy Region Southeast
COMPTUEX	Composite Training Unit Exercise
CP&L	Community Plans and Liaison
CRC	Coastal Resources Commission
CSAR	Combat Search and Rescue
CSG	Carrier Strike Group
CVN	Nuclear Aircraft Carrier
CVOA	Carrier Operating Area
CVW	Carrier Air Wing
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
D-Tags	Digital Acoustic Recording Tags
DAWM	Division of Air and Waste Management
dBA	decibel (A-weighted)
dd	distance doubled
DDG	Guided Missile Destroyer
DENR	Department of Environment and Natural Resources (NC)
DEQ	Department of Environmental Quality
DIN	dissolved inorganic nitrogen
DIP	dissolved inorganic phosphorus
DLQ	Deck Landing Qualifications
DMA	Dynamic Management Area
DNL	Day-Night Average Sound Level
DNREC	Delaware Department of Natural Resources and Environmental Control
DO	Dissolved oxygen
DoD	Department of Defense
DoN	Department of the Navy
DTE	Detect-to-Engage
DVD	Digital Versatile Disk
DWEL	Drinking Water Equivalent Level

DWQ	Division of Water Quality (NC)
EA	Environmental Assessment
EC	Electronic Combat
EEZ	Exclusive Economic Zone
EFD	Energy Flux Density
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
EFV	Expeditionary Fighting Vehicles
EGMTTA	Eastern Gulf of Mexico Testing and Training Areas
EIS	Environmental Impact Statement
EMATT	Expendable Mobile ASW Training Target
EO	Executive Order
EOD	Explosive ordnance disposal
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
ESG	Expeditionary Strike Group
ESGEX	Expeditionary Strike Group Exercise
EW	Electronic Warfare
EXTORP	Exercise Torpedo
F	Fahrenheit
FAA	Federal Aviation Administration
FAC	Forward Air Controller
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 Frigate
FIP	Federal Implementation Plan
FIREX	Firing Exercise
FL	Flight Level
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
fps	feet per second
FRP	Fleet Response Plan
FRS	Fleet Replacement Squadron
F-SEL	Flat weighted SEL
Ft	Feet
FR	Federal Register
FRP	Fleet Response Plan
FRTP	Fleet Response Training Plan
FWPCA	Federal Water Pollution Control Act
FWS	Future Water Supply
FY	Fiscal Year
GMFMC	Gulf of Mexico Fishery Management Council
GOMEX	Gulf of Mexico
GPS	Global Positioning System
GTF	Grow the Force
GTFP	Green Turtle Fibropapillomatosis
GUNEX	Gun Exercise
H_2	Hydrogen
H_2O	Water
HAB	harmful algal blooms
HAPC	Habitat Areas of Particular Concern
HARMEX	High Speed Anti-Radiation Missile Exercise
HARPS	High Frequency Acoustic Recording Packages
HAZMINCEN	Hazardous Material Minimization Center
HCN	hydrogen cyanide
HE	High Explosive
HELO	Helicopter
HITS	Historical Temporal Shipping
HM	Hazardous Material
HMX	Octogen (high Meltin g Explosive)
HQW	High Quality Waters

HSMT	High-Speed Maneuverable Target
HSMST	High-Speed Maneuverable Surface Target
HSO_3	Hydrogen Sulfite (Bisulfite)
HW	Hazardous Waste
Hz	Hertz
IBA	Important Bird Area
ICAO	International Civil Aviation Authority
ICMP	Integrated Comprehensive Monitoring Program
IEER	Improved Extended Echo Ranging
IEF	In Ex Fish
IFH	Improved Flex Hose
IFR	Instrument Flight Rules
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator System
IOC	Initial Operational Capability
IP	Implementation Plan
IRIS	Integrated Risk Information System
ISE	Independent Steaming Exercise
ISR	Intelligence, Surveillance and Reconnaissance
ISTT	Improved Surface Tow Target
ITS	Incidental Take Statement
IUSS	Integrated Undersea Surveillance System
IWC	International Whaling Commission
JAX	Jacksonville
JFCOM	Joint Forces Command
JNTC	Joint National Training Capability
JSF	Joint Strike Fighter
JTFEX	Joint Task Force Exercise
kg	kilogram
kHz	kilohertz
KIAS	Knots Indicated Air Speed
LAR	Light Amphibious Reconnaissance vehicle
LATR	Large Area Tracking Range
LAV	Light Armored vehicle
Lb.	Pound
LCAC	Landing Craft Air Cushion
LCS	Littoral Combat Ship
LCU	Landing Craft Utility
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
LFA	Low Frequency Active
LHA	Amphibious Assault Ship, general purpose
LHD	Amphibious Assault Ship, multi-purpose
LiBr	Lithium Bromide
LIDAR	Light Detection and Ranging
$LiSO_2$	Lithium sulfur dioxide
L_{max}	Maximum sound pressure level within a measuring period
L_{min}	Lowest sound pressure level within a measuring period
LMRS	Long-Term Mine Reconnaissance System
LNG	Liquid Natural Gas
LOA	Letter of Authorization
LPD	Amphibious Transport Dock
LSD	Dock Landing Ship
LW	Sound Power Level
M&S	Modeling and Simulation
M3R	Marine Mammal Monitoring on Navy Ranges
MAB	Mid-Atlantic Bight
MAEWR	Mid-Atlantic Electronic Warfare Range
MAFMC	Mid-Atlantic Fishery Management Council

MAGTF	Marine Air Ground Task Force
MARPOL	International Convention for the Prevention of Pollution from Ships
MATS	Mid-Atlantic Tursiops Surveys
MAUS	Mid-Atlantic United States
MBTA	Migratory Bird Treaty Act
MCALF	Marine Corps Auxiliary Landing Field
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCM	Mine Countermeasures
MCOLF	Marine Corps Outlying Field
MDE	Maryland Department of the Environment
MEM	Military Expended Material
MEMC	Military Expended Material Constituent
MEU	Marine Expeditionary Unit
MFA	Mid-frequency active
MFAS	multi-function active sensor
MIB	Mid-Atlantic Bight
µg/L	micrograms per liter
µPa	micropascals
mg/L	milligrams per liter
MINEX	Mining Exercise
MIO	Maritime Intercept Operations
MISSILEX	Missile Exercise
MIW	Mine Warfare
mm	Millimeter
MMA	Mutli-Mission Maritime Aircraft
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOA	Military Operating Area
MOUT	Military Operations on Urban Terrain
MPCD	Marine Pollution Control Device
mph	miles per hour
MRA	Marine Resource Assessment
MS	Maritime Security
MSAT	Marine Species Awareness Training
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MSR	Mobile Sea Range
MU	Management Unit
N	Newton
N_2	Nitrogen
NAAQS	National Ambient Air Quality Standards
NAB	Naval Amphibious Base
NALF	Naval Auxiliary Landing Field
NAMS	National Air Monitoring Site
NAO	North Atlantic Oscillation
NARWC	North Atlantic Right Whale Consortium
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NASOCEANAINST	NAS Oceana Instruction
NAVAIR	Naval Air Systems Command
NAVFAC	Naval Facilities Engineering Command
NAWQC	National Ambient Water Quality Criteria
NC	North Carolina
NCA	National Coastal Assessment
NCAC	North Carolina Administrative Code
NC DENR	North Carolina Department of Environment and Natural Resources
NCGS	North Carolina General Statute
NDAA	National Defense Authorization Act

NDCBR	Navy Dare County Bombing Range
NDZ	No Discharge Zone
NEFMC	New England Fishery Management Council
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NEPM	Non-Explosive Practice Munitions
NERR	National Estuarine Research Reserve
NEUS	Northeast United States
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_x	Nitrogen Oxide
NOA	Notice of Avalilability
NOAA	National Oceanic and Atmospheric Agency
NODE	Navy OPAREA Density Estimate
NOI	Notice of Intent
NOTAM	Notice-to-Airmen
NOTMAR	Notice-to-Mariners
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRC	National Research Council
NRHP	National Register of Historic Places
NRIS	National Register Information System
NSFS	Naval Surface Fire Support
NSW	Naval Special Warfare Or Nutrient Sensitive Waters
NSWC	Naval Surface Warfare Center
NTTL	Navy Tactical Task List
NWS	Naval Weapons Station
OASIS	Organic and Surface Influence Sweep
OB/OD	Open Burn/Open Detonation
OCE	Officer Conducting the Exercise
OCM	Oil Content Monitor
OCSLA	Outer Continental Shelf Lands Act
ODD	Officer of the Deck
OEA	Overseas Environmental Assessment
OEIS	Overseas Environmental Impact Statement
OMCM	Organic Mine Countermeasures
OMP	Office of Marine Programs
OOD	Officer of the Deck
OPA	Oil and Pollution Act
OPAREA	Operating Area
OPFOR	Opposition Force
OPNAVINST	Chief of Naval Operations Instruction
OPS	Operations
ORRV	Off road recreational vehicle
ORW	Outstanding Resource Waters
OTC	Officer in Tactical Command
P2	Pollution Prevention
Pa	Pascals
PACFIRE	Pre-Action Calibration Firing
PAH	polycyclic aromatic hydrocarbon
PARS	Port Access Route Study
$PbCl_2$	Lead Chloride
$PbCO_3$	Lead Carbonate
$PbOH_2$	Lead Hydroxide
PCB	polychlorinated biphenyls
PBR	Potential Biological Removal
PERSTEMPO	Personnel Tempo of Operations

PL	Public Law
PM	Particulate matter
PMAR	Primary Mission Areas
pna	primary nursery areas
POC	Point of Contact
POL	petroleum, oils, and lubricants
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
psf	pounds per square foot
psi	pounds per square inch
psu	practical salinity units
PTC	Pilot Training Center
PTP	Pre-deployment Training Program
PTS	Permanent Threshold Shift
PVC	polyvinyl chloride
PWC	Personal Watercraft
PWL	Sound Power Level
R&D	Research and Development
RAICUZ	Range Air Installations Compatible Use Zone
RAM-D	Reliability, Availability, Maintainability, and Durability
RAMICS	Rapid Airborne Mine Clearance System
RCD	Required Capabilities Document
RCDO	Range Control Duty Officer
RCMP	Range Complex Management Plan
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Test and Evaluation
RDX	Cyclotrimethylene-trinitramine (Royal Demolition Explosive)
REC	Regional Environmental Coordinator
REXTORP	recoverable exercise torpedo
RF	radio frequency
RFF	Request for Forces
RFMSS	Range Facility Management Support System
RHIB	Rigid Hull Inflatable Boat
rms	root mean squared
ROD	Record of Decision
RONA	Record of Non-Applicability
RONEX	Squadron Exercise
RSG	Range Sustainability Group
RSO	Range Safety Officer
S-A	Surface-to-Air
SAB	South-Atlantic Bight
SAFMC	South Atlantic Fishery Management Council
SAR	Stock Assessment Report or Search and Rescue
SARA	Superfund Amendments and Reauthorization Act
SAV	Submerged Aquatic Vegetation
SCP	Spill Contingency Plan
SDWA	Safe Drinking Water Act
SEAC	Submarine Exercise Area Coordinator
SEAD	Suppression of Enemy Air Defenses
SEARCH	Southeastern Archaeological Research, Inc.
SEIS	Supplemental Environmental Impact Statement
SEL	Sound Exposure Level
SEPTAR	Seaborne Powered Target
SESEF	Shipboard Electronic Systems Evaluation Facility
SEUS	Southeastern United States
SFH	Strong Flex Hose
SHPO	State Historic Preservation Office
SINKEX	Sinking Exercise
SiO_2	Silicon Dioxide

SIP	State Implementation Plan
SLA	Submerged Lands Act
SLAMS	State and Local Air Monitoring Site
SM	Standard Missile
SMA	Seasonal Management Area
SMCA	Sunken Military Craft Act
SME	Subject Matter Expert
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SPL	Sound Pressure Level
S-S	Surface-to-Surface
SSG	Surface Strike Group
SSN	Nuclear Submarine
SST	Sea Surface Temperature
STOVL	Short Take-off/Vertical Landing
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 Study
T&E	Testing & Evaluation
T&R	Training & Readiness
TACAN	Tactical Air Navigation
TACTS	Tactical Air Combat Training System
TALD	Tactical Air-Launched Decoy
TAMU	Texas A&M University
TAP	Tactical Training Theater Assessment and Planning
TCTS	Tactical Combat Training System
TDS	Total Dissolved Solids
TED	Turtle-Excluder Device
TEU	Twenty-Foot Equivalent Units
TL	Transmission Loss
TMDL	total maximum daily load
TNT	trinitrotoluene
TOW	Tube-Launched, Optically Tracked Wire-Guided
TR	Trout waters
TRACKEX	Tracking Exercise
TRES	Threat Radar Emitter System
TSP	total suspended particulates
TSPI	Time, Space and Position Information
TTS	Temporary Threshold Shift
UAV	Unmanned Aerial Vehicle
UCAV	Unmanned Combat Air Vehicle
UJTL	Universal Joint Task List
ULT	Unit Level Training
UNDET	Underwater Detonation
UNDS	Uniform National Discharge Standards
U.S.	United States
USACOE	United States Army Corp of Engineers
USAF	United States Air Force
U.S.C.	United States Code
USCB	United States Census Bureau
USCG	United States Coast Guard
USCOP	U.S. Commission on Ocean Policy
USEPA	U.S. Environmental Protection Agency
USFF	United States Fleet Forces
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
USVI	U.S. Virgin Islands
USWTR	Undersea Warfare Training Range Unique Wetland
VACAPES	Virginia Capes
VAST	Virtual At-Sea Training

VBSS	Visit, Board, Search, and Seizure
VEMS	Versatile Exercise Mine System
VFR	Visual Flight Rules
VIMS	Virginia Institute of Marine Science
VLA	vertical launch anti-submarine rocket
VMRC	Virginia Marine Resource Commission
VOC	Volatile Organic Compound
V/STOL	Vertical/Short Take-Off and Landing
W-	Warning Area
WMA	Water Management Administration
WFF	Wallops Flight Facility
WQIP	Water Quality Infrastructure Program
WQMIRA	Water Quality Monitoring, Information, and Restoration Act
WQS	Water Quality Standards
WW II	World War II
XBT	expendable bathythermograph
XO	Executive Officer

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EXECUTIVE SUMMARY

The United States (U.S.) Department of the Navy (DoN, 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 Atlantic Fleet training; research, development, testing, and evaluation (RDT&E) activities; and associated range capabilities enhancements in the Navy Cherry Point Range Complex. The components of the Navy Cherry Point Range Complex encompass 18,966 nm^2 of special use airspace (SUA) warning area; 18,617 nm^2 of offshore surface and subsurface operating area (OPAREA); and 12,529 nm^2 of deep ocean area greater than 100 fathoms (600 feet). The geographic scope of this EIS/OEIS, referred to as the Navy Cherry Point Study Area (See Figure ES-1), includes the airspace; seaspace; and undersea space of the Navy Cherry Point Range Complex, plus the 3 nm strip of coastal water between the shoreline and the OPAREA's north-western boundary . The Navy Cherry Point Study Area does not include any land ranges.

This 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 *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 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 FEIS/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 descriptions of Maritime Security Operations and Mine Warfare training, descriptions of the deployment and recovery of non-explosive training mines in Onslow Bay, and more detailed Weapon System data sheets located in Appendix E.

In accordance with 50 CFR § 401.12 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). 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. 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 has concurred with the Navy's conclusions. The Record of Decision for this Final EIS/OEIS will address any additional mitigation measures which may result from these ongoing regulatory processes.

The Navy and Marine Corps use each other's training areas and integrated training, as described in Chapter 2 (Tables 2..2-1 and 2.2-2), during Expeditionary Strike Group (ESG) Strike Composite Training Unit Exercise (COMPTUEX), Joint Task Force Exercise (JTFEX), amphibious assault and amphibious raid in the three adjoining range complexes of Navy Cherry Point, Marine Corps Air Station (MCAS Cherry Point) and Marine Corps Base (MCB) Camp Lejeune. However, the majority of the Marine Corps training that occurs in the three adjoining range complexes of Navy Cherry Point, MCAS

Cherry Point and MCB Camp Lejeune is conducted independently and not in conjunction with the Navy. Despite the high degree of Navy and Marine Corps interaction in this region, the functions, structure, management and use of the three range complexes are sufficiently distinct that the Navy and Marine Corps analyzed potential environmental effects of their combined training activities in three separate documents. Each service will provide environmental documentation for the Range Complex(es) over which it has cognizance:

- Navy Cherry Point Range Complex EIS/OEIS (this document) considers training activities in the sea space and undersea space of Cherry Point Operating Area (OPAREA); overlying Special Use Airspace (SUA) of Warning Area 122; and the 3nm-wide coastal strip from the mean high tide line, up to and extending seaward to the north-western OPAREA boundary. The Navy is the Action Proponent.
- MCAS Cherry Point Range Operations EA considered training activities on the air station; its outlying and auxiliary landing fields; its two impact areas of Bombing Target (BT) 11 and BT-9 in Pamlico Sound; and overlying SUA. Sections 1.5 and 1.7.1 describe the scope of the analysis in more detail. Section 6.2 discusses past and present actions resulting from Marine Corps training, and Section 6.4 includes Marine Corps action in foreseeable future training. The Marine Corps is the Action Proponent for the MCAS Cherry Point Range Operations EA.
- MCB Camp Lejeune Range Operations EA considered training activities on the installation's many ranges and impact areas, some of which extend into the Cherry Point OPAREA (e.g. N-1/BT-3), and overlying SUA. Section s 1.5 and 1.7.1 describes the scope of the analysis in more detail. Section 6.2 discusses past and present actions resulting from Marine Corps training, and Section 6.4 includes Marine Corps action in foreseeable future training. The Marine Corps is the Action Proponent for the MCB Camp Lejeune Range Operations EA.

ES 1.0 Purpose and Need

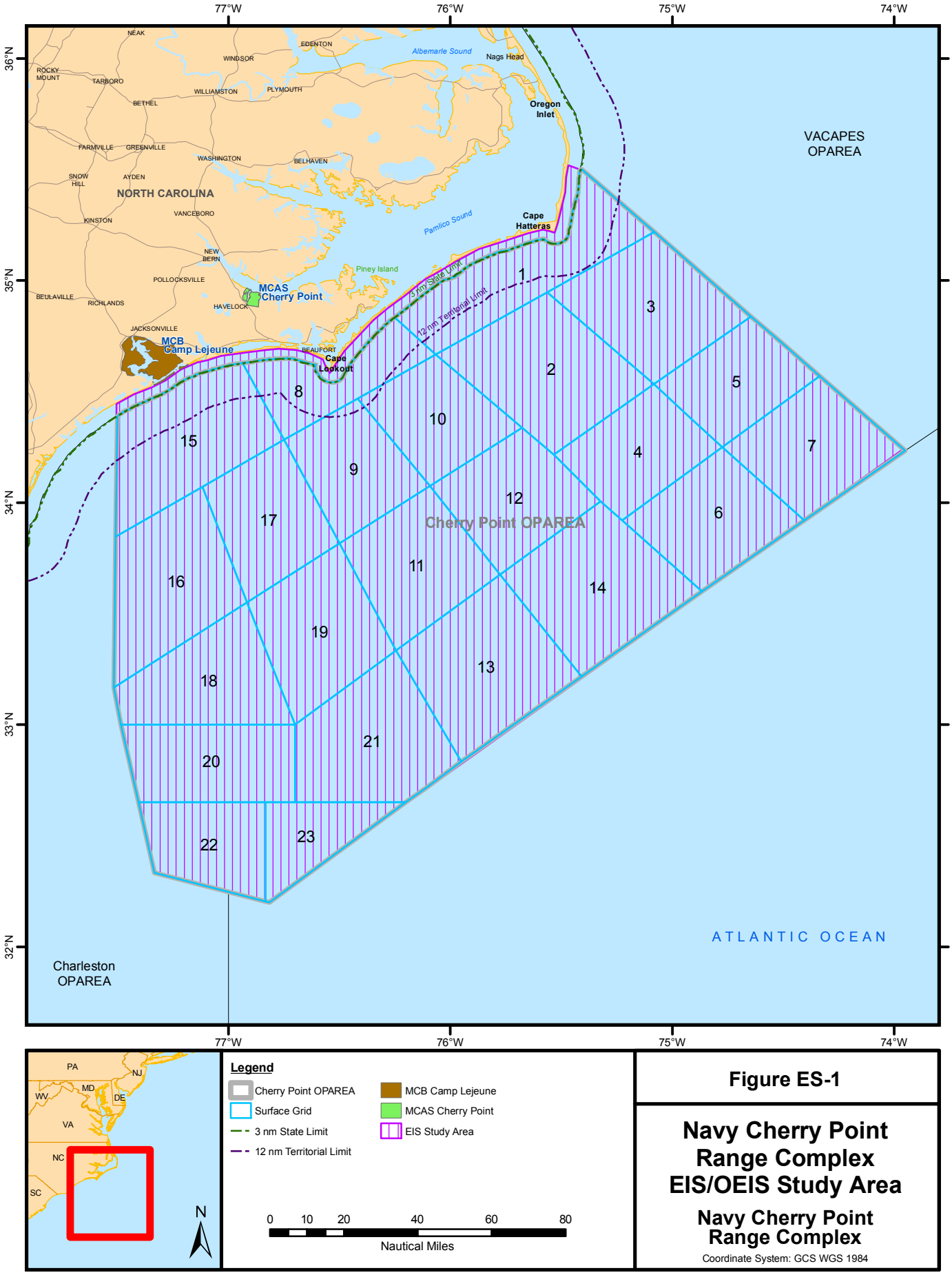
The purpose for the proposed action is therefore to:

- Achieve and maintain Fleet readiness using the Navy Cherry Point Range Complex to support and conduct current, emerging, and future training operations and RDT&E operations;
- Expand warfare missions supported by the Navy Cherry Point 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 Navy Cherry Point Range Complex furthers the Navy's execution of its Congressionally mandated roles and responsibilities under Title 10 U.S.C Part 5062. For further information on the purpose and need for the proposed action refer to Chapter 1 of the FEIS/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 Navy Cherry Point Range Complex. The proposed action does not indicate major changes to Navy Cherry Point 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 Navy Cherry Point Range Complex that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission.



Legend

- Cherry Point OPAREA
- Surface Grid
- 3 nm State Limit
- 12 nm Territorial Limit
- MCB Camp Lejeune
- MCAS Cherry Point
- EIS Study Area

0 10 20 40 60 80
Nautical Miles

Figure ES-1

Navy Cherry Point Range Complex EIS/OEIS Study Area

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

ES 2.1 Proposed Action

The proposed action is to support and conduct current and emerging training and RDT&E operations in the Navy Cherry Point 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 Alternative 2 is selected, then:

- Increase or modify training and RDT&E operations from current levels in support of the Fleet Response Training Plan (FRTP) and the US Marine Corps Pre-deployment Training Program (PTP).
- Accommodate mission requirements associated with force structure changes, including those resulting from the introduction of new aircraft and weapons systems.
- Implement enhanced range complex capabilities.

The decision-maker for this FEIS/OEIS will decide both the level and mix of training and testing, and range capability enhancements, that best meet Navy and the Marine Corps requirements within the Navy Cherry Point 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 FEIS/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 PTP; and the capability to support training requirements while following Navy Personnel Tempo of Operations guidelines. Three alternatives are analyzed in this FEIS/OEIS:

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: increase operational training, plus changes in type and quantity of operations and tactical employment of forces to accommodate expanded mission areas, force structure changes[1] (including training resulting from the introduction of new platforms and weapon systems), and new range capabilities. This alternative is composed of all operations currently conducted under the No Action Alternative, with modifications to current training or introduction of new training. These would include:

    a) adjusting training levels to ensure that deployment can be stepped up quickly and at multiple locations in response to world events;
    b) incorporating Maritime Security training into existing training events;
    c) conducting surface-to-air missile training events;
    d) conducting new or modified training associated with the introduction of the new MH-60 helicopter, and new organic mine countermeasure systems;
    e) increasing use of commercial aircraft to displace Navy aircraft as oppositional forces for electronic combat, air intercept control, strike and close air support exercises, and as tow aircraft for air-to-air gunnery exercises; and
    f) upgrading electronic combat capabilities.

[1] Force Structure Changes include changing weapon systems and platforms and homebasing new aircraft and ships.

3. Alternative 2 (Preferred Alternative)– Includes all operations under Alternative 1 plus eliminating all high explosive at-sea BOMBEXs and designating two mine warfare training areas for major exercise mine training events.

   For detailed information on each alternative refer to Chapter 2 of the FEIS/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 (non-explosive practice munitions) within the Navy Cherry Point 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, it would not be able to meet its obligations, as identified in Title 10 United States Code, Section 5062.
- The Navy Cherry Point Range Complex is an important component in the available suite of Navy and Marine Corps training and testing capabilities. The proximity of the Navy Cherry Point 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 Cherry Point operations, they are no substitute for realistic field conditions. The value of live training provided by actually operating a combat system or handling explosive ammunition cannot be substituted 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 EIS/OEIS.

A notice of intent to develop the Draft EIS/OEIS was published in the Federal Register on April 30, 2007, and in five local newspapers in North Carolina. The newspaper notices were run five times in each newspaper. Two scoping meetings were held (Morehead City and Wilmington, NC) 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, 14 comments were received; 13 from government agencies at various levels and one from an individual. Commenters raised concerns about impacts on fish and fishing; harm to cultural resources, marine protected areas, and endangered species; and potential conflicts between boating or shipping and Navy activities. This 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 73, No. 178, September 12, 2008). 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 Beaufort and Wilmington, NC 14-15 October 2008. Public and agency comments were received via the Navy Cherry Point web site, facsimile, and regular mail. The public comment period for the Draft EIS/OEIS ended on 27 October 2008. Eighty-six public 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; or
- Public Health and Safety.

The potential impacts would generally be temporary, short-term, long-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 the cessation of high explosive BOMBEXs in Alternative 2, there is a substantial decrease in the number of marine mammals and sea turtles potentially impacted compared to the No Action Alternative and Alternative 1. 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) FEIS/OEIS is incorporated by reference in this FEIS/OEIS for active sonar and Anti-Submarine Warfare associated activities as they pertain to the Navy Cherry Point Range Complex. The reader should refer to the AFAST FEIS/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 FEIS/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 Navy Cherry Point Range Complex is provided by resource area in Section 3.19.

Table ES-1
Comparison of Alternatives and Effects

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Bathymetry and Sediments	Short term, minor impacts in the surf zone from amphibious operations (landing craft and amphibians) (Section 3.1.3.1)	Short term, minor impacts in the surf zone from amphibious operations (landing craft and amphibians) (Section 3.1.3.2)	Short term, minor impacts in the surf zone from amphibious operations (landing craft and amphibians) (Section 3.1.3.3)
Marine Communities	Long-term minor impacts to benthic habitats from accumulation of Non-explosive Practice Munitions (NEPM) (Section 3.6.3.1)	Slight increase in potential impacts to benthic habitats from accumulation of NEPM and short term, minor impacts from deployment and recovery of MIW mine shapes considering mitigation measures in place (Section 3.6.3.2)	An increase in potential impacts to benthic habitat from accumulation of NEPM and an increase in short term minor impacts from deployment and recovery of MIW mine shapes (Section 3.6.3.3)
Marine Mammals	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 2,877 non-injurious potential exposures, and 65 injurious exposures. Under ESA, proposed activities may affect listed whale species. The proposed activities will have no effect on the manatee (Section 3.7.3.3).	Using acoustic modeling estimates for underwater explosions , no mortality potential exposures, 2,878 non-injurious potential exposures, and 65 injurious potential exposures. Under ESA, proposed activities may affect listed whale species. The proposed activities will have no effect on the manatee (Section 3.7.3.4).	Using acoustic modeling estimates for underwater explosions , no mortality potential exposure, 2 non-injurious potential exposures, and no injurious potential exposures. Under ESA, proposed activities may affect listed whale species. The proposed activities will have no effect on the manatee. The Navy has submitted to NMFS an application for a Letter of Authorization under MMPA and has initiated the ESA Section 7 formal consultation process with NMFS for listed whales. The Navy has submitted a Biological Evaluation to USFWS concluding that the proposed action would not affect manatees. The USFWS concurred (Section 3.7.3.5).

Table ES-1
Comparison of Alternatives and Effects (Continued)

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Preferred Alternative
Sea Turtles	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 137 non-injurious exposures, and 3 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, 137 non-injurious exposures, and 3 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 no injurious exposures. Under ESA, proposed activities may affect listed species. The Navy has initiated the ESA Section 7 formal consultation process with NMFS for listed sea turtles. (Section 3.8.3.4).
Fish	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level affects. (Section 3.9.3.1)	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level affects. (Section 3.9.3.2)	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level affects. (Section 3.9.3.3)
Essential Fish Habitat (EFH)	No adverse affect to EFH. Any impacts, mainly due to military expended materials, 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, mainly due to military expended materials, 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. Any impacts, mainly due to military expended materials, 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)
Seabirds and Migratory Birds	Vessel movements and high explosive detonations may affect, but not likely to adversely affect Bermuda petrels. Under ESA and MBTA, no effect would occur to other listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.1)	Vessel movements and high explosive detonations may affect, but not likely to adversely affect Bermuda petrels. Under ESA and MBTA, no effect would occur to other listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.2)	Vessel movements and high explosive detonations may affect, but not likely to adversely affect Bermuda petrels, although any effect would be less than the No Action Alternative and Alternative 1. Under ESA and MBTA, no effect would occur to other listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.3)
Atlantic Fleet Active Sonar Training (AFAST)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.19)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.19)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.19)

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. Due to the long-term nature of the proposed action, mitigation measures for many elements of the action have been established through previous environmental analyses, consultations, and/or permitting processes.

The Navy believes that a comprehensive approach to mitigation for the Navy Cherry Point 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 the NMFS, mitigation and monitoring measures presented in this EIS/OEIS focus on the requirements for protection and management of marine resources.

Between 20004 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 will continue to fund a significant amount of marine research directly applicable to its training activities. 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. 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 proposed action will not make radical changes to the Navy Cherry Point Range Complex facilities, operations, training, or RDT&E capabilities. Rather, the actions proposed in Alternatives 1 and 2 are incremental increases over 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 FEIS/OEIS. Twenty projects including, but not limited to, military

activities in other OPAREAs on the Atlantic coast, offshore oil and gas activities along the Atlantic seaboard, maritime traffic, scientific research, and marine ecotourism were analyzed for cumulative effects. For each resource area evaluated in this FEIS/OEIS, the effects to these resources from other past, present and reasonably foreseeable future projects were analyzed to assess the potential for this action to incrementally contribute to cumulatively significant impacts. Cumulative impacts resulting from sonar training were assessed using the conclusions from the Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS. Potential impacts to resources are identified in Section 6.4. Most of the summary conclusions on past, present, and reasonably future actions for the resources evaluated were no adverse impacts and potential for minor, but recoverable, adverse impacts. There were fewer summary conclusions categorized as potential for moderate, but recoverable, adverse impacts. No summary conclusions were characterized as potential for major, non-recoverable, adverse impacts (Table ES-2).

Table ES-2 Summary of Cumulative Impacts by Resource Area

		Bathymetry/Sediments	Hazardous Materials/Waste	Water Resources	Air Quality	Noise Environment	Marine Communities	Marine Mammals	Sea Turtles	Fish	Seabirds/Migratory Birds	Land Use	Cultural Resources	Transportation	Demographics	Regional Economy	Recreation	Environmental Justice	Public Health and Safety
Past and Present Actions	Commercial and Recreational Fishing	*	*	NE	NE	NE	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Maritime Traffic	*	*	*	NE	*	NE	**	*	NE	NE	NE	*	*	NE	*	*	NE	*
	Scientific Research	NE	*	NE	NE	NE	*	*	*	*	*	NE	NE	NE	NE	NE	NE	NE	NE
	Debris	*	*	*	NE	NE	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Environmental Contamination and Biotoxins	NE	NE	**	NE	NE	**	**	**	**	**	NE	NE	NE	NE	NE	NE	NE	NE
	Marine Ecotourism	NE	NE	*	NE	NE	NE	*	*	NE	NE	NE	NE	NE	NE	*	*	NE	NE
	Military Operations	*	*	*	*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	*
	MMS: Oil and Gas	**	*	**	**	*	*	**	**	*	**	NE	*	NE	NE	NE	NE	NE	NE
	Dredging	**	**	**	**	*	**	NE	**	**	NE	NE	*	NE	NE	NE	NE	NE	NE
Future Actions	Military Operations	*	*	*	*	*	*	*	*	*	*	NE	*	NE	NE	NE	NE	NE	*
	MMS Oil and Gas Leases	*	NE	*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Navy Cherry Point 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

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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 Environmental Impact Statement (EIS) Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with Navy and Marine Corps training and research, development, testing, and evaluation (RDT&E) activities, and associated range capabilities enhancements (including infrastructure improvements) in the Navy Cherry Point 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.) Part 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 exercises and ensuring naval forces have access to ranges, operating areas (OPAREA) and airspace where Navy can develop and maintain skills for wartime missions and conduct RDT&E of naval weapons systems. For purposes of this EIS/OEIS, exercises and training do not include combat operations, operations in direct support of combat, or other activities conducted primarily for purposes other than training.

Generally, the proposed action is to support and conduct current and emerging training and RDT&E operations in the Navy Cherry Point Range Complex. The decision to be made by 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 Navy Cherry Point Range Complex that best meets the needs of the Navy and the Marine Corps.

Figure 1.1-1 depicts the three range complex areas of Navy Cherry Point Range Complex, Marine Corps Air Station (MCAS) Cherry Point Range Complex, and Marine Corps Base (MCB) Camp Lejeune Range Complex. The focus of this EIS/OEIS is the Navy Cherry Point Range Complex, consisting of the offshore airspace, seaspace, and undersea space. The activities analyzed in this EIS/OEIS include current and future proposed Navy and Marine Corps training and RDT&E operations within Navy-controlled OPAREAs, special use airspace (SUA), instrumented ranges, and Navy-funded range capabilities enhancements (including infrastructure improvements). The actual study area is further defined in Section 1.5. United States Fleet Forces (USFF) prepared a separate EIS/OEIS for active sonar activities along the east coast and Gulf of Mexico (including the Navy Cherry Point Range Complex) that evaluated the potential impacts of active sonar on the marine environment. The Atlantic Fleet Active Sonar Training (AFAST) Final EIS (FEIS)/OEIS is incorporated by reference for active sonar activities as they pertain to the Navy Cherry Point Range Complex. The AFAST FEIS/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 all the East Coast and Gulf of Mexico range complexes and specifically identifies the Navy Cherry Point Range Complex. Chapter 3 (Section 3.19) of this document addresses the AFAST FEIS/OEIS and assesses the impact of sonar activities in the context of the Navy Cherry Point EIS/OEIS proposed action and other past, present, and reasonably foreseeable actions.

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

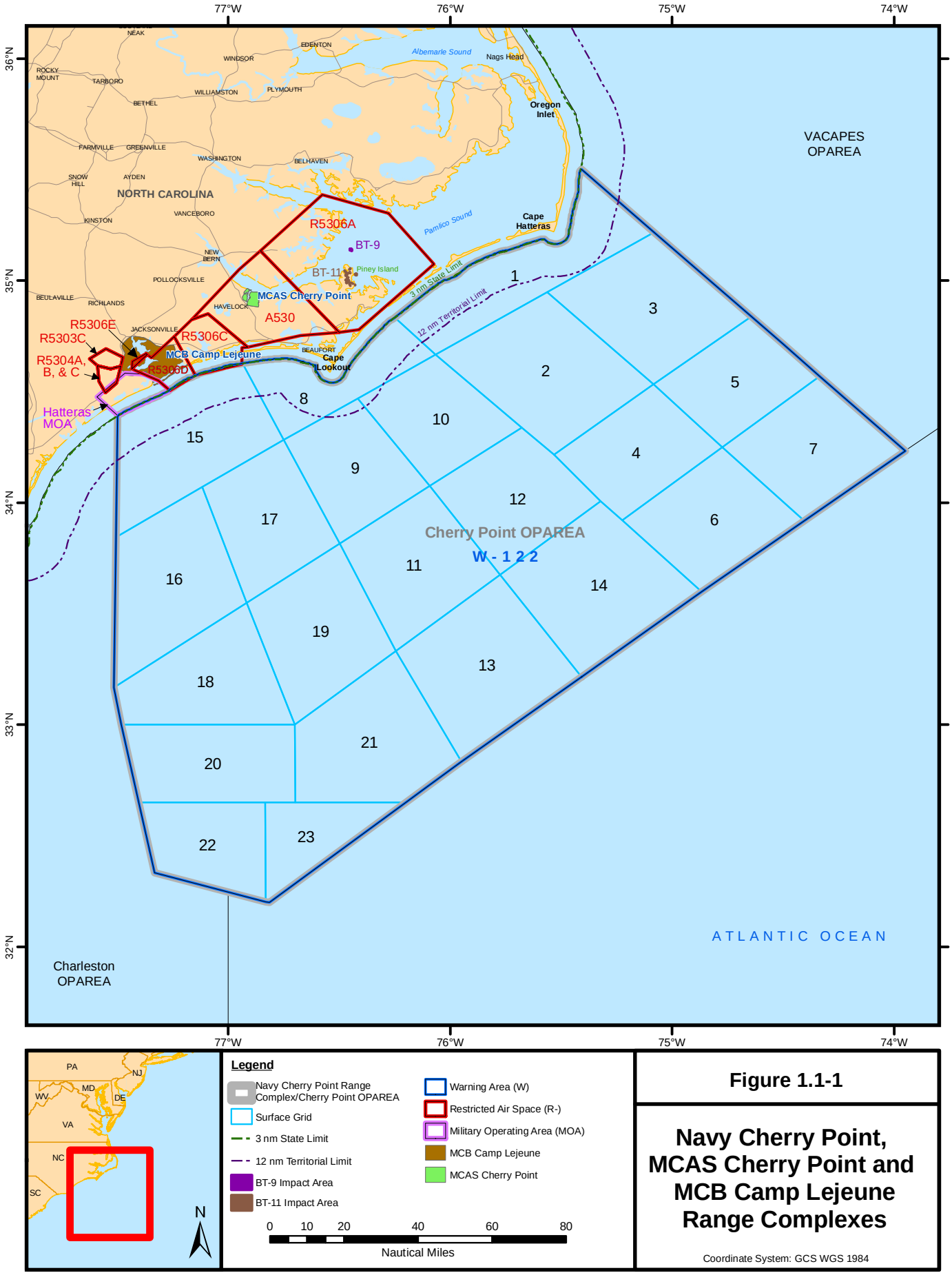
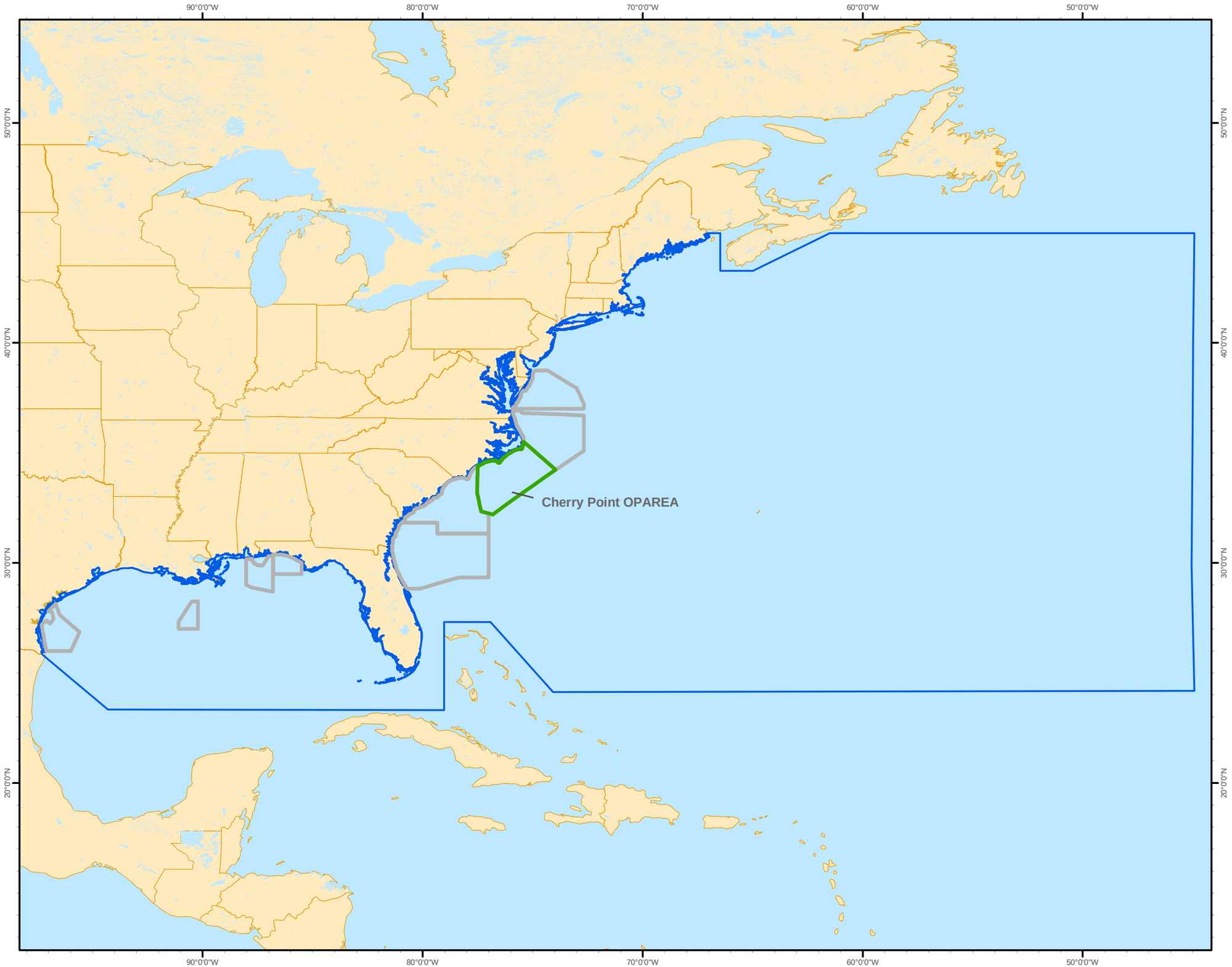


Figure 1.1-1

Navy Cherry Point, MCAS Cherry Point and MCB Camp Lejeune Range Complexes

Coordinate System: GCS WGS 1984

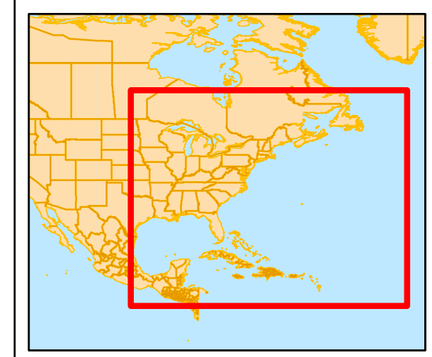


AFAST Study Area

Figure 1.1-2

Legend

- Cherry Point OPAREA
- 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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of the U.S. territorial seas -- greater than 12 nautical miles (nm) offshore. The proposed action requires analysis of potential impacts within and outside U.S. territory; therefore, this document is written to satisfy requirements of both NEPA and EO 12114.

1.2 BACKGROUND

The Navy has historically trained in the area now defined as the Navy Cherry Point Range Complex for national defense purposes. The air, sea, and undersea space of the complex has and continues to provide a safe and realistic training environment to ensure military personnel are ready to carry out assigned missions in furtherance of its Congressionally mandated duty. The Navy Cherry Point Range Complex is situated close to Norfolk, Virginia and Jacksonville, Florida, the two primary homeports for the U.S. Atlantic Fleet. The Navy Cherry Point Range Complex is a preferred location for portions of U.S. Atlantic Fleet major training exercises, and provides the training infrastructure and proximity for Navy and Marine Corps forces homeported in the Marine Forces Atlantic concentration area of MCAS Cherry Point and MCB Camp Lejeune.

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 United States Code Title 10, 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 their 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, several surface combatant ships and submarines, can project power ashore via aircraft or missiles. An Expeditionary Strike Group (ESG), consisting of amphibious ships, surface combatant ships, submarines, and an embarked Marine Expeditionary Unit (MEU)[2], can project power ashore via amphibious landing of men, armor and materiel. Traditionally, a CSG or ESG 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 Maritime Security (MS) 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 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." The Navy developed the Fleet Response Plan (FRP) as a deliberate process to ensure continuous availability of agile, flexible, trained, and ready surge-capable forces. The goal of

[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.

FRP is a standing ability to deploy six CSGs in a very short time, and one additional CSG in stages soon thereafter. FRP addresses all aspects of maintaining these surge-capable Navy forces, including maintenance, manning, deployment schedules, and so on. The Cherry Point Range Complex 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 deployment of 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, as well as 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 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 initial combat experience crucial to success and survival in this environment.

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 carry out operations on and below the ocean surface, on land and in the air simultaneously. To optimize all this capability, Navy training activities must focus on achieving proficiency in eight functional areas, known as Primary Mission Areas (PMAR): 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 EIS/OEIS is categorized under one of the PMARs. Appendix D describes each of these PMARS and individual training exercises in greater detail.

1.2.1.3 Fleet Response Training Plan (FRTP)

This Cherry Point Range Complex EIS/OEIS addresses the training side of the Fleet Response Plan, which is the 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 (by the Type Commanders due to weapon system availability) during which major shipyard or depot level repair and most personnel turnover occurs. Ships and squadrons will 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 will include multi-ship air defense and anti-submarine warfare exercises, and ten-plane bombing strikes at multiple target sites, all occurring simultaneously in a realistic battle scenario.

Sustainment Phase begins upon completion of the Integrated Phase, 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 USAF and/or allied navies during a ten-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 Pre-Deployment Training Program

The Marine Corps Pre-Deployment Training Program (PTP) is a training and certification process used to prepare a Marine Expeditionary Unit (MEU) for combat operations in conjunction with an Expeditionary Strike Group (ESG) FRTP. The PTP is broken down into three phases: a unit level or basic phase designed to establish individual unit and staff skills; an integrated or intermediate phase designed to build and foster ESG/MEU integration and certify advanced skills; and a sustainment phase that provides pre-overseas movement time. The PTP prepares and certifies an MEU for major combat operations and other assigned missions upon satisfactory completion to prescribed standards of designated tasks under the Navy Mission Essential Task List and established Marine Corps requirements (Navy/Marine Corps Instruction: COMSECONDFLT INSTRUCTION 3502.1/ CG II MEF INSTRUCTION 3502.1).

1.2.1.5 Range Complexes

Training must be as realistic as possible in order to provide the experiences important to success and survival. 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 Navy Cherry Point Range Complex, is a set of co-located areas of sea space, undersea space, land ranges and overlying airspace designated for military training and testing operations. No single range complex on the east coast can accommodate the entire spectrum of Navy and Marine Corps training and testing (see Figure 1.1-2). Individual East Coast range complexes serve as "backyard" ranges, supporting Naval forces home based and home ported in multiple locations. Also, the combined capabilities of the VACAPES, Navy Cherry Point, and Jacksonville range complexes are required to support the multiple aspects of integrated, major training events. The result is a system of range complexes, which provides a robust training and testing capability for all naval warfare missions. 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 undersea 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 prepares 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 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 training areas (such as the Navy Cherry Point 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 SUA that support the FRTP.

The TAP program represents the first time the Navy has managed its training areas on a broad, complex-wide basis. One element of the TAP Program is the development of the Required Capabilities Document (RCD) (DoN, 2006a), and a companion document, the Range Complex Management Plan (RCMP) (DoN, 2006b). Another TAP Program element is environmental planning documentation (*e.g.*, this EIS/OEIS), which will assess the potential for environmental impacts associated with certain activities/actions conducted within a range complex. These documents are described below.

The purpose of the RCD is to quantitatively define range complex capabilities required to support Navy mission-essential training in an unconstrained environment over a 10-year planning horizon. The RCD lists range attributes needed to support the eight Navy Primary Mission Areas at three training levels (Basic, Intermediate and Advanced). 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, Undersea 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. Three categories:

  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 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).[3]

The Navy has developed an RCMP for each range complex, including the Navy Cherry Point Range Complex. 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 the requirements needed to support warfare areas of individual range complexes. The Final Draft RCMP for the Cherry Point/Camp Lejeune Range Complex, which includes the Navy Cherry Point Range Complex, was completed in 2006 (DoN, 2006b). The RCMP iterates the strategic vision for the Navy Cherry Point Range Complex, which is to provide sustainable and modernized ocean operating areas, airspace, 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 Navy Cherry Point Range Complex include providing training opportunities for all eight naval warfare mission areas: Strike Warfare, Air Warfare, Amphibious Warfare, Surface Warfare, Anti-submarine Warfare, Mine Warfare, Electronic Combat, and Naval Special Warfare at varying levels of training complexity. RDT&E is conducted in the Navy Cherry Point Range Complex on new aircraft and weapons that are designed to support each of these six naval warfare missions.

When compared to the Complex's required capabilities, the Cherry Point/Camp Lejeune Range Complex RCMP (DoN, 2006b) identifies moderate to severe capabilities shortfalls in several warfare mission areas, especially for intermediate and advanced level training. In an attempt to remedy the identified shortfalls, the Cherry Point/Camp Lejeune RCMP makes recommendations for range enhancements, some of which may have an impact on the environment. Those recommended range enhancements that have been identified since the development of the RCMP, as well as current and future training operations that have the potential to impact the at-sea environment, are the primary focus of this EIS/OEIS, and are further described in Chapter 2. Land-based operations and training conducted within the MCAS Cherry Point and MCB Camp Lejeune Range Complexes have been or are being addressed in separate environmental documents that are being prepared by these two Marine Corps installations.

1.3 PURPOSE AND NEED

The purpose for the proposed action is to:

- Achieve and maintain Fleet readiness using the Navy Cherry Point Range Complex to support and conduct current, emerging, and future training and RDT&E operations;
- Expand warfare missions supported by the Navy Cherry Point Range Complex; and

[3] A range complex may not provide capabilities for all primary mission areas. The Marine Corps has its own separate RCD that organizes training levels and mission areas differently than the Navy Ranges RCD, but training is conducted in essentially the same way and with a similar outcome.

- Upgrade and modernize existing range capabilities to enhance and sustain Navy and Marine Corps 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 Navy Cherry Point Range Complex furthers the Navy's execution of its Congressionally mandated roles and responsibilities under Title 10 U.S.C. Part 5062.

To implement this Congressional mandate, the Navy needs to:

- Maintain current levels of military readiness by training in the Navy Cherry Point Range Complex;
- Accommodate future increases in operational training tempo in the Navy Cherry Point Range Complex and support the rapid deployment of naval units or strike groups;
- Achieve and sustain readiness of ships and squadrons so the Navy and Marine Corps can quickly surge significant combat power in the event of a national crisis or contingency operation;
- Support the acquisition and implementation into the Fleet of advanced military technology. The Navy Cherry Point 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 Navy Cherry Point 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 will be evaluated in this EIS/OEIS. The assessed actions include:

- Increase use of contractor-operated aircraft flights that simulate enemy aircraft during training (Commercial Air Services Support for Fleet Opposition Forces and Electronic Warfare Threat Training);
- Increase Maritime Security (MS) training (MS surface strike group training);
- Support MH-60R/S helicopter warfare mission areas;
- Designate a littoral mine warfare training area for deploying temporary mineshapes in support of Strike Group mine warfare training during major exercises; and
- Upgrade the Mid-Atlantic Electronic Warfare Range (MAEWR).

1.4 OVERVIEW OF THE NAVY CHERRY POINT RANGE COMPLEX

1.4.1 Summary Description

The Navy Cherry Point Range Complex geographically encompasses offshore and near-shore OPAREAs, instrumented ranges, and SUA located on and adjacent to the east coast of the United States (Figure 1.1-1). The Study Area of this EIS/OEIS includes the area from the shoreline out to the 3 nm boundary of the OPAREA, as well as the OPAREA. The Study Area does not include the separate and distinct MCAS Cherry Point Range Complex and MCB Camp Lejeune Range Complex. Together, components of the Navy Cherry Point Range Complex encompass (DoN, 2006b):

- 18,966 nm^2 of SUA warning area;
- 18,617 nm^2 of offshore surface and subsurface OPAREA, of which 12,529 nm^2 is deep ocean with depths greater than 100 fathoms (600 feet).

The specific OPAREAs and airspace included in the Navy Cherry Point Range Complex addressed in this EIS/OEIS are identified in Table 1.4-1. The Navy Cherry Point Range Complex is a portion of the larger AFAST Study Area, depicted in Figure 1.1-2.

Table 1.4-1 Components of Navy Cherry Point Range Complex

Component Area	Description	Addressed in this EIS/OEIS?
OPAREAs – Surface Waters	Cherry Point OPAREA: Offshore surface operating area extending southeast along the coast seaward for 103 nm from 3 nm off the coast of North Carolina.	Yes
OPAREAs – Subsurface Waters	The subsurface operating area coterminous with the surface waters of the Cherry Point OPAREA, including two submarine transit lanes (Charlie and Delta).	Yes
Special Use Airspace (SUA)	Warning Area (W)–122: Off-shore SUA generally overlying the Cherry Point OPAREA, with dimensions of 185 nm (north-south) and 100 nm (east-west).	Yes
Instrumented Ranges	Cherry Point Tactical Aircrew Combat Training System (TACTS) Range: TACTS supports aircrew training and evaluation using a set of fixed instrumentation sites to form a specialized range known as the Cherry Point TACTS Range located in portions of Navy Cherry Point Range Complex and the MCAS Cherry Point Range Complex. Aircraft using the air grid over the OPAREA use the TACTS system. TACTS is supported by eight land-based towers.	The infrastructure will not be included in this EIS, however the operations that occur in the Navy Cherry Point Range Complex and use the TACTS Range are included.
	The Cherry Pt Large Area Tracking Range (LATR) system provides a capability very similar to TACTS. However, it is a Global Positioning System (GPS)-based system. Instrumented LATR participants must only be in connectivity with a single ground tower or another participant who can relay their information. Unlike TACTS, LATR instrumentation is available for surface participants as well as aircraft.	The LATR infrastructure will not be included in this EIS, however the operations that occur in the Navy Cherry Point Range Complex and use LATR are included.
	Tactical Combat Training System (TCTS) will replace both the TACTS and LATR systems. TCTS is the next generation system that utilizes GPS-based instrumentation for air and surface participants. It can communicate with a ground relay in order to provide real-time monitoring of events. Additionally, each participant records their own positional information as well as the positional information of any other participant within data link connectivity. This feature allows for replay of the events if participants are not in connectivity with a ground relay and live monitor.	The infrastructure will not be included in this EIS, however the operations that will occur in the Navy Cherry Point Range Complex and use the TCTS Range are included.
	Mid-Atlantic Electronic Warfare Range (MAEWR): Airspace overlying MCAS Cherry Point & MCB Camp Lejeune Range Complexes and northern portion of W-122. The range is defined by the reception area of a set of 30 fixed and mobile threat emitters located at Marine Corps Outlying Fields (MCOLF) Atlantic & Bogue, and BT-11, which simulate surface-to-air missiles, anti-aircraft artillery, and RF threats. Aircraft using the air grid over the OPAREA use the MAEWR system.	Yes

1.4.2 Mission of the Navy Cherry Point Range Complex

The mission of the Navy Cherry Point Range Complex is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support naval training requirements. Navy Cherry Point Range Complex is centrally located between the Atlantic Fleet concentration areas in Hampton Roads, Virginia and Jacksonville, Florida, and the Marine Forces Atlantic concentration areas in North Carolina. With its proximity to Onslow Beach, the only

Department of Navy beach large enough to accommodate an amphibious assault, and the premier electronic combat range on the east coast as well as several air-to-ground bombing ranges, it has been the primary venue for all levels of amphibious training and intermediate and advanced levels of CSG, ESG, and MEU training. Additionally, local Navy, Marine Corps and Air Force aircraft use W-122 and adjoining instrumented and bombing ranges for all manner of aviation unit level training. This EIS/OEIS considers impacts from Navy and Marine Corps range complex users, and other services' operations that are similar to typical naval training activities.

1.5 SCOPE AND CONTENT OF THE EIS/OEIS

The geographic scope of this EIS/OEIS (referred to from this point forward as the Study Area) includes the airspace; seaspace; and undersea space of the Navy Cherry Point OPAREA and Warning Areas, including the area from the mean high tide line, up to and extending seaward 3 nm to the OPAREA's north-western boundary. It does not include the separate and distinct MCAS Cherry Point and MCB Camp Lejeune Range Complexes, nor any land or inland ranges or their associated SUA, or water-based targets in the Pamlico Sound. Figure 1.5-1 depicts the Study Area for this EIS/OEIS, and Section 2.2 of this EIS/OEIS describes the training and RDT&E events that are addressed within the Study Area. It is important to note that this EIS/OEIS provides an evaluation of current and proposed emerging training and testing activities, force structure changes (to include new platforms, weapons systems, and mission areas), and associated enhancements as identified in the Cherry Point/Camp Lejeune RCMP (DoN, 2006b).

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. The Proclamation thus did not alter existing legal obligations under NEPA or other federal environmental statutes. As a matter of policy, however, the Department of the Navy has elected to apply NEPA to the 12 nm limit established by the Proclamation. Figure 1.1-1 depicts the 12 nm territorial sea established by Presidential Proclamation 5928 as it relates to the Cherry Point offshore areas. Impacts to these areas and those portions of the inner sea range within these boundaries are subjected to analysis under NEPA. Impacts in the areas that are outside U.S. Territorial Waters are analyzed using the procedures set out in EO 12114 and associated implementing regulations.

Even though the mean high tide line on the beach separates the scope of this EIS/OEIS from the scope of the USMC EAs, Navy and Marine Corps training cross this line. Naval Surface Fire Support (FIREX land) originating from ships in Onslow Bay was assessed in this EIS/OEIS, while the ordnance that is fired from these weapons will impact land being assessed by the MCB Camp Lejeune EA. Amphibious assaults and raids originating from the sea and its impacts to resources in the sea space are analyzed in this EIS/OEIS and any impacts on land by these training operations are assessed in the MCB Camp Lejeune EA. ESA Section 7 and MMPA compliance consultations by the Navy and the USMC overlap geographically to some degree in Onslow Bay. Please refer to Figure 2.2-2 in this EIS/OEIS. The USMC will initiate ESA Section 7 and MMPA compliance consultations to cover impacts in the N1 and BT-3 Impact Areas identified in Figure 2.2-2 due to USMC live-fire training which originates on shore. The N1 and BT-3 impact areas overlap to a certain extent the proposed Mine Warfare (MIW)

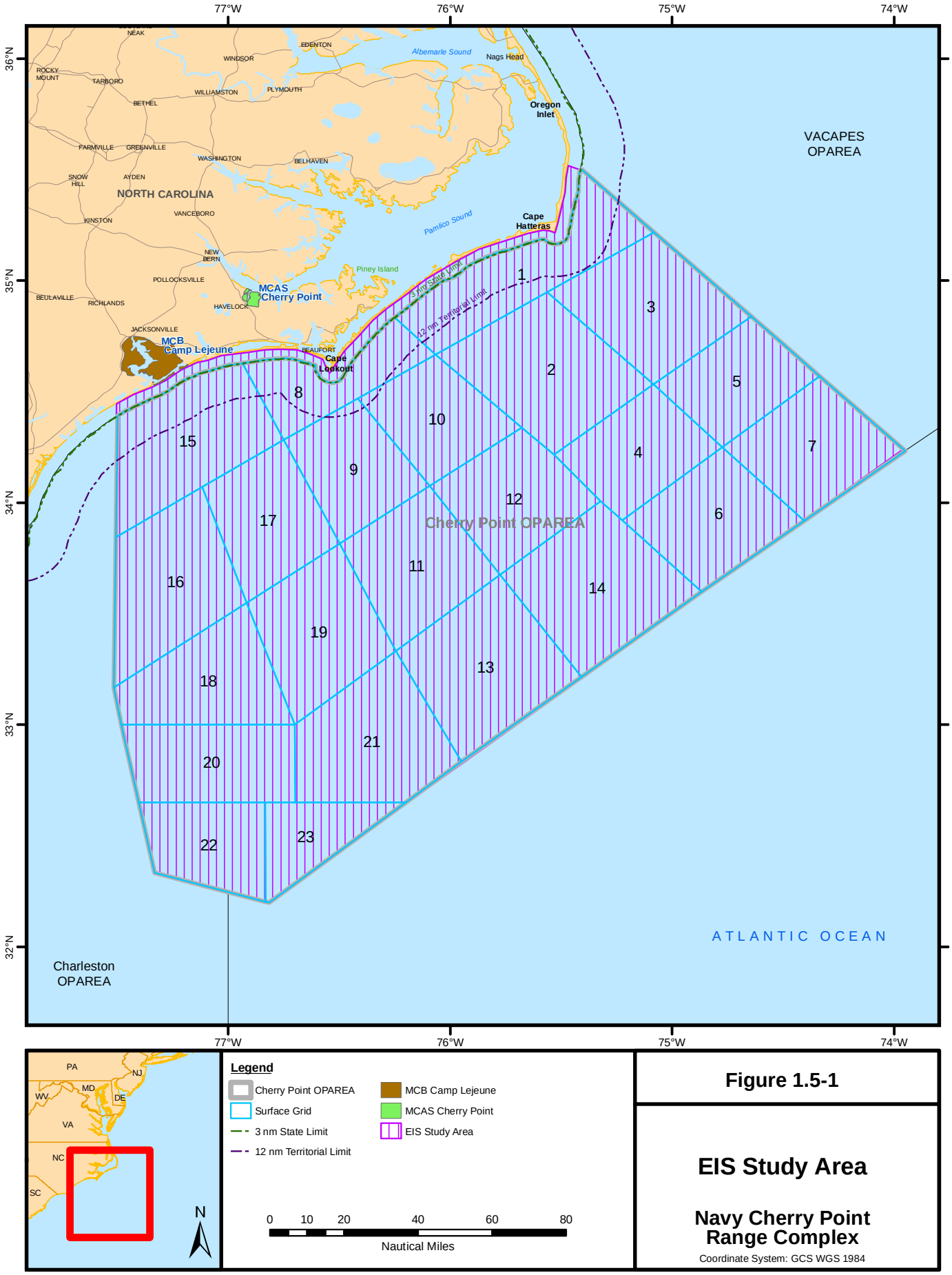

Figure 1.5-1

EIS Study Area

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

Training Area and UNDET Area identified in Figure 2.2-2 which are within this EIS/OEIS Study Area. The Navy's consultation with NMFS under ESA Section 7 and the MMPA will address Navy training in the Mine Warfare (MIW) Training Area and the UNDET Area, plus amphibious Navy assaults and raids in the water. Impacts identified in the USMC EAs are added to the cumulative impacts discussion of all other past, present, and foreseeable future actions in Chapter 6 of this EIS/OEIS.

The Navy and Marine Corps use each other's training areas and conduct integrated training as described in Tables 2.2-1 and 2.2-2 during Expeditionary Strike Group (ESG) Strike Composite Training Unit Exercise (COMPTUEX), Joint Task Force Exercise (JTFEX), amphibious assault and amphibious raid in the three adjoining range complexes of Navy Cherry Point, MCAS Cherry Point and MCB Camp Lejeune. However, the majority of the Marine Corps training that occurs in the three adjoining range complexes of Navy Cherry Point, MCAS Cherry Point and MCB Camp Lejeune is conducted independently and not in conjunction with the Navy. Despite the integrated training of the Navy and Marine Corps described above, the functions, structure, management and use of the three range complexes are sufficiently distinct that the Navy and Marine Corps analyzed potential environmental effects of their combined training activities in three separate documents. Each service prepares environmental documentation for the Range Complexes over which it has cognizance:

- Navy Cherry Point Range Complex EIS/OEIS (this document) considers training activities in the sea space and undersea space of Cherry Point Operating Area (OPAREA); overlying Special Use Airspace (SUA) of Warning Area 122; and the 3nm-wide coastal strip from the mean high tide line, up to and extending seaward to the north-western OPAREA boundary (see Figure 1.1-1). The Navy is the Action Proponent.
- MCAS Cherry Point Range Operations EA considered training activities on the air station; its outlying and auxiliary landing fields; its two impact areas of Bombing Target (BT) 11 and BT-9 in Pamlico Sound; and overlying SUA (see Figure 1.1-1). Section 1.7.1 describes the status of the analysis in more detail. The Marine Corps is the Action Proponent for the MCAS Cherry Point Range Operations EA.
- MCB Camp Lejeune Range Operations EA considered training activities on the installation's many ranges and impact areas, some of which extend into the Cherry Point OPAREA (e.g. N-1/BT-3), and overlying SUA (see Figure 1.1-1). Section 1.7.1 describes the status of the analysis in more detail. The Marine Corps is the Action Proponent for the MCB Camp Lejeune Range Operations EA.

In general, Navy training activities that occur at MCAS Cherry Point and MCB Camp Lejeune are similar to ongoing Marine Corps training.

Navy training activities at the MCAS Cherry Point Range Complex, occurring within the BT-9/BT-11 and R-5306A airspace, include the following:

- Air-to-surface and air-to-ground bombing and gunnery by Navy strike fighters;
- Air-to-surface and air-to-ground gunnery, and combat search and rescue training by Navy helicopters;
- Navy Special Warfare training, including insertion/extraction, direct action, target illumination, and small boat operations, including live fire training;
- Electronic combat activities for both helicopter and fixed wing aircraft;
- Air-to-surface missile exercises at targets in BT-9; and
- Small boats firing .50 caliber machine guns at targets on BT-11.

Navy training activities at MCB Camp Lejeune Range Complex include the following:

- Amphibious warfare training at Onslow Beach, typically involving up to eight Navy landing craft transporting Marine personnel, artillery, armor and supporting equipment from the amphibious ships in Onslow Bay to the beach;
- Riverine training on the New River and Intra-coastal Waterway, occasionally involving small boats conducting live fire at shore targets;
- Naval Surface Fire Support training involving Navy cruisers and destroyers firing live rounds from their main battery guns into the G-10 Impact Area;
- Other training including use by Navy personnel of the many firing ranges, special warfare activities, and close air support by Navy fixed wing aircraft; and
- Air-to-surface missile exercises at targets on Brown's Island in the BT-3 Impact Area.

Chapter 6, Cumulative Impacts, of this EIS/OEIS includes relevant analyses from both Marine Corps EAs. Examples of topics discussed in the EAs that are relevant to the Navy Cherry Point Final EIS/OEIS include the following:

- Training activities that occur on both land and sea. For example, amphibious assaults and raids typically begin with service members and materiel moving from amphibious assault ships in Onslow Bay in helicopters, landing craft or amphibians, to Onslow Beach, then moving inland. Another example is Navy and Marine Corps aircraft launching from ships at sea and bombing or strafing targets on shore.
- Training areas and instrumentation that overlap geographically. An example of such overlap occurs within the BT-3 for which the firing point is on land or the Intra-Coastal Waterway, and the ordnance could impact offshore. The Mid-Atlantic Electronic Warfare Range threat emitters are examples of instrumentation reception areas that overlap in that aircraft over land and over the OPAREA can use the systems.
- Mobile environmental resources that occur within different portions of the range complex during different portions of their life cycle. For example, adult sea turtles nest on Onslow Beach while subadults frequent the inshore waters, and dolphins that swim both at sea and in inshore waters. Additionally training impacts, such as noise and air emissions, have the potential to cross geographic boundaries.

The Navy and Marine Corps coordinated their public outreach efforts to ensure the public had access to clear, accurate information about all three environmental planning efforts. The Marine Corps, with Navy representation, hosted four public information meetings at venues near MCAS Cherry Point and MCB Camp Lejeune in June 2008. The USMC held two additional public information meetings specific to the Cherry Point EA on 6 and 7 October 2008. The Navy, with Marine Corps representation, held public meetings on 14 and 15 October 2008 in Beaufort and Wilmington NC, respectively, to provide information about the Navy Cherry Point Range Complex Final EIS/OEIS.

1.5.1 MCAS Cherry Point Range Complex Environmental Assessment and Associated Navy Operations

Marine Corps Air Station (MCAS) Cherry Point prepared an Environmental Assessment (EA) to evaluate the potential environmental consequences from current and emerging training operations at the MCAS Cherry Point Range Complex.

Training operations analyzed in this EA did not include combat operations, operations in direct support of combat, or other activities conducted primarily for purposes other than training. Under the preferred alternative, the types of training operations at the MCAS Cherry Point Range Complex would remain essentially the same. The level of training, however, would increase from the current level. Under the preferred alternative, there would be a 10-20 percent increase in small arms range activities (at MCAS Cherry Point main station) and additional training increases in sortie operations and munitions usage

associated with rotary-wing aircraft (AH-1, CH-53, and UH-1) squadrons. A water restricted area at Bombing Target (BT-) 11 for intermittent use in support of a proposed change in small arms live-fire training would be established.

The primary mission of MCAS Cherry Point is to provide a combat-ready aviation element that includes the training and support of aircrews, combat engineers, and aviation control group personnel. MCAS Cherry Point has fulfilled this mission since 1942 by providing coastal, inland, and airspace training areas, which together support the combat readiness of Marine Corps, Navy, and other operational forces. The MCAS Cherry Point Range Complex supports air combat, ground combat, and combat service support elements at varying levels of training complexity. The tempo of training operations fluctuates during times of conflict and declared war.

The purpose and need for the proposed action is for the Marine Corps to meet its statutory responsibility to organize, train, equip, and maintain combat-ready Marine Forces at MCAS Cherry Point. The activities analyzed in the EA include: air combat training in restricted airspace, such as air-to-ground weapons delivery and electronic warfare; land-based training, such as convoy escort operations and weapons firing on ranges; water-based training occurring on the Pamlico Sound at Bombing Target (BT-) 9 and BT-11, such as small boat operations; and integrated training activities involving tactical vehicles and aircraft, such as forward arming and refueling exercises. The EA considered the potential environmental impacts associated with the current training tempo and proposed increases in the training tempo. Increasing the operational training tempo would address pre-deployment training schedules for emerging missions and foreseeable increases in the number of military personnel training at MCAS Cherry Point. The environmental impacts of the total influx of personnel that are expected at MCAS Cherry Point in the coming years in relation to achieving a balanced growth in capability throughout the Marine Corps are being analyzed in a separate document (Environmental Impact Statement, USMC Grow the Force at Marine Corps Base Camp Lejeune, MCAS New River, and MCAS Cherry Point, North Carolina; and discussed in chapter 6 on cumulative impacts of this EIS/OEIS for more details).

The scope of the EA does not include airfield operations at the main station or MCAS Cherry Point's outlying landing fields because the potential environmental impacts of these operations have been studied in previous documents (refer to the EA for documentation). The scope of the EA also does not include combat operations, operations in direct support of combat, or other activities conducted primarily for purposes other than training.

MCAS Cherry Point is located in eastern North Carolina, approximately 32.2 kilometers (km) (20 miles [mi]) southeast of New Bern and 161 km (100 mi) northeast of Wilmington. Region of influence (or study area as referred to in this EIS/OEIS) is defined as the geographical region that may be affected in some way by the proposed action alternatives. The region of influence analyzed in the EA for potential environmental consequences encompasses assets within the MCAS Cherry Point Range Complex: MCAS Cherry Point Main Station; BT-9 and its existing danger zone (water) (water prohibited area); BT-11 and its existing water restricted areas and danger zone (water) (water prohibited area); special use airspaces R-5306A and R-5306C; Marine Corps Outlying Landing Field (MCOLF) Atlantic; and Marine Corps Auxiliary Landing Field (MCALF) Bogue.

Marine Corps training proceeds on a continuum, from teaching of basic and specialized individual military skills, to intermediate skills or small unit training, to advanced, integrated training events, culminating in joint exercises or pre-deployment certification events. Each step on this continuum is assessed for effectiveness on an ongoing basis, as new systems, tactics, techniques, and procedures are developed and implemented.

The Joint Chiefs of Staff determine the deployment of Marine Corps forces, including those that train at the MCAS Cherry Point Range Complex, based on worldwide requirements and commitments. As a result, deployment schedules are not fixed, but are flexible, often changing to meet the Nation's security

needs. The support necessary to conduct required pre-deployment training, particularly training range support, must therefore be available when and as needed.

Marine Corps, Naval Special Warfare, or Naval Expeditionary Combat Command Personnel with Small Arms Weapons Training at MCAS Cherry Point

Marine Corps, Naval Special Warfare, or Navy Expeditionary Combat Command units use combat tactics, such as advanced, offensive raid and close-quarters battle techniques, appropriate for seizing and securing an opposing force's airfield in order to make it available for follow-on friendly force use. The operation consists of a raid/seizure force coming from over the horizon and assaulting across an opposing force territory in a combination of rotary- and/or fixed-wing Close Air Support aircraft. The battle techniques applied must move the friendly force through a hostile environment where noncombatants are, or may be, present and where collateral damage must be kept to a minimum in order to be able to use the airfield facilities after they have been seized.

Munitions used during this operation include live, simulated, or blank 5.56 mm, 7.62 mm, 9 mm, and 12-gauge small arms, 40 mm grenades, and breaching explosive charges. Blanks from organizational equipment or "paint ball" type weapons are typically employed over different portions of the training scenario, which is usually especially tailored for a possible real world scenario.

Water Ranges Training Activities, Surface-to-Surface Gunnery Exercises at MCAS Cherry Point

A small boat, typically operated by Special Boat Team personnel, uses a machine gun to attack and disable or destroy a surface target that simulates another ship, boat, swimmer, floating mine or near shore land targets.

A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most often used by Naval Special Warfare teams, Navy Expeditionary Combat Command units (Naval Coastal Warfare, Inshore Boat Units, Mobile Security Detachments, Explosive Ordnance Disposal, and Riverine Forces), and US Coast Guard units. These units have missions to protect ships in harbors and high value units, such as aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, insertions and extractions, and various Naval Special Warfare operations. The boats used by these units include: Small Unit River Craft, Combat Rubber Raiding Craft, Rigid Hull Inflatable Boats, Patrol Craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.

1.5.2 MCB Camp Lejeune Range Complex Environmental Assessment and Associated Navy Operations

MCB Camp Lejeune prepared an Environmental Assessment (EA) to evaluate the potential environmental consequences from current and emerging training operations at the MCB Camp Lejeune Range Complex.

Training operations analyzed in this EA did not include combat operations, operations in direct support of combat, or other activities conducted primarily for purposes other than training. The preferred alternative includes the following: a 20 percent increase in small arms training, except .50 caliber arms; an increase in rotary-wing (helicopter) operations, including a 33 percent increase in CH-53 sorties and a 100 percent increase in AH-1 and UH-1 sorties; a 10 percent increase in training with MK-19 40-mm grenade rounds; a 5 percent increase in training with artillery, mortar, and other large arms; a 39 percent increase in training with tank rounds; and a 33 percent increase in tactical vehicle operations.

The primary mission of MCB Camp Lejeune is to sustain combat ready units for expeditionary deployments. MCB Camp Lejeune has fulfilled this mission since 1941 by providing ocean, coastal, riverine, inland, and airspace training areas, which together support the combat readiness of Marine

Corps and Navy operational forces. The MCB Camp Lejeune Range Complex supports ground combat, air combat, and combat service support elements at varying levels of training complexity. The tempo of training operations fluctuates during times of conflict and declared war.

The purpose and need for the proposed action is for the Marine Corps to meet its statutory responsibility to organize, train, equip, and maintain combat-ready Marine Forces at MCB Camp Lejeune. The activities analyzed in the MCB Camp Lejeune Range Complex EA include: land-based training, such as infantry ground maneuvers and weapons firing on ranges; water-based training, such as amphibious vehicle operations on the New River, Atlantic Intracoastal Waterway, and Onslow Bay, and air combat training in special use airspace. The EA provides a detailed look at the potential environmental impacts associated with the current training tempo and proposed increases in the training tempo at existing ranges. Increasing the operational training tempo would address pre-deployment training schedules for emerging missions and foreseeable increases in the number of military personnel training at MCB Camp Lejeune. The environmental impacts of the total influx of personnel that are expected at MCB Camp Lejeune in the coming years in relation to achieving a balanced growth in capability throughout the Marine Corps are being analyzed in a separate document (Environmental Impact Statement, US Marine Corps Grow the Force at MCB Camp Lejeune, MCAS New River, and MCAS Cherry Point, NC) and discussed in chapter 6 on cumulative impacts of this EIS/OEIS.

MCB Camp Lejeune is located along the southern coast of eastern North Carolina adjacent to the City of Jacksonville, with 20.4 kilometers (km), (11 nautical miles [nm]) of Atlantic Ocean coastline. The potential environmental consequences in this EA was evaluated for training operations conducted in land ranges, water ranges, and special use airspace in the MCB Camp Lejeune Range Complex.

MCB Camp Lejeune is the largest Marine Corps Base on the east coast. Its ranges, training areas, and airspace provide a safe and realistic training environment to ensure military personnel are ready to defend the nation. In addition to the Marine Corps and Navy, many other services and agencies train at the MCB Camp Lejeune Range Complex: Army, Air Force, Coast Guard, foreign military services, state wildlife resource officers, and law enforcement personnel from federal, state and local agencies. The EA addresses training operations conducted by all services and agencies within the MCB Camp Lejeune Range Complex.

Munitions Firing Activities on Water Ranges at MCB Camp Lejeune

Munitions firing on water ranges and training areas includes the following two different training scenarios:

- Surface-to-Ground - Firing conducted from ships (indirect fire) at sea and boats (direct fire) in the river and near shore areas against targets within impact areas on the ground. Navy Cruisers and Guided Missile Destroyers use 5-inch guns with high explosive or nonexplosive practice munitions. Ships will typically fire while moving very slowly.
- Surface-to-Surface - Firing conducted from boats and amphibious vehicles at sea to targets at Sea. Small boats will typically use .50 caliber, 7.62 mm, 5.56 mm ball ammunition or blanks, and 40 mm training practice grenades. Small boats may fire while stationary or at speeds from 5 to 10 knots.

Munitions Firing Locations from Water Ranges at MCB Camp Lejeune

The firing of munitions takes place primarily from the prohibited area, located in the Atlantic Ocean's Onslow Bay, which surrounds the BT-3 Impact Area. Blanks are fired from water restricted areas, which are present in: New River, Atlantic Intracoastal Waterway, and Atlantic Coast. The New River prohibited area is further separated into sectors. Further detail on MCB Camp Lejeune prohibited areas and water restricted areas can be found in Appendix B of the EA.

There are currently about 50 training operations per year requiring closure of the Atlantic Intracoastal Waterway water restricted area for about 110 one-hour periods and US Coast Guard and Navy operations that involve 40 one-hour period Atlantic Intracoastal Waterway closures.

1.6 THE ENVIRONMENTAL REVIEW PROCESS

1.6.1 NEPA

In 1969, Congress enacted NEPA, which requires consideration of environmental issues in federal agency planning and decision-making. Regulations for federal agency implementation of the act were established by the President's Council on Environmental Quality.

NEPA requires federal agencies to prepare an EIS for proposed actions that may significantly affect the quality of the human and natural environments or where the impacts are largely unknown or controversial. 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 this proposed action. The National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) is a cooperating agency for this EIS/OEIS. A copy of the Cooperating Agency Agreement is provided in Appendix A.

The first step in the NEPA process is the preparation of a notice of intent (NOI) to develop the Draft EIS (DEIS). The NOI provides an overview of the proposed project and the scope of the EIS. The NOI for this project was published in the *Federal Register* on April 30, 2007 and in five local newspapers. A copy of the NOI is provided in Appendix B. The newspaper notices ran five times in each newspaper. The notice included Navy Point of Contact (POC) information, a list of information repositories, the project website address (www.NavyCherryPointRangeComplexEIS.com), a request for public comments, and the dates and locations of the scoping meetings.

The following North Carolina regional newspapers were used to publish the NOI and scoping meeting locations:

Jacksonville Daily News

Havelock Times

Carteret County News-Times

New Bern Sun Journal

Wilmington Star News

Scoping is an early and open process for developing the "scope" of issues to be addressed in the EIS and for identifying significant issues related to a proposed action. The scoping process for this EIS was initiated by the publication of the NOI in both the *Federal Register* and local newspapers. During scoping, the public helps define and prioritize issues and convey these issues to the agency through both oral and written comments.

Scoping meetings were held in two locations, as follows:

Meeting Dates	Meeting Locations
May 16, 2007	West Carteret High School, 4700 Country Club Rd., Morehead City, NC 28557
May 17, 2007	New Hanover High School, 1307 Market St., Wilmington, NC 28401

During the scoping process, 14 comments were received; 13 from government agencies at various levels and one from an individual. Commenters raised concerns about impacts on fish and fishing, harm to

cultural resources, marine protected areas and oyster reefs, endangered species, and potential conflicts between boating or shipping and Navy activities. The majority of these comments are either addressed in Chapter 2 and Appendix D by defining Navy operations that occur within the Study Area, or in Chapter 3 by addressing the stressors on the various biological resources that occur in the Study Area. Comments regarding sonar training are evaluated in the AFAST EIS/OEIS unless activities are specific to the Cherry Point OPAREA and then evaluated in this document.

After scoping, a Draft EIS/OEIS was prepared to provide an assessment of the potential impacts of the proposed action and alternatives on the environment. The DEIS/OEIS was then provided to the U.S. Environmental Protection Agency for review and comment in accordance with its responsibilities and to have a Notice of Availability (NOA) published in the *Federal Register* (Appendix B). The Navy also placed notices in the aforementioned newspapers announcing the availability of the DEIS/OEIS. The DEIS/OEIS was circulated for internal review and comment, and notices of availability sent to many federal, state and local officials (DEIS distribution list is presented in Chapter 10). The DEIS was made available for general review in public libraries; the public comment period for the DEIS ended October 27, 2008. In addition, public meetings were held to accept public comments at the following locations.

Meeting Dates	Meeting Locations
October 14, 2008	Maritime Museum, 315 Front Street, Beaufort, North Carolina
October 15, 2008	Best Western Inn and Convention Center, 503 Nutt Street, Wilmington, North Carolina

These locations were also identified in the NOA and Public Hearing Notice published in the *Federal Register*. Copies of Agency Correspondence are provided in Appendix C; a copy of the NOA is provided in Appendix B. Transcripts of the public hearings are in Appendix L.

Twenty-nine Federal, State, non-governmental organizations and private entities provided comments on the DEIS/OEIS. A variety of issues were raised regarding mitigation measures, stressors on biological resources, and concerns of potential impacts from expended materials. Several comments requested additional time to review the DEIS/OEIS. Appendix F contains a list of all the comments as well as brief Navy responses. Navy responses to comments are included in the appendix and where appropriate referred to sections of the FEIS/OEIS that included additional information or clarifications.

The Final EIS (FEIS)/OEIS incorporates, and formally responds to, all public comments received on the DEIS (see Appendix F). During the public review process for the Draft EIS/OEIS, 86 comments were received; 15 from federal agencies, 30 from state agencies, 29 from organizations and 12 from individuals. 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. 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. There were additional revisions, which are reflected in this Final EIS/OEIS, that were made to amplify information previously provided. These changes included a more detailed description of Maritime Security Operations, more detailed Weapon System data sheets located in Appendix E, and clarification of the deployment and recovery of non-explosive mineshapes in Onslow Bay. The Notice of Availability of this Final EIS/OEIS was published in the *Federal Register*, in various newspapers, and on the project website. The Final EIS/OEIS will be made available during a 30-day wait 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 EO 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 this document. Several documents address actions that are applicable to this proposed action for the Navy Cherry Point Range Complex. The following paragraphs provide brief descriptions of the documents incorporated by reference in this EIS/OEIS.

ESA Section 7 Consultation on Use of the N-1 Impact Area and Browns Island Target and Bombing Area BT-3 at Marine Corps Base Camp Lejeune, North Carolina (November 1982). This consultation addresses concerns relative to live-firing into offshore areas in the aforementioned training locations. Methods are in place to avoid the loss of endangered/threatened sea turtles and whales. Base range regulations restrict firing at any endangered/threatened animals in the subject area. Observation towers are manned on Onslow Beach and along the Intracoastal Waterway when live-firing is being conducted. It was determined that the subject activity would not adversely affect populations of endangered/threatened species in the target locations.

ESA Section 7 Consultation on Current Use and Modification of Training Areas, Dune Stabilization, and Continued Recreational Use of Onslow Beach, Marine Corps Base (MCB), Camp Lejeune (May 2002). NMFS issued this BO (NMFS, 2002) based on the Navy BA (DoN, 2002b) that evaluated the potential of the proposed ground-based training that would take place as part of a major Atlantic Fleet training exercise to significantly impact threatened or endangered species. The Service's biological opinion was that the project, as described, is not likely to jeopardize the continued existence of seabeach amaranth, loggerhead and green sea turtles, and the piping plover.

ESA Section 7 Consultation on Ongoing Ordnance Delivery at Marine Corps Air Station Cherry Point Bombing Target 9 and Bombing Target 11 in Pamlico Sound, North Carolina (March 2002). NMFS issued this BO based on the USMC BA (USMC, March 2002) for the ongoing delivery of ordnance at BT-9 and BT-11 and agreed to a 10 year life-span for the BO. A comprehensive review of the activities to be conducted by MCAS Cherry Point, North Carolina was conducted to analyze their effects on loggerhead turtles, Kemp's ridley turtles, green turtles, and leatherback turtles. The BO concludes that the proposed action is not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, green, or leatherback sea turtles. However, NMFS anticipates incidental take of these species and

issued an Incidental Take Statement (ITS) pursuant to Section 7 of the ESA. The ITS contains reasonable and prudent measures with implementing terms and conditions to help minimize this take.

OEA: Programmatic OEA for Sinking Exercises (SINKEX) in the Western Atlantic Ocean (December 2006). This OEA (DoN, 2006c) provides environmental impact analysis for sinking exercises conducted in the western Atlantic Ocean. The purpose of the SINKEX program is to train personnel, test weapons, and study the survivability of ship structures. SINKEX's are conducted at least 50 nm from the U.S. coastline and in a depth of at least 2000 meters. With the protective measures implemented, the OEA concluded that proposed action would cause no significant or long-term adverse impacts to the marine environment. The OEA found that no harassment, as defined under the Marine Mammal Protection Act, would result from the proposed action. It also concluded the proposed action would not result in impacts to National Marine Sanctuaries or Marine Protected Areas, and no adverse effect on Essential Fish Habitat.

ESA Section 7 Consultation for Sinking Exercises (SINKEX) in the Western Atlantic Ocean (September 2006). NMFS issued a BO (NMFS, 2006) based on the Navy BA (DoN, 2006d) that evaluated the potential of the SINKEX to affect the following listed species: North Atlantic right whale, humpback whale, blue whale, fin whale, sei whale, sperm whale, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, and green sea turtle. The BO concluded that proposed SINKEX events are not likely to adversely affect threatened and endangered species or their critical habitat.

Marine Corps Base Camp Lejeune Environmental Assessment. The Marine Corps prepared an EA (DoN, 2009a) on current and future training operations at training facilities, ranges, air and ground maneuver areas, and waters within and adjacent to MCB Camp Lejeune including one offshore range (N1/BT-3). The preferred alternative includes the following: a 20 percent increase in small arms training, except .50 caliber arms; an increase in rotary-wing (helicopter) operations, including a 33 percent increase in CH-53 sorties and a 100 percent increase in AH-1 and UH-1 sorties; a 10 percent increase in training with MK-19 40-mm grenade rounds; a 5 percent increase in training with artillery, mortar, and other large arms; a 39 percent increase in training with tank rounds; and a 33 percent increase in tactical vehicle operations. Section 4.1.6.3 of this USMC EA acknowledges that MCB Camp Lejeune has previous consultations and previous authorized take for threatened and endangered species for the current military training activities that occur aboard this installation. The management of nesting sea turtles and piping plover are covered by a May 2002 USF&WS Biological Opinion. The management of the red cockaded woodpecker is covered in an October 2006 USF&WS Biological Opinion. All T&E species are addressed in the base Integrated Natural Resources Management Plan.

Marine Corps Air Station Cherry Point Environmental Assessment. The Marine Corps prepared an EA (DoN, 2009b) on current and future training operations at training facilities, ranges, air and ground maneuver areas, and waters within and adjacent to MCAS Cherry Point Range. The preferred alternative includes an increase in .50 caliber weapons firing from helicopters and small boats that would occur within a new, intermittent water restricted area, which currently has commercial, recreational, and state sponsored fisheries activities as discussed in this USMC EA in section 2.2.2.3 and described in Figure 2-4. This new, intermittent water restricted area, will not be implemented until a modification of the existing water surface danger zone at BT-11 is approved by the U.S. Army Corps of Engineers which requires a separate administrative procedure and notice to the public through the Federal Register to modify the existing Code of Federal Regulation. Federally listed threatened and endangered species under the authority of NMFS are currently covered under the Biological Opinion addressing ongoing Ordnance Delivery at Marine Corps Air Station Cherry Point Bombing Target 9 and Bombing Target 11 in Pamlico Sound, North Carolina (March 2002) described at the beginning of this section for current military training that occurs at this installation.

EIS/OEIS: Atlantic Fleet Active Sonar Training (AFAST). The Navy prepared an EIS/OEIS (DoN, 2009c) for the use of active sonar and other sources (see Table 3.19-1 of this 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 U.S. Navy training operations in the EIS/OEIS. In addition to incorporating the AFAST EIS/OEIS by reference, the Navy Cherry Point Range Complex EIS/OEIS includes a summary of effects from active sonar sources utilized in the Navy Cherry Point Range Complex based on the analysis of effects from the Final AFAST EIS/OEIS (see Section 3.19). *(Record of Decision January 23, 2009).*

1.7.2 Other Relevant Environmental Documents

The following environmental documents are relevant to the Navy Cherry Point Final EIS/OEIS because they are Environmental Impact Statements for the two adjacent Range Complexes – Jacksonville Range Complex and Virginia Capes Range Complex.

Final EIS/OEIS: Virginia Capes Range Complex: The EIS/OEIS (DoN, 2009d) assesses the potential environmental impacts over a 10-year planning horizon associated with Navy Atlantic Fleet training, research, development, testing, and evaluation activities, and associated range capabilities enhancements (including infrastructure improvements) in the Virginia Capes (VACAPES) Range Complex. The EIS/OEIS Study Area includes the VACAPES Operating Area and Warning Areas as well as portions of the lower Chesapeake Bay. 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 was a Cooperating Agency for this EIS/OEIS. (ROD expected in June 2009)

Final EIS/OEIS: Jacksonville Range Complex: The EIS/OEIS (DoN, 2009e) assesses the potential environmental impacts over a 10-year planning horizon associated with Navy Atlantic Fleet training, research, development, testing, and evaluation activities, and associated range capabilities enhancements (including infrastructure improvements) in the Jacksonville (JAX) Range Complex. The EIS/OEIS Study Area includes the JAX and Charleston Operating Areas and Warning Areas as well as Rodman Range and Lake George 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 was a Cooperating Agency for this EIS/OEIS. (ROD expected in June 2009)

The following document is in progress at this time and is relevant to Navy training and RDT&E in the Navy Cherry Point Study Area, but will not be completed by the time the Navy Cherry Point Range Complex EIS/OEIS is finalized.

EIS/OEIS: Undersea Warfare Training Range (USWTR). The Navy is preparing an EIS/OEIS that analyzes the potential impacts of installing and operating a USWTR along the east coast. The proposed action includes training involving the use of mid-frequency active sonar at the USWTR. Several sites along the east coast are under consideration for the USWTR, including a site within the Navy Cherry Point Range Complex OPAREA. The analyses in this document, as it pertains specifically to the Navy Cherry Point Range Complex will be included in Chapter 6, Cumulative Impacts of the Navy Cherry Point Range Complex EIS/OEIS. (*Record of Decision anticipated Summer/Fall 2009*).

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CHAPTER 2 :DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The Navy has identified the need to support and conduct current and emerging training and operations in the Navy Cherry Point Range Complex (see Chapter 1). This chapter provides detailed information on the proposed action and alternatives analyzed in the Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). Over a 10-year planning period the Navy proposes to implement actions within the Navy Cherry Point Range Complex to meet this need by:

- Maintaining baseline training and operations at current levels;
- Increasing training and operations from current levels as necessary to support the Fleet Response Training Plan (FRTP) and Pre-Deployment Training Program (PTP);
- Accommodating mission requirements associated with force structure changes including those resulting from the introduction of new aircraft and weapons systems; and
- Implementing enhanced range complex capabilities.

Navy training is governed by the FRTP. The FRTP sets a deployment cycle for the Strike Groups that includes three phases: (1) basic, intermediate, and advanced pre-deployment training and certification; (2) deployment; and (3) 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.

The Proposed Action does not indicate major changes to Navy Cherry Point 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 and the Marine Corps are 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 and Marine Corps mission.

This chapter is divided into two major subsections: Section 2.1 provides a detailed description of the Navy Cherry Point 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 NAVY CHERRY POINT RANGE COMPLEX EIS/OEIS STUDY AREA

The geographic scope of this EIS/OEIS (Study Area) includes Navy Cherry Point Range Complex (described in Table 2.1-1) and the 3 nm-wide strip of ocean from the shoreline (mean high tide line) to the Cherry Point OPAREA western boundary. It does not include the separate and distinct MCAS Cherry Point and MCB Camp Lejeune Range Complexes, nor any land or inland ranges or their associated SUA. Figure 1.5-1 depicts the Study Area for this EIS/OEIS.

2.1.1 Cherry Point OPAREA

The Cherry Point OPAREA is a set of operating and maneuver areas with defined ocean surface and subsurface operating areas described in Table 2.1-1.

Table 2.1-1 Navy Cherry Point Range Complex Description

Component	Description
Operating Areas (OPAREA)-Surface Waters	Cherry Point OPAREA within the Navy Cherry Point Range Complex has an area of 18,617 nm^2 extending from 3 nm to 120 nm from the shoreline. The OPAREA is subdivided into 23 areas (called a surface grid). These are used by Navy operators to communicate locations in which they will be located or where training will occur. Training in these areas includes surface gunnery, missile firing, bombing exercises, mine warfare, and amphibious operations. See Figure 2.1-1
Operating Areas - Subsurface Waters	The undersea space underlies and is coterminous with the surface space and includes 12,529 nm^2 of deep offshore waters in excess of 100 fathoms (600 feet). See Figure 2.1-1
Special Use Airspace (SUA)	Warning Area (W)–122 is 18,966 nm^2 of SUA overlaying the Cherry Point OPAREA from the surface to an unlimited altitude. Operations conducted in W-122 include all weather flight training, refueling, rocket and missile firing, bombing, fleet training, independent unit training, anti-submarine warfare, and air warfare, and surface gunnery. High explosive ordnance (up to 2,000-Lb. Net Explosive Weight) is permitted. See Figure 2.1-2
Instrumented Ranges	Mid-Atlantic Electronic Warfare Range (MAEWR): Airspace overlying MCAS Cherry Point and MCB Camp Lejeune Range Complexes and the northern portion of W-122. The range is defined by the reception area of a set of 30 fixed and mobile threat emitters located at Marine Corps Outlying Fields (MCOLF) Atlantic & Bogue, and BT-11, which simulate surface-to-air missiles, anti-aircraft artillery, and RF threats.

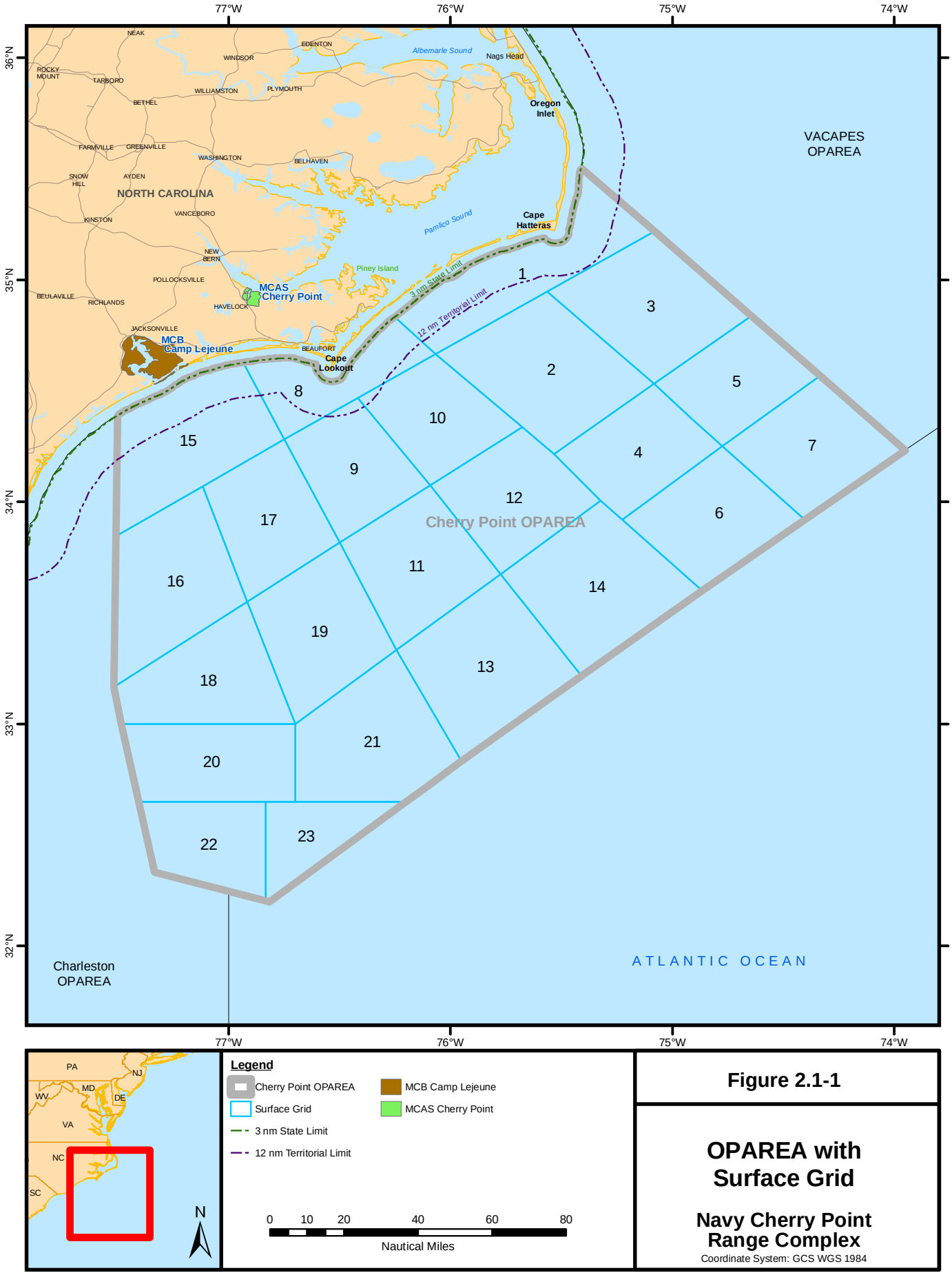
2.1.2 Special Use Airspace

Restricted Airspace and Warning Areas are components of SUA 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 on aircraft operations that are not part of those activities.

Restricted Airspace: The flight of non-military 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). No Restricted Airspace in the Navy Cherry Point Range Complex is considered in this EIS/OEIS.

Warning Areas: A warning area is airspace of defined dimensions, extending from 3 nm outward from the U.S. coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning area is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both. Warning area in the Navy Cherry Point Range Complex considered in this EIS/OEIS is W-122.



Legend

- Cherry Point OPAREA
- Surface Grid
- 3 nm State Limit
- 12 nm Territorial Limit
- MCB Camp Lejeune
- MCAS Cherry Point

0 10 20 40 60 80
Nautical Miles

Figure 2.1-1

OPAREA with Surface Grid

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

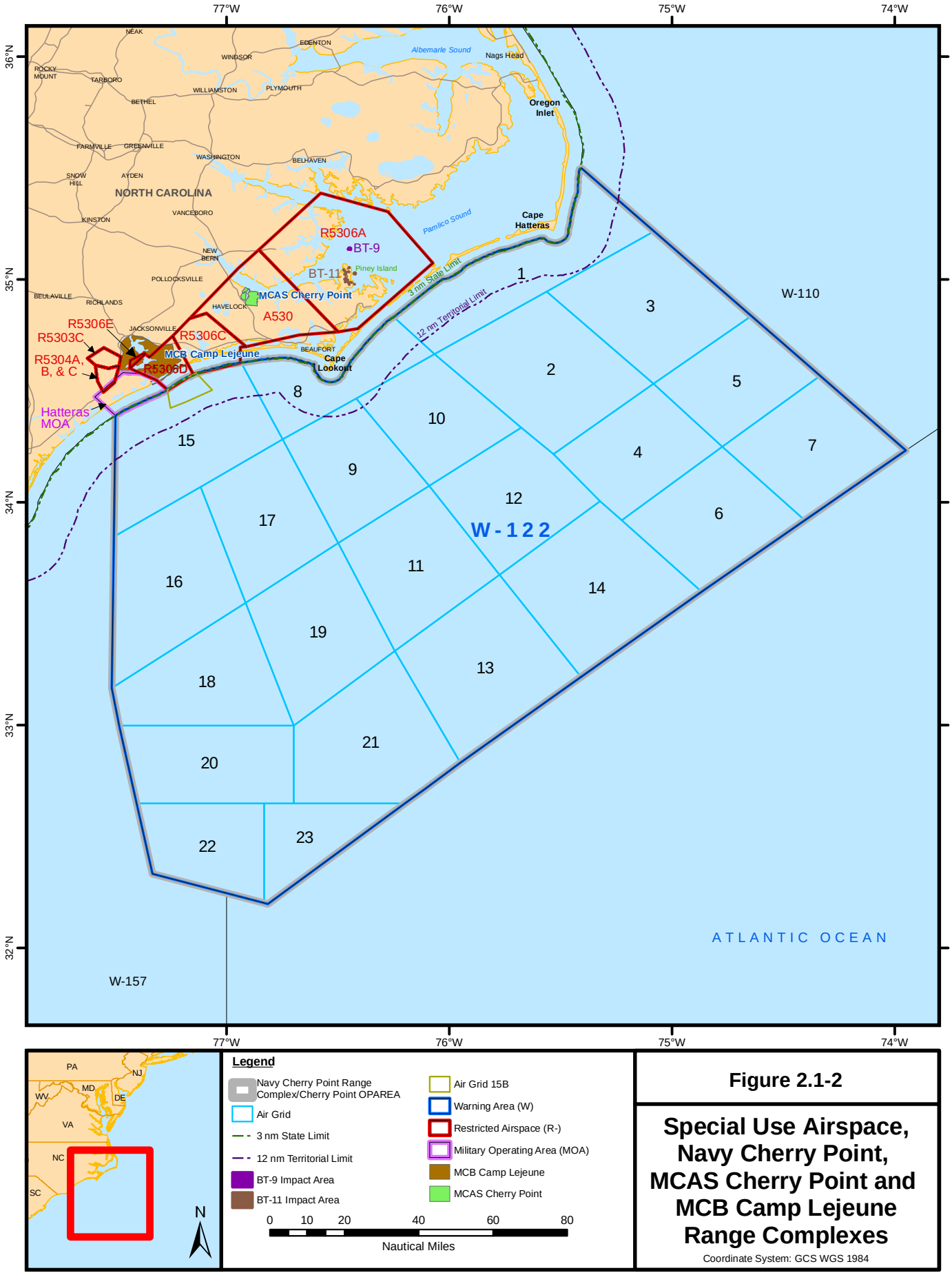


Figure 2.1-2

Special Use Airspace, Navy Cherry Point, MCAS Cherry Point and MCB Camp Lejeune Range Complexes

Coordinate System: GCS WGS 1984

2.2 PROPOSED ACTION AND ALTERNATIVES

The 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 the President's Council on Environmental Quality (CEQ) regulations (40 CFR §§ 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 if they are reasonable 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 emerging training and RDT&E operations in the Navy Cherry Point 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 Alternative 2 is selected, then:

- Increase or modify training and RDT&E operations from current levels in support of the Fleet Response Training Plan (FRTP) and the US Marine Corps Pre-deployment Training Program (PTP).
- Accommodate mission requirements associated with force structure changes, including those resulting from the introduction of new aircraft and weapons systems.
- Implement enhanced range complex capabilities.

The decision-maker for this FEIS/OEIS will decide both the level and mix of training and testing, and range capability enhancements, that best meet Navy and the Marine Corps requirements within the Navy Cherry Point Range Complex. The following sections discuss the alternatives with respect to the components that make up the Proposed Action.

2.2.2 Alternatives

This EIS/OEIS evaluated the alternatives to ensure they can all fulfill the purpose and need, namely to ensure the long-term viability of the Navy Cherry Point Range Complex to support fleet readiness per the Fleet Response Training Plan (FRTP), USMC's Pre-deployment Training Program (PTP) and within the Navy's Personnel Tempo of Operations (PERSTEMPO) guidelines[4].

The Navy Cherry Point Range Complex EIS/OEIS analyzed three alternatives:

- 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).

- Alternative 1 – No Action Alternative plus: increase operational training, plus changes in type and quantity of operations and tactical employment of forces to accommodate expanded mission areas, force structure changes[5] (including training resulting from the introduction of new platforms and weapon systems), and new range capabilities. This alternative is composed of all operations

[4] PERSTEMPO is defined by the Navy as time away from homeport, as tracked at the unit level.
[5] Force Structure Changes include changing weapon systems and platforms and homebasing new aircraft and ships.

currently conducted under the No Action Alternative, with modifications to current training or introduction of new training. These would include:

a) adjusting training levels to ensure that deployment can be stepped up quickly and at multiple locations in response to world events;
b) incorporating Maritime Security training into existing training events;
c) conducting surface-to-air missile training events;
d) conducting new or modified training associated with the introduction of the new MH-60 helicopter, and new organic mine countermeasure systems;
e) increasing use of commercial aircraft to displace Navy aircraft as oppositional forces for electronic combat, air intercept control, strike and close air support exercises, and as tow aircraft for air-to-air gunnery exercises; and
f) upgrading electronic combat capabilities.

- Alternative 2 – Includes all operations under Alternative 1 plus eliminating all high explosive at-sea BOMBEXs and designating two mine warfare training areas for major exercise mine training events.

2.2.3 No Action Alternative – Description of Current Training Operations within the Navy Cherry Point Range Complex

2.2.3.1 Baseline Training Operations

The No Action Alternative is required by regulations of the Council on Environmental Quality (CEQ) as a baseline against which the impacts of the Proposed Action are compared. For the purposes of this EIS/OEIS, the No Action Alternative serves as the baseline level of operations on the Navy Cherry Point Range Complex, representing the regular and historical level of training and testing activity necessary to maintain Navy readiness. Consequently, the No Action Alternative stands as no change from current levels of training and testing usage.

Training operations in the Navy Cherry Point Range Complex span from unit level exercises to integrated major range training events. The scope of operations consists of air combat maneuvers or ordnance delivery by a single aircraft to Joint Task Force Exercises (JTFEX), which may involve thousands of participants over a period of two weeks.

A general description of the training operations typically conducted on the Navy Cherry Point Range Complex is shown below in Table 2.2-1. Each military operation described in this EIS/OEIS meets a requirement established by the Navy's FRTP and/or Marine Corps' PTP. RDT&E events similar to training activities conducted in the Navy Cherry Point Range Complex are accounted for in the total events for each warfare area. Training or range enhancements discussed in the Range Complex Management Plan (DoN, 2006a) that do not involve environmental resources are not included in the analysis of this EIS/OEIS. 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.

Table 2.2-2 describes major exercises performed in the Navy Cherry Point Range Complex. All major warfare areas are performed in major exercises within the Navy Cherry Point Range Complex; however, Anti-Submarine Warfare and Mine Warfare training using active sonar platforms are being analyzed in the AFAST EIS/OEIS and summarized in Section 3.19 of this document.

Under the No-Action Alternative, training operations and major range events would continue at current levels. Under this alternative, the Navy Cherry Point Range Complex would not accommodate an increase in training operations, except surge (due to the requirements of the FRTP) or proposed force structure changes, and it would not implement enhancements identified in the RCMP. Evaluation of the No-Action Alternative in this EIS/OEIS provides a credible baseline for assessing environmental impacts of Alternative 1 and Alternative 2 (Preferred Alternative).

Table 2.2-1 Navy Cherry Point Range Complex Typical Operations

Range Operations	Description	Area
MINE WARFARE (MIW)		
Mine Countermeasures (MCM)	Helicopters, surface and subsurface units detect, identify, classify, mark, disable and/or destroy sea mines using a variety of methods.	ESG COMPTUEX & JTFEX: Onslow Bay MIW Area, (Onslow Beach out to 12 nm, in portion of Area 15) CSG COMPTUEX: Carrier OPAREA North
Mine Neutralization	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.	Area 15 (UNDET Area) Onslow Bay
SURFACE WARFARE (SUW)		
Bombing Exercise (Sea) (BOMBEX A-S)	Fixed wing aircraft deliver bombs against maritime targets.	Cherry Point OPAREA (Area 18)
Missile Exercise (Air-to-Surface)	Air-to-Surface Missile Exercise (Laser and Live Fire) [MISSILEX (A-S)] trains fixed-wing aircraft and helicopter aircrews in the delivery of optical, infrared seeking or laser guided missiles at surface targets.	W-122 (Area 16, 17)
Gunnery Exercise (Air-to-Surface)	Air-to-Surface Gunnery Exercise (GUNEX) trains fixed-wing aircraft and helicopter aircrews to attack at-sea surface targets using guns.	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)
Gunnery Exercise Ship (Surface-to-Surface) (GUNEX S-S (Ship))	Surface ships fire main battery guns and crew-served weapons against maritime targets.	Cherry Point OPAREA
Maritime Security (MS) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship and Helo; anti-piracy operations; and special operations forces	VBSS/MIO: Crews from Navy helicopters and 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.	Cherry Point OPAREA
AIR WARFARE (AW)		
Air Combat Maneuver (ACM)	Two or more aircraft engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed in an attempt to destroy the opposition. Fighter aircraft do fire live weapons during ACM, just not in a training environment.	W-122 (Areas 1, 8, 15 & 16)
GUNEX (Air-to-Air)	GUNEX Air-to-Air training operations in which guns are fired from aircraft against unmanned aerial target drones	W-122 Area 9, 10, 11, 12)
MISSILEX (Air-to-Air)	Air-to-Air Missile Exercise [MISSILEX (A-A)] are training operations in which air-to-air missiles are fired from aircraft against unmanned aerial target drones such as BQM-34 and BQM-74.	W-122 (Area 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, 17)

Table 2.2-1 Navy Cherry Point Range Complex Typical Operations (Continued)

Range Operations	Description	Area
MISSILEX (Surface-to-Air)	These operations train surface ship crews in defending against airplane and missile attacks with the ship's missiles. Missile firing ships, including guided missile cruisers, frigates, and destroyers, armed with surface-to-air missiles are required to engage each of three different presentations of aerial threats once per FRTP. The target used unmanned aerial drones, such as BQM-74.	Cherry Point OPAREA
Air Intercept Control (AIC)	Surface ships vector friendly aircraft to intercept and destroy adversary aircraft.	W-122
Electronic Combat (EC)		
Electronic Combat Operations (EC)	Aircraft, surface ships, and submarines attempt to control critical portions of the electromagnetic spectrum to degrade or deny the enemy's ability to defend its forces from attack and/or recognize an emerging threat early enough to take the necessary defensive actions.	Electronic Warfare Range (MAEWR)
Chaff Exercise	Ships and aircraft deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack.	Cherry Point OPAREA
Flares Exercise	Aircraft deploy flares to disrupt infrared guidance systems of threat missiles.	W-122 (Areas 1, 8, 15, 16)
Strike Warfare (STW)		
High-Speed Anti-Radiation Missile Exercise (HARMEX) (air-to-surface)	Aircraft crews train in the use of High-Speed Anti-Radiation Missiles (HARM), the primary weapon designed to target anti-aircraft missile sites.	W-122 (Areas 18, 19, 20, and 21)
Amphibious Warfare (AMW)		
Firing Exercise (FIREX) -Land (FIREX (Land))	Surface ships fire main battery guns against land targets in G-10 Impact Range Camp Lejeune in support of military operations ashore.	Firing Point: Cherry Point OPAREA (Area 15B)
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Surface ships fire main battery guns against simulated land targets in support of military operations ashore. This training is conducted at-sea using a series of buoys.	Cherry Point OPAREA (Area 4/5 and 13/14)
Amphibious Assault	A Marine Battalion Landing Team (typically two reinforced companies, including armor and service support units) moves ashore from the Expeditionary Strike Group at-sea to establish a beachhead in hostile territory, then moves further inland for an extended period. Ingress via amphibians, landing craft and/or rotary-wing aircraft. Coordinated fire support from aircraft, surface ships and artillery	Cherry Point OPAREA, Onslow Bay
Amphibious Raid	A reinforced company (100-150 marines) makes a swift, short-term incursion from the Expeditionary Strike Group at-sea to a hostile area ashore for a specified purpose and a specified time, then makes a planned withdrawal. Ingress and extraction via small boats, amphibians, landing craft and/or helicopters.	Cherry Point OPAREA, Onslow Bay

Table 2.2-2 Navy Cherry Point Range Major Range Events

Range Operations	Primary Warfare Area	Description	Area
Expeditionary Strike Group (ESG) Composite Training Unit Exercise (COMPTUEX)	Amphibious Warfare (AMW), Strike Warfare (STW), Electronic Combat (EC), Mine Warfare (MIW), Surface Warfare (SUW), Air Warfare (AW)	A major training event lasting several weeks involving an ESG of 5-9 Navy amphibious and surface warfare ships and submarines, and a Marine Expeditionary Unit (MEU) of 2200 Marines and their supporting air, armor, and service support units. ESG COMPTUEX focuses on integration and interoperability of participating units in maritime and amphibious environments. Typical component exercises include an amphibious assault and several amphibious raids and large coordinated mine, air defense, surface, anti-submarine, electronic combat and strike operations.	Cherry Point, Charleston, and Jacksonville OPAREAS and inland ranges
Carrier Strike Group (CSG) Composite Training Unit Exercise (COMPTUEX)	Mine Warfare (MIW), Surface Warfare (SUW), Air Warfare (AW), Electronic Combat (EC), Strike Warfare (STW)	A major training event lasting several weeks involving a Carrier Strike Group (CSG) of an aircraft carrier, its airwing and about 12 surface warfare ships and submarines. CSG COMPTUEX focuses on integration and interoperability of participating units in maritime and overland strike environments. Typical component exercises include extensive flight operations and several large coordinated mine, air defense, surface, anti-submarine, electronic combat and strike operations.	Cherry Point, Charleston, and Jacksonville OPAREAS and inland ranges
Joint Task Force Exercise (JTFEX)	Amphibious Warfare (AMW), Strike Warfare (STW), Electronic Combat (EC), Mine Warfare (MIW), Surface Warfare (SUW), Air Warfare (AW)	A major training event lasting about 10 days involving one to two aircraft carriers and their airwings; three Navy amphibious ships and their Marine Expeditionary Unit (MEU) of 2200 Marines and their supporting air, armor, and service support units; 10-14 surface warfare ships and submarines; and units from other DoD and/or allied services. JTFEX is an advanced training event, typically following ESG and CSG COMPTUEXs that uses non-scripted, scenario-driven battle problems focusing on mission planning and strategy, and integrated maneuvers, communication and coordination. Typical component exercises include an amphibious assault, and several amphibious raids and large coordinated mine, air defense, surface, anti-submarine, electronic combat and strike operations.	Cherry Point, Charleston, and Jacksonville OPAREAS and inland ranges

* *Sonar component of this training is analyzed separately in the AFAST EIS/OEIS. Potential effects are summarized in section 3.19 of this document. Additionally, component exercises of CSG COMPTUEX, ESG COMPTUEX and JTFEX conducted in Jacksonville Range Complex will be addressed in Jacksonville Range Complex EIS/OEIS and cumulatively in this document*

2.2.4 Alternative 1 – Increases and Modifications to Operational Training, Expand Warfare Missions, Accommodate Force Structure Changes, and Enhance Range Capabilities

Whereas the No Action Alternative evaluated *current* range complex operations (including surge capabilities consistent with the FRTP), Alternative 1 proposes increased range complex operations and capabilities enhancements to address Navy and DoD *emerging and foreseeable future* training and RDT&E requirements. Alternative 1 includes the type and quantity of training and testing done currently (i.e. the No Action Alternative), plus an across-the-board increase in most operations to

provide the Navy and Marine Corps with flexibility to train for real world situations, plus changes in type and quantity of operations and tactical employment of forces to accommodate expanded mission areas, force structure changes, and new range capabilities.

Under Alternative 1, training and RDT&E operations would increase as identified in Tables 2.2-3 and 2.2-4. The expansion of warfare missions would result from training Maritime Security (MS) Surge Surface Strike Groups, a new concept for organizing, deploying, and employing naval forces. Force structure changes address the effects on Navy Cherry Point Range Complex of increasing the number of MH-60S Seahawk Multi-Mission Combat Support Helicopters at NS Norfolk from four squadrons to nine, and introducing new Organic Mine Countermeasures systems into the airplanes. Finally, enhanced range capabilities include increased use of Commercial Air Services and upgraded electronic combat threat emitters at Mid-Atlantic Electronic Warfare Range to support training operations in Navy Cherry Point Range Complex.

Under Alternative 1, training operations would be increased or modified as identified in Tables 2.2-3 and 2.2-4. Force structure changes (new platforms) to be implemented would include introduction of the MH-60R/S Seahawk Multi-Mission Helicopter. Force structure changes associated with new weapons systems would also include limited capability to support Organic Mine Countermeasures (OMCM).

2.2.4.1 Increased Training Operations

The Navy proposes to increase training from current baseline levels at the Navy Cherry Point Range Complex by approximately 10% for most operations to accommodate short-term national security contingencies and provide planners with flexibility to develop realistic battle problems for major fleet training exercises.

2.2.4.2 Expand Warfare Missions

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 Navy Cherry Point 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 anti-terrorism, 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. The Navy does not expect MS SSG training to significantly alter the overall type and quantity of operations currently conducted in Navy Cherry Point Range Complex.

Conduct Surface-to-Air Missile (MISSILEX (S-A)) training. The Navy proposes to conduct up to eight MISSILEX (S-A) training events annually in Cherry Point OPAREA. In these air defense exercises, surface ships launch surface-to-air missiles with either high explosive or non-explosive warheads at target drones simulating enemy aircraft. Once a required training event, the Navy suspended live missile training launches from all surface ships except aircraft carriers in 2004. However, it continues to conduct MISSILEX (S-A) test and evaluation events in the northern part of

VACAPES OPAREA (W-386) offshore from the Goddard Flight Facility, Wallops Island, VA. If the Navy decides to reinstate MISSILEX (S-A) training events, it will conduct most of them in the VACAPES OPAREA (W-72A/B), but would need the operational flexibility to train in Cherry Point OPAREA (W-122), as well. Participants could include cruisers (CG) or destroyers (DDG) launching SM-2 Standard Missiles, or large amphibious ships (LHA or LHD) launching NATO Sea Sparrow missiles. The targets would be BQM-74 drones, launched from either G-1 Commercial Air Services aircraft or the Mobile Sea Range. Lack of a missile launch platform at either MCAS Cherry Point or MCB Camp Lejeune precludes use of the BQM-34 drone, which requires a land-based launch platform. Since the BQM-34 is the target of choice for the Rolling Airframe Missile (RAM), the Navy will schedule launches of these missiles in the VACAPES OPAREA.

Navy does not anticipate any underwater detonations to result from these renewed MISSILEX (S-A) events. Both the SM-2 and NATO Sea Sparrow missiles are extremely accurate missiles with fuzing characteristics that will ensure airborne detonations.

2.2.4.3 Force Structure Changes

Conduct MH-60R/S Training. The Navy proposes to increase the type and quantity of MH-60R and MH-60S training conducted in Navy Cherry Point Range Complex. The on-going restructuring of its helicopter forces will eventually replace the aging fleet of CH-46D, UH-1N, HH-3U, SH-60B, SH-60F and HH-60H helicopters with the MH-60R/S airframes.

MH-60S Multi-Mission Combat Support Helicopter missions will include organic mine countermeasures (OMCM, described in detail below), combat search and rescue (CSAR), special operations, logistics support, surface warfare (SUW), maritime intercept operations (MIO) and search and rescue (SAR). Naval Station (NS) Norfolk will host all 100 airframes destined for the Atlantic Fleet, distributed between five carrier airwing (CVW) squadrons, three expeditionary squadrons, and one fleet replacement squadron.

Most MH-60S operations in Navy Cherry Point Range Complex will be with helicopters embarked aboard ships participating in major fleet training exercises. A CVW squadron will deploy as an entire squadron onto the aircraft carrier when part of a CSG, whereas an expeditionary squadron will deploy one or two helicopter detachments aboard frigates, destroyers, cruisers and amphibious ships in support of an ESG. MH-60S training in Navy Cherry Point Range Complex addressed in this EIS/OEIS is all at-sea training: OMCM, and chaff and flare exercises (electronic combat capability that supports all other mission areas). Navy MH-60Ss will also launch from ships and fly inland to participate in CSAR and special operations battle problems during major exercises. The Marine Corps will address those operations in their separate MCB Camp Lejeune and MCAS Cherry Point Range Complex Environmental Assessments.

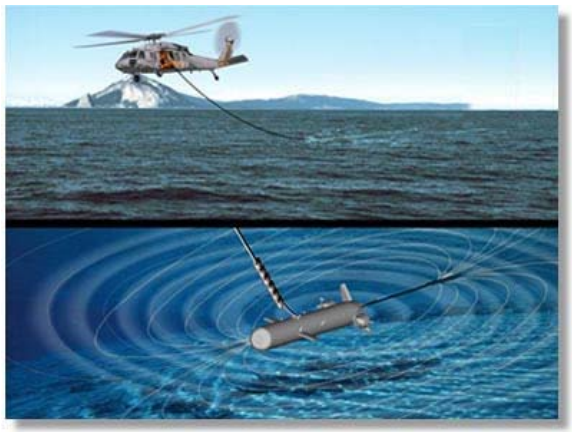
MH-60R Multi-Mission Helicopter missions will include anti-submarine warfare (ASW), SUW, MIO and SAR. The Atlantic Fleet will split the projected 105 airframes between Naval Air Station (NAS) Jacksonville and NS Mayport, distributed between five CVW squadrons, two expeditionary squadrons, and one fleet replacement squadron.

Most MH-60R ULT operations will occur in the Jacksonville Range Complex near their home bases. With few exceptions, the MH-60R will only train in the Navy Cherry Point Range Complex when participating in a major exercise. The deployment and training patterns for the MH-60R resemble those for the MH-60S described above. MH-60R operations in Navy Cherry Point Range Complex are primarily sonar training which is not addressed in this EIS/OEIS. All Navy sonar operations in the Atlantic Ocean and Gulf of Mexico are analyzed separately in the Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS, summarized in Section 3.19 of this document

Conduct training with Organic Mine Countermeasures (OMCM) systems. The Navy proposes to accommodate operations of MH-60S helicopters, surface ships and submarines equipped with new OMCM systems in Navy Cherry Point Range Complex. This will entail some changes in tactics, techniques and procedures from current mine warfare training. Organic refers to the concept of embedding mine warfare capability into the strike group rather than as an external capability of specialized ships and aircraft, only brought in on an as-needed basis. The Navy will configure 51 of the 102 MH-60Ss eventually homebased at NS Norfolk with OMCM capability. These systems, described below and in Appendix D, include a towed mine hunting sonar (AQS-20A), a towed magnetic influence and acoustic mine sweeping body (OASIS), airborne mine hunting laser (ALMDS), submerged mine neutralization self-propelled device (AMNS), and airborne mine neutralization ordnance (RAMICS). The active sonar component of AQS-20 and AMNS is over 200 kHz and therefore not analyzed in the Final AFAST EIS/OEIS because the system frequency is outside the upper frequency limit for marine mammals (see Table 2-1 "Acoustic Systems Analyzed and Not Analyzed" on page 2-5 of the Final AFAST EIS/OEIS).

AN/AQS-20 is a towed mine hunting system designed to detect, classify and localize bottom and moored mines in deep or shallow water. An underwater towed body attached to a MH-60S helicopter with electromechanical cable contains the high frequency, high resolution, side-looking, multi-beam sonar system. It can also be configured with an electro-optic identification sensor that incorporates a laser Light Detection and Ranging (LIDAR) system to identify bottom mines. An operator on the helicopter identifies potential mines from the sonar and laser images on a video monitor and marks their exact locations. A separate mine neutralization system is needed to disable or destroy mines once identified. The Navy evaluated the potential environmental effects of AN/AQS-20 inert mission tests and determined that there were no significant impacts on marine resources (DoN, 2003a).

AN/AQS-20

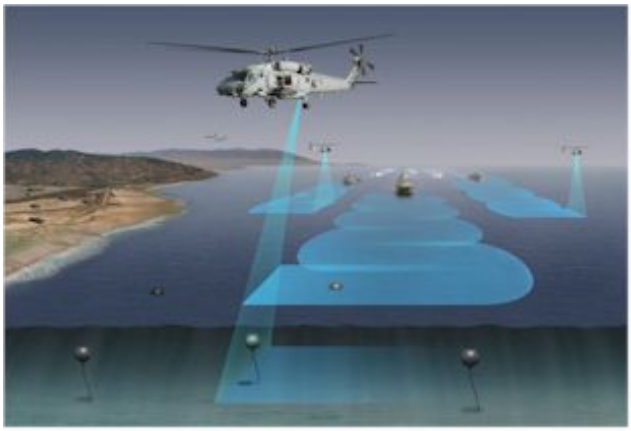


OASIS Sweeping Device

AN/ALQ-220 Organic and Surface Influence Sweep (OASIS) is a high-speed (25 kts), towed minesweeping system designed to rapidly neutralize magnetic and acoustic mines in shallow coastal waters. It emulates the magnetic and acoustic signatures of transit platforms, thereby causing nearby mines to detonate. An underwater towed body attached to a MH-60S helicopter with electromechanical cable contains the electromagnetic field generator and the acoustic generator, a mechanical device that needs no external power.

AN/AES-1 Airborne Laser Mine Detection System (ALMDS) is a non-towed (airborne) mine hunting system designed to rapidly detect, classify and locate near-surface floating or moored mines. A pod mounted on the MH-60S pylon contains the laser Light Detection and Ranging (LIDAR) system used to detect mines. An operator on the helicopter identifies potential mines from the laser images on a

video monitor and marks their exact locations. A separate mine neutralization system is needed to disable or destroy mines once identified. The Navy evaluated the potential environmental effects of testing ALMDS and concluded that significant impacts would not occur (DoN, 2003b).



Airborne Laser Mine Detection System

MH-60S Helicopter with RAMICS

AN/ASQ-235 Airborne Mine Neutralization System (AMNS) is a non-towed system designed to identify and neutralize bottom and moored mines in the ocean environment. A hovering MH-60S or MH-53E helicopter lowers an expendable, self-propelled neutralizer device into the water at a safe distance from a potential mine previously identified with a separate mine hunting system. A fiber-optic cable connected to the neutralizer relays depth, position and sensor (sonar and video) information to the operator in the helicopter, who in turn sends control and guidance commands back to the neutralizer. The operator guides the lightweight (15.5 kg) and highly maneuverable vehicle to the target location using on-board high frequency sonar. After the target is viewed and positively identified with an on-board video camera, the operator fires an armor-piercing warhead from the vehicle to neutralize the mine.

For training and testing purposes, the AMNS explosive charge can be replaced with a ballast device that will cause the neutralizer to float to the surface for recovery and reuse after completion of the exercise. Training targets are expendable, non-explosive, bottom and moored mineshapes. The Navy evaluated the potential environmental effects of testing AMNS and concluded that significant impacts would not occur (DoN, 2001; 2002b).

A/AWS-2 Rapid Airborne Mine Clearance System (RAMICS) is a non-towed system designed to neutralize floating and near-surface mines. RAMICS is a MK44 Bushmaster II cannon with a laser Light Detection and Ranging (LIDAR) targeting fire control system that fires a flat-nosed 30mm armor-piercing non-explosive super-cavitating projectile. A hovering MH-60S helicopter uses the LIDAR to reacquire a mine previously located with a separate mine hunting system. Once the target is reacquired, an onboard fire control subsystem automatically tracks it and aims the gun, firing the projectiles in bursts. A successful neutralization will disable the mine at a safe distance from the helicopter. Training targets are expendable inert bottom and moored mineshapes. The Navy evaluated the potential environmental effects of testing RAMICS and concluded that significant impacts would not occur, though the gun tested was a 20-mm Gatling gun and not the current 30-mm Bushmaster (DoN, 2000).

In Alternative 1, Navy MH-53E and MH-60S helicopters would continue to train in Navy Cherry Point Range Complex only in conjunction with major exercise mine warfare events, lasting seven to 14 days with up to four MH-53Es and three MH-60Ss. The mine training area for ESG exercises is in the

shallower water where amphibious operations take place, whereas for CSG exercises, mine training occurs in the deeper water where the CSG would operate. Mine events in most major exercises currently are conducted without benefit of mineshapes which seriously compromises the quality of training. These events focus on the mine warfare commander's ability to plan an appropriate search based on the specific battle problem, deploy and coordinate the efforts of all MCM assets at his disposal, and make necessary adjustments as the situation unfolds. The individual aircrews can practice deploying their equipment in an operational environment, flying the search patterns, familiarizing the operators with system procedures, and recovering the equipment, all useful exercises. Some systems have an organic simulation capability. However, without target mineshapes, the operators can not gain experience in actually detecting, identifying, locating, and/or neutralizing mines, and the warfare commander and trainers can not provide feedback to the aircrew about the efficacy of their tactics and technique. Infrequently, the exercise planners will deploy temporary mineshapes in the ESG Operations Box off Onslow Beach in the Cherry Point OPAREA.

2.2.4.4 Enhance Range Complex Capabilities

Increase Commercial Air Services (CAS) Support for Fleet Training. The Navy proposes to increase the number, type and operation of CAS within the Navy Cherry Point 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, provide air-to-air refueling capabilities and tow and stream targets used for surface-to-air gunnery training. Their use enhances the following range capabilities:

1) Opposition Force (OPFOR) aircraft against naval aircraft and ships in air defense (Air Intercept Control (AIC) and Detect to Engage) and strike (BOMBEX A-G) events, 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 for multi-aircraft strike flights during major exercises;
4) Tow aircraft for target banners in air-to-air and surface-to-air gunnery exercises.

Increased use of CAS to support fleet training would not substantially increase aircraft numbers, emissions or time spent in the warning areas, or alter current airspace usage. Rather, CAS 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 CAS aircrew.

Upgrade electronic combat (EC) capabilities at Mid-Atlantic Electronic Warfare Range (MAEWR). The Navy proposes to upgrade MAEWR threat emitters to include new mobile coastal anti-ship missile system simulators and add reactive Threat Radar Emitter System (TRES) capability to several current threat emitters.

Coastal Anti-ship Missile System Simulators will be four mobile electronic emitters that train friendly surface ships to effectively identify and counter anti-ship electronic acquisition and targeting radars, and to gather coastal surveillance intelligence. Most often, these systems will operate from positions along the shoreline primarily in support of major exercises, prompting the air warfare commander and individual ships to react defensively and counter the threat. This training does not involve actual missile or ordnance use.

Threat Radar Emitter System (TRES). Current surface-to-air threat emitters at MAEWR simulate the radar signature of enemy missile systems, designed to cause inbound aircraft to react in such a manner so as to defeat the threat. However, the emitters do not have a mechanism to provide the pilot with feedback as to the effectiveness of his response. TRES will track aircraft response to the threat signal,

gauge whether that response would have successfully defeated the enemy threat, and provide real-time feedback to the pilot.

Neither proposal is expected to significantly change the total number of training events, but will greatly improve the quality of training provided. Table 2.2-3 lists training operations affected by these upgrades.

Table 2.2-3 Training Elements Affected by Commercial Air Services

Training Event	Proposed Range Capability	Baseline Sorties/Events	Proposed Sorties/Events	Percentage Increase
GUNEX (A-A)	CAS	12	20	40%
Electronic Combat (aircraft)	CAS, MAEWR	2230	2450	10%
Electronic Combat (ships)	CAS, MAEWR	45	50	10%
Air Intercept Control	CAS	21	21	0%
Strike, Close Air Support[6]	CAS, MAEWR	50	55[7]	10%

2.2.5 Alternative 2 – Eliminate High Explosive Bombs At-sea and Implement Enhanced Mine Warfare Training Capability (Preferred Alternative)

Alternative 2, the Preferred Alternative, includes implementing Alternative 1 plus eliminating all high explosive (HE) bombing exercises at-sea (BOMBEX Air-to-Surface) and designating two mine warfare (MIW) training areas for major exercise MIW events. The latter proposal includes use of temporarily deployed training mines in Onslow Bay and an increase in the number of Mine Countermeasures (MCM) and Mine Neutralization training operations. See Table 2.2-4.

Eliminating High Explosive Bombs At-sea. Under Alternative 2, the Navy proposes to eliminate HE BOMBEX (Air-to-Surface) in Navy Cherry Point Range Complex, primarily conducted at smoke float targets in Area 18 of W-122 (see Figure 2.2-3). The Navy and Marine Corps will continue to drop Non-Explosive Practice Munitions (NEPM or inert bombs) in W-122.

Implementing Enhanced Mine Warfare Training Capability. Under Alternative 2, the Navy proposes to designate two separate MIW Training Areas in the Cherry Point Range Complex, one each in the distinctly different operating environments of Expeditionary Strike Groups (ESG) and Carrier Strike Groups (CSG), to enhance MIW training during major exercises. Even with the two newly-designated areas, all underwater detonation (UNDET) operations will continue to occur in the currently-authorized UNDET area for which the Navy has already studied the environmental effects and received permits (NMFS, 2002). Figure 2.2-1 depicts these three training areas:

[6] Strike warfare or Close Air Support operations involving flights of 8-10 F/A-18 aircraft from the CV in a CSG or 2-4 AV-B aircraft from LHA or LHD in an ESG during a major exercise to attack targets at inland ranges. These operations are fully addressed in the MCAS Cherry Point Range Complex Environmental Assessment (DoN, 2009).

[7] These sorties only include flights that originate on a CV, LHA or LHD during a major exercise, then fight their way to the target at inland ranges through OpFor generated by CAS or MAEWR. Single aircraft ULT strike (BOMBEX A-G) or close air support sorties that originate from a land base typically do not use CAS OpFor, and MAEWR support is included in Electronic Combat (aircraft) above.

- **ESG MIW Training Area.** Relatively shallow water (littorals) in the three-mile strip of Onslow Bay seaward from Onslow Beach at Marine Corps Base (MCB) Camp Lejeune, and extending out to 12 nm into the Cherry Point OPAREA. Navy Cherry Point Range Complex will be the primary venue for ESG major exercise MIW events. The Navy proposes to temporarily deploy non-explosive recoverable training mines in the ESG MIW Training Area for each MIW event, typically up to two weeks each for a maximum of three ESG exercises in a surge year. It will recover these training mines at event completion.
- **CSG MIW Training Area.** Deep water in the Cherry Point OPAREA 50 to 100 nm off the North Carolina coast frequently used as an operating box during CSG major exercises. Fleet will conduct most CSG major exercise MIW events in the JAX and Charleston OPAREAs, but needs Navy Cherry Point Range Complex as an alternate location which it does not expect to use more than once during any year. Since water depth is too deep for routine retrieval of submerged objects, events will take place without training mines.
- **UNDET Area.** Relatively shallow water 3 to 12 nm off the coast of MCB Camp Lejeune in the Cherry Point OPAREA. All mine neutralization training involving UNDETs conducted during either ESG or CSG major exercises will occur here. Following a mine neutralization operation, divers gather expended mine shapes (as practicable) in order to assess training success.

Detailed discussion of both MIW training areas follows below.

As the nature of naval warfare has evolved in the post-Cold War era, the primary operating environment for Navy Strike Groups has shifted from open ocean with its relatively low mine threat, to areas much closer to shore where mines are most effective. In response, the Navy is developing a mine countermeasures and neutralization capability to embed in its CSGs and ESGs (see description of Organic Mine Countermeasures (OMCM) systems in Paragraph 2.2.4.3 above), and desires to improve the quality of the MIW training events in major exercises. Currently, most MIW events during major exercises in the Cherry Point Range Complex are tabletop exercises (*i.e.,* exercises conducted on paper only). The Strike Group MIW Commander and his staff are presented with a mine problem for which they must plan a solution using all available mine countermeasures (MCM) assets. However, typically the event does not involve any helicopters, ships, or submarines actually executing the plan. The obvious shortfalls of this process is that neither the commander nor the MCM units derive the benefit of working together to execute the plan, feedback on the plan's efficacy, and the opportunity to respond to real-world contingencies that inevitably arise to complicate any plan. As ESGs and CSGs begin to embark with OMCM-configured MH-60S helicopters, fleet exercise planners intend to increase the amount of live MIW training events during major exercises.

ESG MIW Training Area A typical ESG major exercise MIW scenario would include mines in both the ESG Operating Box (see Figure 2.2-2) that threaten the ESG amphibious and support ships, and in the landing craft and amphibian transit lanes between the ESG Operating Box and the amphibious landing beach. These littoral waters are shallow enough that the Navy can easily deploy and recover training mines for the duration of the exercise MIW event. Use of training mines greatly increases the quality of training for the MIW Commander and his aircrews who will gain experience coordinating their efforts to detect, identify, locate, and/or neutralize mines over a large area, and get feedback about the efficacy of their initial planning and subsequent revisions. The type of training mine in a particular area depends on characteristics of the systems for which they are targets.

A surface support craft would deploy bottom and moored mines in the exercise area just prior to commencing the MIW event. A crane or similar equipment will lower the training mine (with mine shape, anchor and mooring line as a pre-assembled unit) into the water at a designated location so the anchor rests on the bottom. Prior to deploying training mines, the Navy will survey the prospective location with side scan sonar and EOD divers to ensure it is clear of shipwrecks, natural and artificial

reefs, oyster beds, and other sensitive natural and cultural resources. Mines will not be deployed in less than 10-m of water in order to prevent sand covering the training mines. At the event's conclusion, the support craft will recover non-expendable training mines. A diver will hook the assembly with the crane's cable in order to hoist it aboard. The Navy has specific instruction manuals describing deployment and recovery of anchors.

Two broad categories of non-explosive training mines:

Inert Training Mines support mine hunting systems (sonar and/or laser sensors) and mine neutralization systems. They are available as bottom or moored mines, the latter of which float at a pre-programmed depth. The following components make up non-explosive training mines:

- **Mine shapes** replicate the appearance of mines that U.S. naval forces could encounter throughout the world. They have an outer shell of glass-reinforced plastic or steel, contain no explosives or target detecting/actuating mechanisms, and are filled with air, concrete or Filler-E (a buoyant foam material). For those training mines used in mine neutralization events, the UNDET simply punctures a hole in the mine casing, causing it to sink to the ocean floor as a single unit. Following a mine neutralization operation, divers gather expended mine shapes including any Filler-E that escapes from the casing and floats to the surface (as practicable) in order to assess training success..
- **Concrete anchors** hold the mine shapes in place, one for each inert bottom or moored mine shape. Each anchor weighs between 1,200 and 2,300 pounds and measures 2 to 2.5 feet on each side (about 8 to 16 cubic feet).
- **Mooring lines** are steel cable or chains that connect inert moored mine shapes to the concrete anchors. Lines are normally between 0.3-in and 0.5-in diameter.

Versatile Exercise Mine System (VEMS) support mine sweeping systems (magnetic and/or acoustic signal generators). They are electronic devices shaped like bottom mines that detect and record acoustic and magnetic fields that pass over them. Each VEMS unit consists of a buoy section with all the sensors and a ballast section, and contains no explosive material. As with the inert mine shapes, a surface support craft will seed the exercise area with VEMS units just before the MIW event. A command from either an acoustic link or at a preprogrammed time activates the self-recovery system, causing the ballast section to release the buoy section. It rises to the surface, but remains tethered by a recovery line to the ballast section which acts as an anchor. A surface vessel can then recover both sections. After extracting the data to provide feedback to the aircrew, maintenance personnel can reassemble and redeploy the VEMS unit.

Examples of VEM Units

A typical ESG major exercise MIW event will include up to four MH-53E and three MH-60S helicopters deployed to the exercise area one to two weeks before strike group arrival, operating from a ship participating in the exercise and/or shore-basing. Their mission is to clear the ESG Operating Area and landing craft transit lanes of mines. The MH-53s will fly two missions/day, three hours/mission, and the MH-60S will fly three missions/day, two hours/mission. Table 2.2-4 projects the total number of operations for each specific MCM and mine neutralization system used by each type aircraft over the course of three MIW events.

The Cherry Point ESG MIW Training Area will have three distinct sub-areas:

- **ESG Operating Box**, 3 to 12 nm seaward from Onslow Beach, between 15 and 25 nm wide. In this area, the helicopters will use their mine sweeping (MK-103, MK-105 and OASIS) and sonar mine hunting (AQS-20A and AQS-24A) systems against about 20 bottom and 5 moored inert training mines, and 10 VEMS.
- **Landing Craft and Amphibian Transit Lanes,** from 3 nm to the shoreline of the Onslow Beach amphibious training area, about 3 nm wide. In this area, the helicopters will use their mine hunting systems (laser ALMDS, and sonar AQS-20A and AQS-24A in areas with at least 40' depth of water) against about 50 bottom and 20 moored inert mine shapes.
- **Mine Neutralization Area,** within the UNDET Area outlined in Figure 2.2-1. The MH-60S will employ inert AMNS and RAMICS, and Explosive Ordnance Disposal (EOD) divers will use up to 20 lb charges against up to 10 inert moored and bottom training mines. In order to avoid interference, mine neutralization events will be conducted separately from mine hunting/sweeping events

These systems and operations are described further in Section 2.2.4.3, Table 2.2-4 and Appendix D. Potential effects associated with the active sonar component of AQS-20 and AQS-24A are analyzed separately in the AFAST EIS and summarized in Section 3.19 of this document.

CSG MIW Training Area A typical CSG major exercise MIW event would simulate two mine threat scenarios: an open ocean environment in the Carrier Operating Box, and a channel or near-shore embayment with limited egress (also known as a "simulated choke point"). Up to four MH-53E and three MH-60S helicopters would deploy to the exercise area one to two weeks before strike group arrival, operate from a ship participating in the exercise, and prepare a safe transit and operating area for the CSG. In the deep water training areas, the helicopters would execute the MCM plan with their mine hunting (AQS-20A and AQS-24A) and mine sweeping (MK-103, MK-105 and OASIS) systems. Although lack of target mineshapes in the area somewhat compromises the quality of training, the participants still benefit from the live exercise. The aircrews practice deploying their equipment in an operational environment, flying search patterns in proximity with other units, familiarizing the operators with system procedures, and recovering the equipment. Some systems have an organic simulation capability. In addition, the system operators can use the sonar mine hunting gear for bottom mapping—detecting, identifying and mapping mine-like objects on the ocean floor for future reference and comparison with other bottom maps. The MIW Commander and his staff can get experience planning a large-scale operation, coordinating all the assets involved in executing the plan, and responding to emergent situations. In the shallow underwater detonation area, the Navy can insert up to ten inert expendable bottom or moored training mines so the MH-60S helicopters can exercise their mine neutralization equipment (inert AMNS and RAMICS), and deployed Explosive Ordnance Disposal personnel can practice their underwater detonation techniques. These systems and operations are described further in Section 2.2.4.3, Table 2.2-4 and Appendix D. Potential effects associated with the active sonar component of AQS-20 and AQS-24A are analyzed separately in the AFAST EIS and summarized in Section 3.19 of this document.

2.2.6 Summary of Operational Parameters for all Alternatives

A summary of the Navy's proposed operational data for the No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) are presented in Table 2.2-4. 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 account for the occasional surge of operations. Current training descriptions are in Appendix D and Appendix E contains weapon systems descriptions.

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 quantities of ordnance used; and detailed locations where the operation would take place.

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 along the East Coast, 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 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 EIS/OEIS.

2.2.7.2 Alternative Range Complex Locations

No single range complex on the East Coast 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 all alone.

As discussed in Paragraph 1.2.1.2 above, 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 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 which 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, distance from home base, and sophistication of range support. West Coast ranges complexes were not considered to meet the purpose and need due to homeporting on the East Coast, transit distances, and fuel consumption.

<u>Unit Level Training (ULT)</u>. As discussed in Paragraph 1.2.1.3 above, 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. The Navy and Marine Corps have concentration areas in the Northeast (undersea research, development, test and evaluation (RDT&E)), VACAPES (most Atlantic Fleet surface ships, strike/fighter and mine warfare aircraft, missile and aircraft RDT&E), Cherry Point (Marine Forces Atlantic), and Jacksonville (air and surface anti-submarine warfare). Consolidating training and testing support for all these disparate mission areas, currently spread across the entire Atlantic seaboard, is highly impractical from a geographic standpoint.

Major Exercises. USFF conducts six to eight large-scale major exercises (JTFEX/COMPTUEX) every year, and 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 of day's transit time for most participants, unlike ULT which requires training venues much closer to the home ports/home bases. 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 East Coast range complex offers the whole package of range attributes to adequately support all major exercises from start to finish.

The Navy Cherry Point Range Complex possesses a number of features that make it an indispensable component of the Navy's East Coast system of ranges. The mid-coastal region of North Carolina has been a Marine Forces Atlantic concentration area since World War II, and today has the largest assemblage of equipment and personnel on the East Coast. The Navy Cherry Point Range Complex, along with the two adjacent Marine Corps range complexes at Marine Corps Air Station (MCAS) Cherry Point and Marine Corps Base (MCB) Camp Lejeune, are by default the backyard ranges for all warfare missions conducted by these forces. The local infrastructure built up over the years—firing ranges, maneuver areas, airfields, fuel depots, maintenance facilities, support personnel, etc.—makes supporting a high volume of training operations relatively easy, an advantage that disappears if most training is done remotely. Conversely, the cost of moving either the homeport or the ULT venues for all these forces is simply cost prohibitive.

Onslow Beach at MCB Camp Lejeune, adjoining Navy Cherry Point Range Complex, is the only Department of the Navy (DoN) military beach on the Atlantic Coast capable of supporting amphibious warfare training with the full Expeditionary Strike Group (ESG) and its embarked Marine Expeditionary Unit (MEU). The shallow-water offshore bathymetry, and beach that opens directly into maneuver areas and live fire ranges, mimic the operating environment that Navy/Marine Corps expeditionary forces may experience in overseas theaters. No suitable substitute for Onslow Beach exists on the East Coast.

The central location and access to desirable range attributes of the Cherry Point OPAREA make it the venue of choice for most Atlantic Fleet major exercise training events. It is situated between the two Atlantic Fleet concentration areas of Hampton Roads, Virginia and Jacksonville Florida, and the Marine Forces Atlantic concentration area of MCAS Cherry Point/MCB Camp Lejeune. This allows the individual units that compose a strike group to easily assemble for an exercise without moving men and materiel over long distances. Also, the military beach, multiple target areas and airfields easily

accessible from Navy Cherry Point OPAREA are essential capabilities for supporting major Navy and Marine Corps exercises.

High performance jet aircraft and helicopters launching from MCAS Cherry Point or MCAS New River can easily and quickly access offshore training areas without interacting with the extremely busy east coast commercial jetways. This situation is ideal for the high volume of daily training flights from Marine Corps operational and pilot replacement squadrons homeported in the area.

As a consequence of the historical and natural features that made this area a Marine Corps concentration area and preferred venue for major exercises, the DoN has invested much money and effort in building the range infrastructure that supports these homeported units and training activities. Several examples:

An extensive network of impact areas can accommodate all manner of ordnance delivery, both live and inert. BT-9 and BT-11 provide backyard ranges for all Marine Corps aircraft based at MCAS Cherry Point and MCAS New River, and targets for live fire training of Navy and Marine Corps small boat crews. Air-to-ground, armor, artillery, mortar and small arms fire are authorized at the MCB Camp Lejeune G-10 and K-2 impact areas. G-10 is also the only land range on the East Coast authorized for naval surface fire support (NSFS). As important as local Marine Corps ULT, these ranges support Navy and Marine Corps carrier-based strike warfare (STW) and close air support (CAS) training and pre-deployment certification during major exercises. The multiple target sets offer strike groups the opportunity to plan and conduct simultaneous, time-sensitive missions.

MCAS Cherry Point hosts a sophisticated instrumentation range. Mid-Atlantic Electronic Warfare Range (MAEWR), the premier electronic combat (EC) range on the East Coast, and Cherry Point Tactical Aircrew Combat Training System (TACTS) range, work in tandem to create a challenging EC environment for training Navy and Marine Corps aircrews from ULT up through large scale integrated training events. MAEWR electronic emitters and instrumentation are unique to the Atlantic area of operations, and TACTS also supports air combat maneuvering training for MCAS-based F/A-18s and AV-8Bs.

Morehead City, North Carolina, near MCB Camp Lejeune, has piers that work well for on-loading and off-loading Marine Corps units into the Navy's amphibious ships.

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 Navy Cherry Point 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 reasonable alternatives for required training purposes/activities described above, and as a result, alternative training locations were eliminated from further consideration.

2.2.7.3 Computer Simulation Training

Under this alternative, only simulated training would be conducted using computer models and classroom training. While computer simulation and classroom training are currently 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 value of live training provided by actually flying an aircraft, operating a combat system such as a shipboard gun or missile launch, or

handling explosive ammunition, simply cannot be substituted through simulation, particularly as it relates to the physical reaction invoked by the danger, noise, and visual effects associated with these systems. Additionally, simulation cannot replicate the environment that is 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 was eliminated from further consideration in this EIS/OEIS.

2.2.7.4 Non-Explosive, Practice Munitions Use

An alternative that would rely entirely on non-explosive, practice munitions use within the Navy Cherry Point Range Complex would not achieve the necessary levels of proficiency in firing weapons in a high stress and realistic environment. Non-explosive, practice munitions is utilized throughout the Navy Cherry Point 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, non-explosive, practice munitions are already utilized extensively to enhance combat performance in the Navy's training program. However, while it is an essential component of training, non-explosive, practice munitions cannot be used exclusively to train safely in 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.

2.2.8 Comparison of Alternatives and Effects

The comparison of alternatives presented in Table 2.2-8 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 operation 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 Bathymetry, Sediment, and Soils; 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, long-term, minor, and/or localized changes to these resources or issues. As defined under NEPA, no significant impacts in U.S. Territory 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), and Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). As a result of the cessation of high explosive BOMBEXs in Alternative 2, there is a substantial decrease in the number of marine mammals and sea turtles potentially impacted compared to the No Action Alternative and Alternative 1. The potential impacts presented in Table 2.2-8 provide the basis for providing choices to the decision maker.

Table 2.2-4 Current and Proposed Operations Per Year in the Navy Cherry Point Study Area[a]

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
MINE WARFARE (MIW)						
Mine Countermeasure (MCM)[bc]	MH-53E (Navy)	MK-103	18 sorties	18 sorties	54 sorties	ESG COMPTUEX & JTFEX: Onslow Bay MIW Training Area, (Onslow Beach out to 12 nm, in portion of Area 15) CSG COMPTUEX: Carrier OPAREA North Figures 2.2-1 and 2.2-2
		MK-105	18 sorties	18 sorties	54 sorties	
		AQS-24A	76 sorties	76 sorties	228 sorties	
	MH-60S (Navy)	OASIS	none	25 sorties	75 sorties	
		AQS-20A	108 sorties	55 sorties	165 sorties	
		ALMDS	none	28 sorties	84 sorties	
Mine Neutralization	MH-60S (Navy)	AMNS (Non-explosive Practice Munitions [NEPM])	none	9 sorties	27sorties	UNDET Area Onslow Bay (3 – 12 nm from Onslow Beach) Figures 2.2-1 and 2.2-2
		RAMICS	none	9 sorties (225 rounds)	27 sorties (675 rounds)	
	Explosive Ordnance Disposal (EOD) (Navy)	20 lb NEW charges	20 events[d]	20 events[d]	20 events[e]	
SURFACE WARFARE (SUW)						
Bombing Exercise (BOMBEX) (Air-to-Surface)	F/A-18 (Navy or USMC)	MK-82 or GBU-30/38 (500 lb High Explosive [HE] bombs)[f]	23 events (92 bombs)	23 events (92 bombs)	0 events	W-122 (Area 18) Figure 2.2-3
		MK-83 or GBU-32 (1000 lb HE bombs)[g]	13 events (52 bombs)	13 events (52 bombs)	0 events	
		MK-84 (2000 lb HE bombs)	1 Sortie (1 bomb)	1 Sortie (1 bomb)	0 events	
BOMBEX (Air to Surface)	F/A-18 (Navy & USMC)	MK-82 or BDU-45 (NEPM)[h,i]	22 events (85 bombs)	24 events (94 bombs)	25 events (98 bombs)	W-122 Figure 2.2-3
	AV-8B (USMC)	MK-82 BDU-45 (NEPM)	10 events (80 bombs)	11 events (88 bombs)	12 events (96 bombs)	
	F/A-18 (Navy & USMC)	MK-83 (NEPM)	0 events	0 events	13 events (52 bombs)j	
	F/A-18 (Navy)	MK-76 (25 lb NEPM)[k]	13 events (129 bombs)	14 events (142 bombs)	14 events (142 bombs)	
	F/A-18 (USMC)	MK-76 (NEPM)[l]	10 events (240 bombs)	11 events (264 bombs)	12 events (290 bombs)	
	AV-8B (USMC)	MK-76 (NEPM)[m]	10 events (120 bombs)	11 events (132 bombs)	12 events (133 bombs)	

Table 2.2-4 Current and Proposed Operations Per Year in the Navy Cherry Point Study Area (Continued)

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
SURFACE WARFARE (SUW) (*…continued*)						
Missile Exercise (MISSILEX) (Air-to-Surface)	AH-1W (USMC)	AGM-114 Hellfire[n]	4 sorties (3 HE; 1 NEPM)	8 sorties (6 HE; 2 NEPM)	8 sorties (6 HE; 2 NEPM)	W-122 (Area 16, 17) Figure 2.2-3
		TOW Missile (all HE)[o]	4 sorties (4 missiles)	8 sorties (8 missiles)	8 sorties (8 missiles)	
Gunnery Exercise (GUNEX) (Air-to-Surface)	AH-1W (USMC)	20 mm cannon	24 sorties 7,200 rounds	40 sorties 12,000 rounds	40 sorties 12,000 rounds	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)[p]
	UH-1N (USMC)	.50 cal machine gun	24 sorties 36,000 rounds	40 sorties 60,000 rounds	40 sorties 60,000 rounds	
		7.62 mm machine gun	24 sorties 36,000 rounds	40 sorties 60,000 rounds	40 sorties 60,000 rounds	
	F/A-18 (USMC)	20 mm cannon	6 sorties (2,000 rounds)	10 sorties (2,400 rounds)	10 sorties (2,400 rounds)	W-122[q]
	AV-8B (USMC)	25 mm cannon	6 sorties (2,000 rounds)	10 sorties (2,400 rounds)	10 sorties (2,400 rounds)	
GUNEX (Surface-to-Surface) (ship)	LHA, LHD, LSD, and LPD[r] (Navy)	.50 cal machine gun	16 events (38,400 rounds)	18 events (43,200 rounds)	18 events (43,200 rounds)	Cherry Pt OPAREA
		25 mm machine gun	16 events (25,600 rounds)	18 events (28,800 rounds)	18 events (28,800 rounds)	
	CG and DDG[s] (Navy)	5" guns (NEPM)[t]	24 events (1,026 rounds)	27 events (1,140 rounds)	27 events (1,140 rounds)	
	FFG[u] (Navy)	76 mm (NEPM)[v]	6 events (171 rounds)	7 events (190 rounds)	7 events (190 rounds)	
GUNEX (Surface-to-Surface) (USMC small arms training)[w]	LHA, LHD, LSD, and LPD (Navy)	9 mm pistol	25 events (10,000 rounds)	30 events (12,000 rounds)	30 events (12,000 rounds)	Cherry Pt OPAREA
		9 mm/.45 cal pistol, M-16, M-4, M-249 squad Automatic Weapon, MK-19, 40 mm TP, M-240G machine gun, .50 cal machine gun (5.56/7.62 mm/.50 cal rounds)	25 events (10,000 rounds)	30 events (12,000 rounds)	30 events (12,000 rounds)	
		M-40 sniper rifle (308 cal)	3 events (30 rounds)	4 events (40 rounds)	4 events (40 rounds)	

Table 2.2-4 Current and Proposed Operations Per Year in the Navy Cherry Point Study Area (Continued)

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
SURFACE WARFARE (SUW) (…*continued*)						
Maritime Security Operations (MSO) to include Visit, Board, Search & Seizure /maritime Intercept Operations (VBSS/MIO)-Ship	Rigid Hull Inflatable Boat (RHIB) or smaller boat and CG, DDG, FFG, LPD, or LSD (Navy)	No ordnance used	14 events	16 events	60 events	Cherry Pt OPAREA
MSO to include VBSS/MIO- Helo[x]	MH-60 and CG, DDG, FFG, LPD, or LSD (Navy)	No ordnance used	7 events (21 sorties)	8 events (24 sorties)	8 events (24 sorties)	Cherry Pt OPAREA
AIR WARFARE (AW)						
Air Combat Maneuvers (ACM)	F/A-18, AV-8B, F-15 and F-16 (Navy, USMC, & USAF)	captive carry missile or telemetry pod[y]	700 sorties	770 sorties	770 sorties	W-122 (Areas 1, 8, 15 & 16) Figure 2.1-2
GUNEX (Air-to-Air)[z]	F/A-18 (USMC)	20 mm cannon	6 sorties (2,000 rounds)	10 sorties (2,400 rounds)	10 sorties (2,400 rounds)	W-122 Area 9, 10, 11, 12)
	AV-8B (USMC)	25 mm cannon	6 sorties (2,000 rounds)	10 sorties (2,400 rounds)	10 sorties (2,400 rounds)	
MISSILEX (Air-to-Air)	F/A-18 (USMC)	AIM-7 Sparrow (NEPM)[aa]	2 sorties (2 missiles)	4 sorties (4 missiles)	4 sorties (4 missiles)	
	AV-8B (USMC)		2 sorties (2 missiles)	4 sorties (4 missiles)	4 sorties (4 missiles)	
MISSILEX (Air-to-Air)	F/A-18 (USMC)	AIM-9 Sidewinder (HE)[bb]	2 sorties (2 missiles)	4 sorties (4 missiles)	4 sorties (4 missiles)	W-122 Area 9, 10, 11, 12)
	AV-8B (USMC)	AIM-9 Sidewinder (HE)	2 sorties (2 missiles)	4 sorties (4 missiles)	4 sorties (4 missiles)	
	AH-1W (USMC)	AIM-9 Sidewinder (HE)	2 sorties (2 missiles)	4 sorties (4 missiles)	4 sorties (4 missiles)	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)
MISSILEX (Surface-to-Air)	CG, DDG LHA, LHD[cc]	SM-2 (HE) Sea Sparrow (HE)	0 events (0 missiles)	8 events (8 missiles)	8 events (8 missiles)	Cherry Point OPAREA
Air Intercept Control	F/A-18[dd] (Navy and USMC)	Air search and fire control radars	54 sorties 21 events	54 sorties 21 events	54 sorties 21 events	W-122

Table 2.2-4 Current and Proposed Operations Per Year in the Navy Cherry Point Study Area (Continued)

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
ELECTRONIC COMBAT (EC)						
EC Operations[ee]	AOE, CG, CVN[ff], DDG, FFG, LHA, LHD, LPD, LSD[gg]	SLQ-32	45 events	50 events[hh]	50 events	Cherry Pt OPAREA
	EA-6B, F/A-18G[ii] (Navy)	AN/ALQ-218. AN/ALQ-99, and AN/USQ-113	108 sorties	120 sorties	120 sorties	W-122
	All Navy and Marine Corps Fixed-wing aircraft[jj]	Multiple fixed and mobile SA, ZSU and EW threat emitters	2,230 sorties	2,450 sorties	2,450 sorties	W-122
Chaff Exercise	MH-60S (Navy)	RR-144A/AL	65 sorties (1,950 canisters)	72 sorties (2,160 canisters)	72 sorties (2,160 canisters)	W-122 (mostly areas 1, 8, 15 & 16) Figure 2.1-2
	F/A-18, AV-8B[kk] (Navy and USMC)		460 sorties (4,600 canisters)	500 sorties (5,000 canisters)	500 sorties (5,000 canisters)	
	CG, DDG, FFG, LCC, LHA, LHD, LPD, LSD (Navy)	MK-214 (seduction chaff)	50 events (300 canisters)	56 events (336 canisters)	56 events (336 canisters)	Cherry Pt OPAREA
		MK-216 (distraction chaff)	16 events (96 canisters)	18 events (108 canisters)	18 events (108 canisters)	
Flare Exercise	MH-60S (Navy)	MK-46 MOD 1C, MJU-8A/B, MJU-27A/B, MJU-32B, MJU-53B, SM-875/ALE	65 sorties (1,950 flares)	72 sorties (2,160 flares)	72 sorties (2,160 flares)	W-122 (Areas 1, 8, 15, 16) Figure 2.1-2
	F/A-18, AV-8B[ll] (Navy and USMC)		30 sorties (150 flares)	35 sorties (175 flares)	35 sorties (175 flares)	
STRIKE WARFARE (STW)						
HARM Missile Exercise (HARMEX) (Air-to-Surface)	F/A-18 (USMC)	AGM-88 HARM (HE)[mm]	6 sorties (6 missiles)	8 sorties (8 missiles)	8 sorties (8 missiles)	W-122 (Area 18, 19, 20, 21)
AMPHIBIOUS WARFARE (AMW)						
FIREX (Land)[nn]	CG, DDG (Navy)	5" guns (HE)	30 events (3,000 rounds)	30 events (3,000 rounds)	30 events (3,000 rounds)	Cherry Pt OPAREA (Firing point Area 15B; impact point is inland range at MCB Camp Lejeune Area G-10)

Table 2.2-4 Current and Proposed Operations Per Year in the Navy Cherry Point Study Area (Continued)

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
AMPHIBIOUS WARFARE (AMW) (… *continued*)						
FIREX(IMPASS)[oo]		5" guns (70 rounds/event [39 HE, 31 NEPM])	2 events (140 rounds, 78 HE, 62 NEPM)	2 events (140 rounds, 78 HE, 62 NEPM)	2 events (140 rounds, 78 HE, 62 NEPM)	Cherry Pt OPAREA (Area 4/5, 13/14) Figure 2.2-2
Amphibious Assault	1 LHA or LHD, 1 LPD, 1 LSD, 1 CG, up to 3 DDG & 2 FFG, with tailored MAGTF[pp]	11-14 amphibians (AAV/EFV or LAV/ LAR);4-8 landing craft (3-5 LCACs; 1-3 LCU); 22 aircraft (4 MH-53, 12 H-46/MV-22, 4 AH-1, 2 UH-1, 4 AV-8)	4 assaults[qq] (52 AAVs and LAVs, 144 LCACs, 96 LCUs, 36 MH-53, 64 H-46 or MV-22, 36 AH-1, 24 UH-1, 16 AV-8)	4 assaults (52 AAVs and LAVs; 144 LCACs, 96 LCUs, 36 MH-53, 64 H-46 or MV-22, 36 AH-1, 24 UH-1, 16 AV-8)	4 assaults (52 AAVs and LAVs; 144 LCACs, 96 LCUs, 36 MH-53, 64 H-46 or MV-22, 36 AH-1, 24 UH-1, 16 AV-8)	Onslow Bay (90% of operations occur in ESG operations box, extending from Onslow Beach seaward 25 nm into OPAREA 15[rr]
	1-3 amphibious ships (1 LHA or LHD, 1 LPD, 1 LSD), partial MAGTF	4-14 AAV/EFV or LAV/LAR; 2-8 LCAC/LCU; 22 aircraft (4 MH-53, 12 H-46/MV-22, 4 AH-1, 2 UH-1, 4 AV-8)	6 assaults[ss] (42 AAVs and LAVs; 28 LCACs, 8 LCUs, 18 MH-53, 32 H-46 or MV-22, 18 AH-1, 12 UH-1, 8 AV-8)	6 assaults (42 AAVs and LAVs; 28 LCACs, 8 LCUs, 18 MH-53, 32 H-46 or MV-22, 18 AH-1, 12 UH-1, 8 AV-8)	6 assaults (42 AAVs and LAVs; 28 LCACs, 8 LCUs, 18 MH-53, 32 H-46 or MV-22, 18 AH-1, 12 UH-1, 8 AV-8)	
Amphibious Raid	1-3 amphibious ships (1 LHA or LHD, 1 LPD, 1 LSD), reinforced company (100-150 Marines)	4-14 AAV/EFV or LAV/LAR; 2-8 LCAC/LCUs; and small boats; 22 aircraft (4 MH-53, 12 H-46 or MV-22, 4 AH-1, 2 UH-1, 4 AV-8	24 raids[tt] (72 AAV/EFV or LAVLAR; 120 LCACs; 24 LCUs; 36 MH-53, 36 H-46 or MV-22, 36 AH-1, 36 UH-1, 36 AV-8)	24 raids (72 AAV/EFV or LAVLAR; 120 LCACs; 24 LCUs; 36 MH-53, 36 H-46 or MV-22, 36 AH-1, 36 UH-1, 36 AV-8)	24 raids (72 AAV/EFV or LAVLAR; 120 LCACs; 24 LCUs; 36 MH-53, 36 H-46 or MV-22, 36 AH-1, 36 UH-1, 36 AV-8)	Onslow Bay (90% operations occur in ESG operations box, extending from Onslow Beach seaward 25 nm into OPAREA 15

Table 2.2-4 Current and Proposed Operations Per Year in the Navy Cherry Point Study Area
FOOTNOTES

a Shaded cells designate ordnance use with High Explosives (HE)
b Number of sorties decreased in Alt 1 to accommodate sorties for other new weapons systems
c Mine Warfare training would be for major exercises only and only for Alt 2. During notional 14 day exercise, four MH-53Es would fly two 3-hr missions/day and three MH-60S would fly three 2-hr missions/day. Temporary moored and bottom mine shapes (non-explosive, instrumented and non-instrumented expendable shapes) would be deployed during ESG and JTFEX; from beach to 3 nm, 50 bottom shapes and 20 moored shapes deployed; from 3-12 nm 20 bottom shapes, 5 moored shapes, and 10 VEMs.
d EOD events for the No Action Alternative and Alt 1 would occur anywhere in the UNDET area shown in Figure 2.2-1; Unit Level Training (ULT) events peformed in conjunction with other MIW training during major exercises; up to 10 expendable moored and bottom mine shapes/exercise; training would be segregated from other MIW training in UNDET area.
e EOD events for Alt 2 would occur only in the portion of the UNDET area co-located in the MIW training area as shown in Figure 2.2-1.
f Assume four bombs/events = 2F/A-18s dropping two MK-82 or GBU 30/38 JDAM each. Target is MK-58 marine marker (smoke float).
g Assume four bombs/events = 2 F/A-18s dropping 2 MK-83 each; target is MK-58
h F/A-18 (Navy), four bombs/event = two aircraft dropping two bombs each; all use MK-58 as target.
i F/A-18 (USMC), 8 bombs/event = 2 aircraft dropping 4 bombs each; all use MK-58 as target.
j F/A-18 (USN & USMC), 4 bombs/event= 2 F/A-18s dropping 2 bombs each; MK-58 as target
k F/A-18 (Navy), 10 bombs/event = 2 aircraft dropping 5 bombs each; MK-58 as target.
l F/A-18 (USMC), 24 bombs/event = 2 aircraft dropping 12 bombs each; MK-58 as target.
m AV-8, 12 bombs/event = 2 aircraft dropping 6 bombs each; MK-58 as target.
n Uses stationary or towed surface targets; one missile/sortie; missile detonates at or just below the water surface.
o Uses stationary or towed surface targets; one missile/sortie; missile detonates at or just below the water surface.
p MK-58 marine marker.
q Uses High-speed Maneuverable Towed (HSMT) target.
r Amphibious Assault Ship (LHA, LHD; Amphibious Transport Dock (LPD); dock Landing Ship (LSD); targets are 55-gal drum, balloon (weather, Mylar, or target), or FAST.
s Cruiser (CG); Guided Missile Destroyer (DDG)
t Targets are HSMST, MK-33 SEPTAR, trimaran or radar reflective surface balloon (Killer Tomato).
u Guided Missile Frigate (FFG)
v Targets are HSMT, MK-33, or Killer Tomato
w Targets are paper Echo Silhouette or barrel on a pallet.
x 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 target vessel.
y No ordnance launched during ACM; typical flight altitude 10K'-30K'.
z Live fire against banner (TDU-34) towed by CAS aircraft.
aa One missile/sorties; uses subsonic or supersonic drone target.
bb One missile/sortie; live fire on flare target.

cc Launch platform for six SM-2 missiles would be CG or DDG; launch platform for two Sea Sparrow missile would be LHA or LHD; targets for either missile would be BQM-74 launched from a Gulfstream aircraft or surface vessel.
dd Occurs during major exercises only; two-four aircraft sorties/event with five intercepts/sorties; no ordnance launched.
ee Both the Mid-Atlantic Electronic Warfare Range (MAEWR) and Commercial Air Services aircraft configured with EC pod provide the threat emitters.
ff Fast Combat Support Ship (AOE); nuclear-powered aircraft carrier (CVN)
gg Major exercises only
hh Would use MAEWR upgrade of coastal anti-ship missile system simulators; applies to both Alt 1 and Alt 2.
ii Major exercises only; offense jamming.
jj ULT and major exercises.
kk No sorties dedicated to chaff; 33% of ACM sorties and 10% of EC sorties use chaff.
ll No sorties dedicated solely to flares; 1% of EC sorties use flares.
mm High-speed Anti-Radiation Missile (HARM); target is stationary barge with elevated emitters intended to preclude barge destruction; missile detonates approximately 30-60 ft above the water.
nn Normally referred to as Firing Exercise (FIREX)
oo Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS).
pp Marine Air Ground Task Force (MAGTF)
qq Amphibious Assault Vehicle (AAV); Expeditionary Fighting Vehicle (EFV); Light Armored Vehicle (LAV); Light rr Amphibious Reconnaissance (LAR); Landing Craft Air Cushion (LCAC); Landing Craft Utility (LCU). Currently, the EFV is in Test and Evaluation phase of acquisition and will not be operational for several years.
rr Assumes one assault per major exercise; two assaults with up to 2,000 Marines and two assaults with 500-1,000 Marines; assume 13 AAV/LAV, 36 LCAC and 24 LCU round trips/assault.
ss 60% of operations occur within 12nm; 40% operations occurs outside 12 nm.
tt All Unit Level Training (ULT); two 3-ship amphibious landing rehearsals, each with 13 AAV/LAVs, 4 LCACs, 2 LCUs, 9 MH-53, 16 H-46 or MV-22, 9 AH-1, 6 UH-1, 4 AV-8 round trips/rehearsal, and four 1-ship events each with four AAV/LAVs, five LCACs, and one LCU round trips/event

Table 2.2-5 Summary of Proposed Changes in Annual Operations for All Alternatives in the Navy Cherry Point Study Area

Potential Stressors	No Action	Alternative 1		Alternative 2	
	(#/yr)	(#/yr)	(Change From No Action)	(#/yr)	(Change From No Action)
Vessel Movements					
Approx.steaming days/yr[8]	900	950	6%	950	6%
Aircraft Overflights					
Fixed-wing aircraft sorties/yr	3,415	3,755	10%	3,668	7%
Helicopters sorties/yr	829	878	16%	1,390	83%
Mine Warfare Devices Towed Through Water by Helicopters (MK-103, MK-105, AQS-24, AQS-20, and OASIS)					
Sorties/yr	220	192	-13%	576	162%
Temporary Mine Shapes (non-explosive; recoverable bottom, moored, VEM units)					
Mine shapes deployed/yr	0	0	NA[9]	315	NA
Munitions Use/Non-Explosive Practice Munitions (NEPM)					
Bombs/yr	654	720	10%	811	24%
Missiles, Hellfire, (Air-to-Surface)	1	2	100%	2	100%
Missiles, AIM-7 (Air-to-Air)	4	8	100%	8	100%
Cannon shells/yr (20-25 mm)	40,800	50,400	24%	50,400	24%
Naval gun shells/yr (5 in & 76mm)	1,259	1,392	11%	1,392	11%
Small caliber/yr (.50 cal)	130,430	187,240	44%	187,240	44%
RAMICS 30-mm rounds[10]	0	225	NA	675	NA
Underwater Explosions/ High Explosives (HE)					
Bombs: MK-82 or GBU-30/38/yr	92	92	0%	0	-100%
Bombs: MK-83 or GBU-32/yr	52	52	0%	0	-100%
Bombs: MK-84/yr	1	1	0%	0	-100%
Missiles: Hellfire (Air-to-Surface)	3	6	100%	6	100%
Missiles: TOW (Air-to-Surface)	4	8	100%	8	100%
Naval gun shells (5in) (FIREX with IMPASS/yr)	78	78	0%	78	0%
Naval gun shells (5 in) (FIREX into landside G-10 Range)	3,000	3,000	0%	3,000	0%
20 lb NEW charges/yr	20	20	0%	20	0%
Above Surface Explosions/High-Explosive (HE)					
Missiles: AIM-9 Sidewinder (Air-to-Air)	6	12	100%	12	100%
Missiles: HARM (Air-to-Surface)	6	8	33%	8	33%
Missiles: SM-2 (Surface-to-Air)	0	6	NA	6	NA
Missiles: Sea Sparrow (Surface-to-Air)	0	2	NA	2	NA
Expended Materials					
Ordnance related materials[11]	see footnote	see footnote		see footnote	
Targets/yr Marine Markers (M-58)	230	250	9%	250	9%
Targets/yr, Stationary or towed	90	110	22%	110	22%
Targets/yr, towed banners	15	20	33%	20	33%
Expendable mine shapes[12]	0	0	0%	30	NA
Chaff RR-144A canisters/yr	6,550	7,160	12%	7,160	12%
Chaff, MK-214 or 216/yr	396	444	12%	444	12%
Flares/yr	2,100	2,335	11%	2,335	11%

[8] Based on the number of events plus two days for travel to and from the range area as well as vessel movements within the individual range complexes. In the Navy Cherry Point Study Area, the Proposed Action covers vessel movements by Marine Corps boats and amphibious vehicles. 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 to include, but not limited to, storm evasion, deployment transits, and movements in the basin to rearrange for repairs/berthing/loading/off-loading from designated piers. 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.
[9] Not applicable due to the fact that denominator would be zero in order to calculate percent.
[10] Assumes 25 rounds per sortie
[11] Values are the same as those presented for weapons firing and ordnance use.
[12] Mine shapes deployed that will be in mine neutralization exercises (MINEX, RAMICS, AMNS).

Table 2.2-6 Summary of Ordnance Use by Training Area in the Navy Cherry Point Study Area

Training Area and Ordnance Type	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
Cherry Pt OPAREA and W-122			
Bombs (NEPM)/yr	654	720	811
Missiles (Surface-to-Air; HE; SM-2 and Sea Sparrow)/yr	0	8	8
Naval gun shells (non-explosive practice munitions [NEPM], 5 in and 76 mm)/yr	1,197	1,330	1,330
Cannon shells (20-25 mm)/yr	29,600	33,600	33,600
Small caliber (.50 cal, 9mm)/yr	58,430	67,240	67,240
Subtotal =	89,881	102,898	102,989
Cherry Pt OPAREA (Areas 4/5 and 13/14)			
Naval gun shells (NEPM, 5 in and 76 mm)/yr	62	62	62
Naval gun shells (high explosive [HE], 5 in and 76 mm)/yr	78	78	78
Subtotal =	140	140	140
Cherry Pt OPAREA (Areas 9, 10, 11, 12)			
Missiles, AIM-7 (NEPM)	4	8	8
Missiles, AIM-9 (HE)	4	8	8
Cannon shells (20-25 mm)/yr	4,000	4,800	4,800
Subtotal =	4,008	4,816	4,816
Cherry Pt OPAREA (Area 15B)			
Naval gun shells (explosive training rounds, 5 in)[13]	3,000	3,000	3,000
Cherry Pt OPAREA (Areas 16 and17)			
Missiles, Hellfire (HE and NEPM)	4	8	8
Missiles, TOW (HE)	4	8	8
Subtotal =	8	16	16
Cherry Pt OPAREA (Area 18)			
Bombs (HE)/yr	145	145	0
Cherry Pt OPAREA (Areas 18, 19, 20, 21)			
Missiles, HARM (HE)	6	8	8
W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17)			
Missiles, AIM-9 (HE)	2	4	4
Cannon shells (20-40 mm)	7,200	12,000	12,000
Small caliber (.50 cal, 7.62 mm, 5.56 mm, 9 mm, 308 cal, .45 cal)	72,000	120,000	120,000
Subtotal =	79,202	132,004	132,004
UNDET Area, Onslow Bay			
20 Lb NEW (HE)/yr	20	20	20
RAMICS, 30-mm rounds (NEPM)	0	225	675
Subtotal =	20	245	695
Total =	176,410	243,272	243,668

[13] Firing point only; impact point is on the land at MCB Camp Lejeune (Area G-10)

Table 2.2-7 Summary of Underwater Explosives and their Net Explosive Weights by Training Area in the Navy Cherry Point Study Area

Training Area and Ordnance Type	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
Cherry Pt OPAREA (Areas 4/5 and 13/14)			
Naval gun shells, 5 in (8 lbs NEW)	78	78	78
W-122 (Areas 16 and, 17)			
Missile, Hellfire (8 lbs NEW) (Air-to-Surface)	3	6	6
Missile, TOW (15.3 lbs NEW) (Air-to-Surface)	4	8	8
Cherry Pt OPAREA (Area 18)			
MK-82 (192.2 lbs NEW)	92	92	0
MK-83 (415.8 lbs NEW)	52	52	0
MK-84 (944.7 lbs NEW)	1	1	0
UNDET Area, Onslow Bay			
Explosive charges, 20 lbs NEW	20	20	20

Table 2.2-8
Comparison of Alternatives

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Bathymetry and Sediments	Short term, minor impacts in the surf zone from amphibious operations (landing craft and amphibians) (Section 3.1.3.1)	Short term, minor impacts in the surf zone from amphibious operations (landing craft and amphibians) (Section 3.1.3.2)	Short term, minor impacts in the surf zone from amphibious operations (landing craft and amphibians) (Section 3.1.3.3)
Marine Communities	Long-term minor impacts to benthic habitats from accumulation of Non-explosive Practice Munitions (NEPM) (Section 3.6.3.1)	Slight increase in potential impacts to benthic habitats from accumulation of NEPM and short term, minor impacts from deployment and recovery of MIW mine shapes considering mitigation measures in place (Section 3.6.3.2)	An increase in potential impacts to benthic habitat from accumulation of NEPM and an increase in short term minor impacts from deployment and recovery of MIW mine shapes (Section 3.6.3.3)

Table 2.2-8
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, 2,877 non-injurious potential exposures, and 65 injurious exposures. Under ESA, proposed activities may affect listed whale species. The proposed activities will have no effect on the manatee (Section 3.7.3.3).	Using acoustic modeling estimates for underwater explosions , no mortality potential exposures, 2,878 non-injurious potential exposures, and 65 injurious potential exposures. Under ESA, proposed activities may affect listed whale species. The proposed activities will have no effect on the manatee (Section 3.7.3.4).	Using acoustic modeling estimates for underwater explosions , no mortality potential exposure, 2 non-injurious potential exposures, and no injurious potential exposures. Under ESA, proposed activities may affect listed whale species. The proposed activities will have no effect on the manatee. The Navy has submitted to NMFS an application for a Letter of Authorization under MMPA and has initiated the ESA Section 7 formal consultation process with NMFS for listed whales. The Navy has submitted a Biological Evaluation to USFWS concluding that the proposed action would not affect manatees. The USFWS concurred (Section 3.7.3.5).
Sea Turtles	Using acoustic modeling estimates for underwater explosions, no mortality potential exposures, 137 non-injurious exposures, and 3 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, 137 non-injurious exposures, and 3 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 no injurious exposures. Under ESA, proposed activities may affect listed species. The Navy has initiated the ESA Section 7 formal consultation process with NMFS for listed sea turtles. (Section 3.8.3.4).
Fish	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level affects. (Section 3.9.3.1)	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level affects. (Section 3.9.3.2)	A limited number of fish would be injured or killed in the proximity of underwater explosions, but no population-level affects. (Section 3.9.3.3)
Essential Fish Habitat (EFH)	No adverse affect to EFH. Any impacts, mainly due to military expended materials, 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, mainly due to military expended materials, 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. Any impacts, mainly due to military expended materials, 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 2.2-8
Comparison of Alternatives and Effects (Continued)

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Alternative 2 (Preferred Alternative)
Seabirds and Migratory Birds	Vessel movements and high explosive detonations may affect, but not likely to adversely affect Bermuda petrels. Under ESA and MBTA, no effect would occur to other listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.1)	Vessel movements and high explosive detonations may affect, but not likely to adversely affect Bermuda petrels. Under ESA and MBTA, no effect would occur to other listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.2)	Vessel movements and high explosive detonations may affect, but not likely to adversely affect Bermuda petrels, although any effect would be less than the No Action Alternative and Alternative 1. Under ESA and MBTA, no effect would occur to other listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.3)
Atlantic Fleet Active Sonar Training (AFAST)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.19)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.19)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.19)

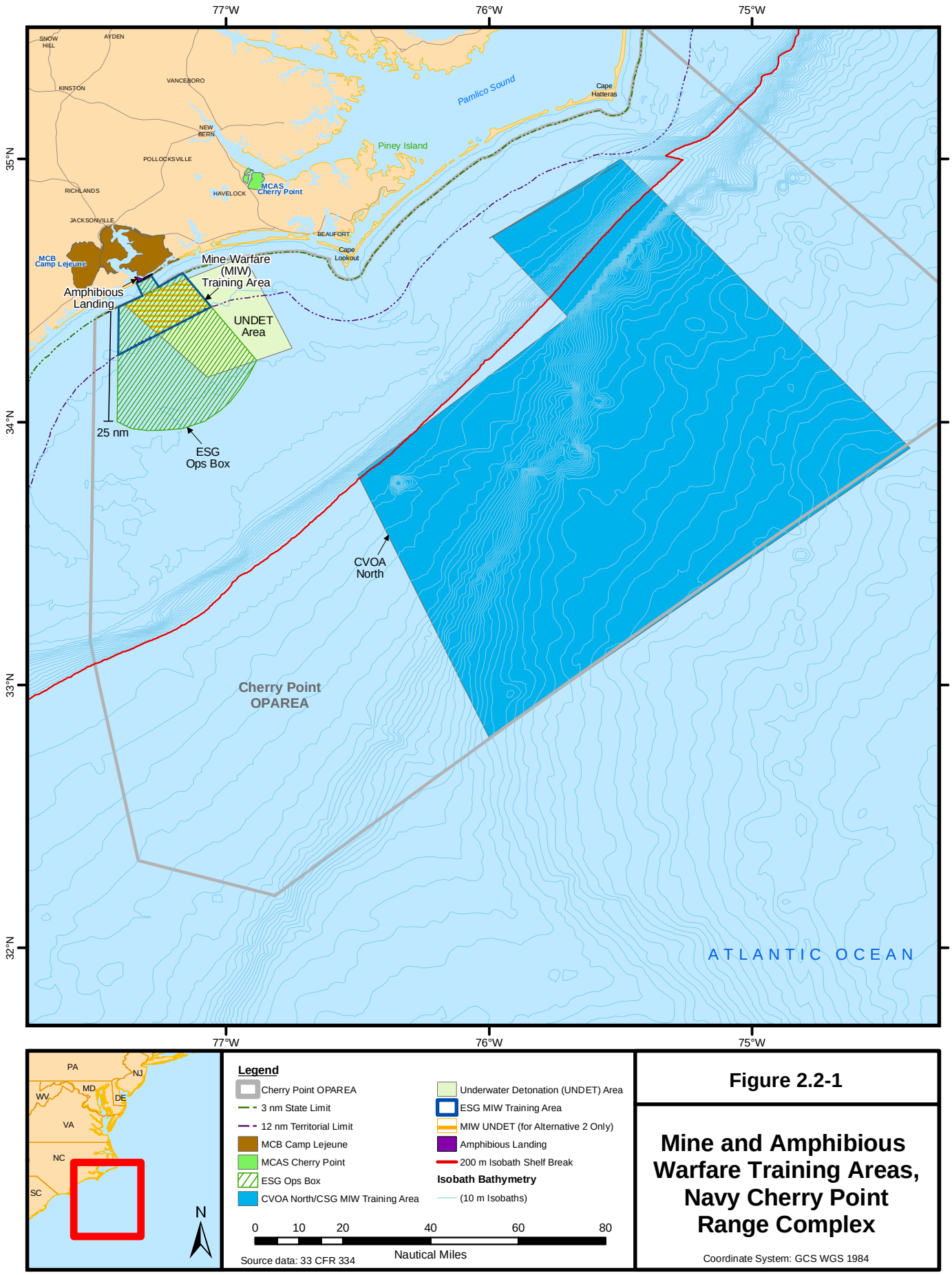


Figure 2.2-1

Mine and Amphibious Warfare Training Areas, Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

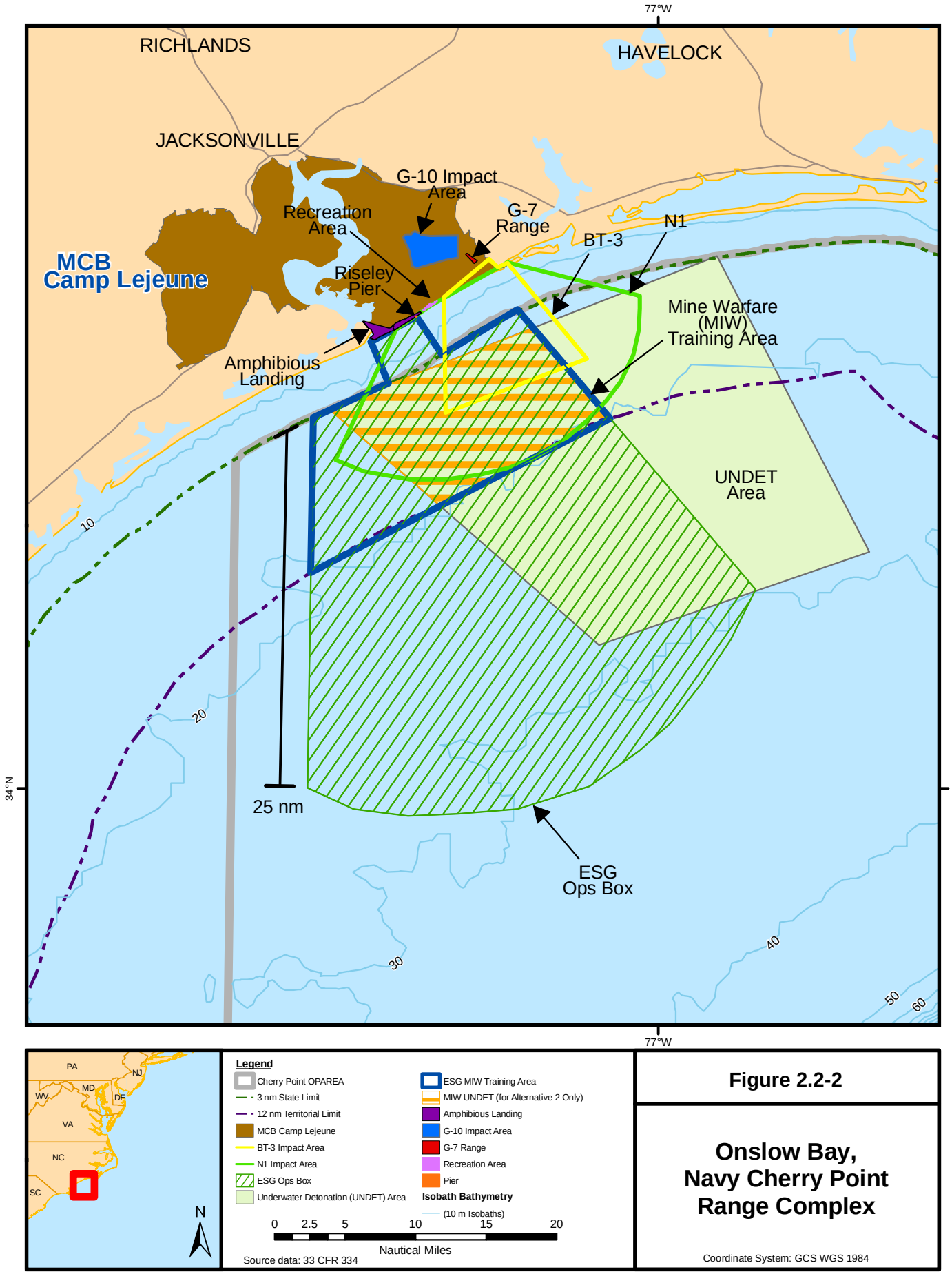


Figure 2.2-2

Onslow Bay, Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

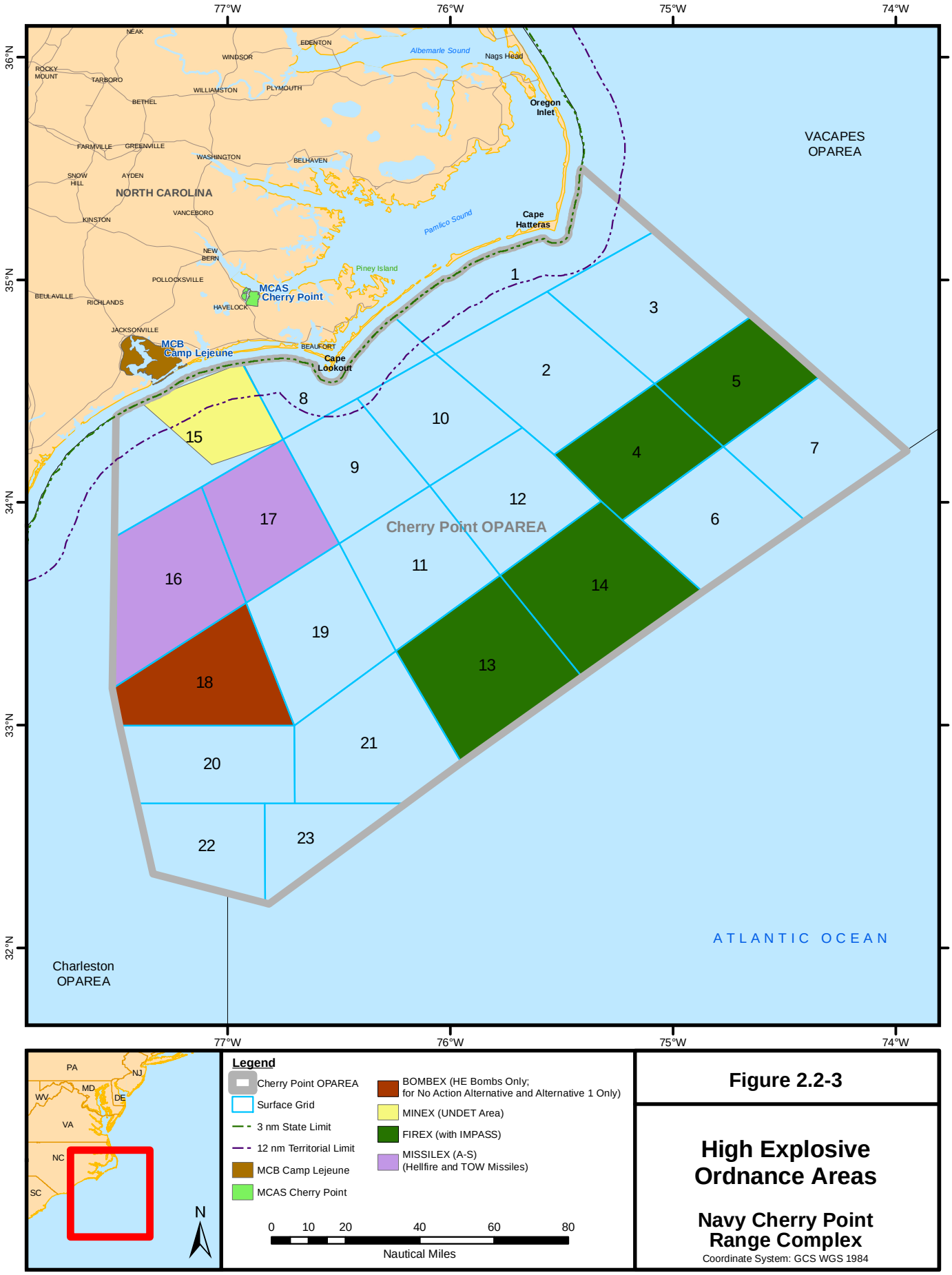


Figure 2.2-3

High Explosive Ordnance Areas

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

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CHAPTER 3 :AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes existing environmental conditions for resources potentially affected by the Proposed Action and alternatives described in Chapter 2. This chapter also identifies and assesses the environmental consequences of the Proposed Action and alternatives. The affected environment and environmental consequences are described and analyzed according to categories of resources. The categories of resources addressed in this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) are:

Table 3.1 Categories of Resources Chapter Locations

Resource	Section	Resource	Section
Bathymetry and Sediments	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	Sea Birds and Migratory Birds	3.10
Land Use	3.11	Cultural Resources	3.12
Transportation	3.13	Demographics	3.14
Regional Economy	3.15	Recreation	3.16
Environmental Justice	3.17	Public Health and Safety	3.18

In addition to the above-listed sections, impacts from environmental consequences associated with sonar use in the Cherry Point OPAREA are analyzed the AFAST EIS/OEIS and summarized in Section 3.19.

3.1 BATHYMETRY AND SEDIMENTS

3.1.1 Introduction and Methods

The bathymetry and sediments of an area are its general bottom features, soil, and sediments. These materials include sediments and rock outcroppings in the near-shore and open ocean underwater environment. Bathymetry is also referred to as seafloor topography. For this analysis, sediments will refer to the sediments, sand, organic matter, and minerals that accumulate at the bottom of a body of water. Soil includes minerals and organic matter capable of supporting plant life on the earth's surface, so this analysis will focus primarily on sediments, as the affected environment is offshore.

The Navy Cherry Point Range Complex lies in the northern portion of the south Atlantic bight, in the region just north of Cape Hatteras to waters slightly southwest of the New River. The northernmost point of the Cherry Point OPAREA is located just offshore of Salvo, North Carolina at 35°30'N, while the southernmost point is 113 nautical miles (nm) southeast of Cape Fear, North Carolina at 32°12'N. The easternmost point of the OPAREA lays 98 nm from Cape Hatteras, North Carolina at 73°57'W in waters greater than 13,120 feet deep. The Cherry Point OPAREA encompasses approximately 18,617 square nautical miles (nm^2) of the surface waters. The undersea space underlies and is coterminous with the surface space (Figure 1.1-1).

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 expended training munitions debris on the ocean bottom. The geographic dispersion of the proposed activities, and the resulting density of the debris, was the primary factor analyzed to determine potential impacts to bathymetry and sediments. A further consideration was the effect of decomposing debris on the ocean bottom sediments.

Data used for assessing the existing conditions for bathymetry and sediments come from the Cherry Point Marine Resource Assessment (MRA) (DoN, 2008) 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 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 were taken from the MRA for the Cherry Point OPAREA (the citations of the original sources were taken from the MRA, but those sources were not reviewed again for this EIS).

3.1.1.2 Warfare Areas and Associated 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, operations, 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 operations that introduced expended material and chemical contaminant items into the water. Table 3.1-1 shows the possible stressors that potentially could affect bathymetry and sediments.

Table 3.1-1 Summary of Potential Stressors to Bathymetry and Sediments[14]

Warfare Area and Operation	Training Area(s)	Inert Mine Shape Deployment/Recovery	Weapons Firing/ Non-explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)					
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)		✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)		✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)		✓	✓	✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA		✓	✓	✓

[14] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations; see Table 2.2-4 and Appendix D.

Table 3.1-1 Summary of Potential Stressors to Bathymetry and Sediments (Continued)

Warfare Area and Operation	Training Area(s)	Inert Mine Shape Deployment/Recovery	Weapons Firing/ Non-explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA		✓	✓	✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA		✓	✓	✓
MSO to include VBSS/MIO-Helo	Cherry Point OPAREA		✓	✓	✓
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)				✓
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)				✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)				✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA				✓
Air Intercept Control	W-122				✓
Electronic Combat (EC)					
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122				✓
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)				✓
Chaff Exercise- ship	Cherry Point OPAREA				✓
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)				✓
Strike Warfare (STW)					
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, 21)				✓
Amphibious Warfare					
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)				
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)		✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)				
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)				

In addition, Table 2.2-6 in Chapter 2 was developed to detail the expended materials that would result from each of the Alternatives. For each of the operations that expended 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 the analysis contained in the Hazardous Materials and Hazardous Waste Section (Section 3.2), combined with information provided in Chapters 1 and 2 of this EIS/OEIS, provided the data used in the analysis of the potential stressors to Bathymetry and Sediments.

3.1.2 Affected Environment

The general bottom features in the Navy Cherry Point Range Complex for bathymetry and sediments are shown in Figure 3.1-1 and Figure 3.1-2.

3.1.2.1 Bathymetry

At the shelf edge, the bottom drops abruptly to the continental slope. The continental slope, the most prominent physiographic feature along the mid-Atlantic continental margin, extends to water depths of between 6,560 and 13,120 feet. Within the Navy Cherry Point Range Complex, the continental shelf has an average depth of 120 feet and ranges in width from about 24 nm off Cape Hatteras to about 55 nm off of the New River. It has a seaward gradient of less than 1:1,000 (Hollister, 1973; Kennett, 1982). An abrupt increase in gradient (from 1:10 to 1:1,000) occurs at the "shelf break." The shelf break is the seaward limit of the continental shelf and the beginning of the continental slope. Another bathymetric feature is the Charleston bump where the sea floor is elevated, east of Charleston, South Carolina. Although it is a small feature, it affects both the flow of the Gulf Stream and the related marine communities.

Two larger canyons dissect the continental slope and continue as deep-sea channels on the continental rise; Pamlico (found in the southern end of the Virginia Capes Operating Area) and Hatteras (found in the northern part of the Navy Cherry Point Range Complex) (see Figure 3.1-1).

3.1.2.2 Sediments

The distribution of bottom sediments found on the continental shelf and slope of the south Atlantic bight are much more complex than in other areas (Johnson, 1987; Amato, 1994). The layers of sand and gravel covering the sea floor of the south Atlantic bight are much thinner than those found north of Cape Hatteras, probably due to the scouring action of the Gulf Stream. Most of the sediments found covering the continental shelf of the south Atlantic bight are well sorted, quartzite sand with a thin band of fine-grained sand and silt (Figure 3.1-2). Pockets or bands of gravel are typical of areas adjacent to or underlying the Gulf Stream (Hollister, 1973). Patches of sediments, especially coarse sand, are common on the continental shelf from Cape Roman north to Cape Hatteras (Pilkey *et al*., 1972). Coastal areas of North Carolina have varying sedimentation rates, leading to varying bottom composition.

Heavy sedimentation rates typify the area from Raleigh Bay northward while the low sedimentation and scouring by currents in southern North Carolina, especially in Onslow Bay, has led to the exposure of rock outcrops (Newton *et al*., 1971; Pilkey *et al.,* 1972). The bottom sediments south of Cape Hatteras contain from 5 to 50 percent calcium carbonate, increasing southward from Cape Hatteras until levels reach 50 to 100 percent on the Blake Plateau and Florida shelf (Amato, 1994). Although sand dominates the sediments of the continental shelf, the concentration of sand typically declines with water depth down the continental slope and rise, where clay and silt predominate. The sandy southern Carolina continental slope is somewhat atypical but, north of Cape Hatteras, silt and clay regains their dominance in continental slope sediments (Hollister, 1973).

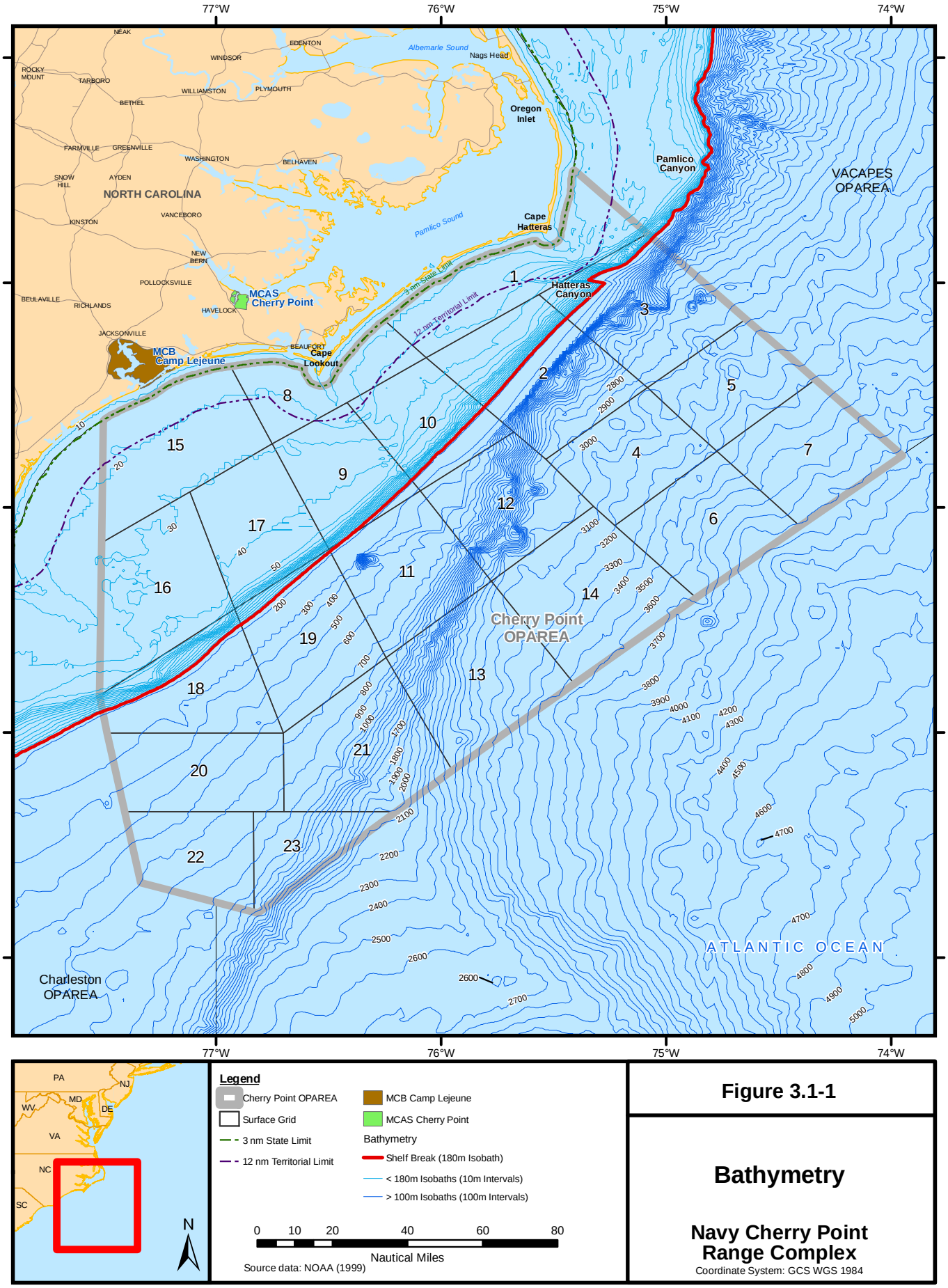


Figure 3.1-1

Bathymetry

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

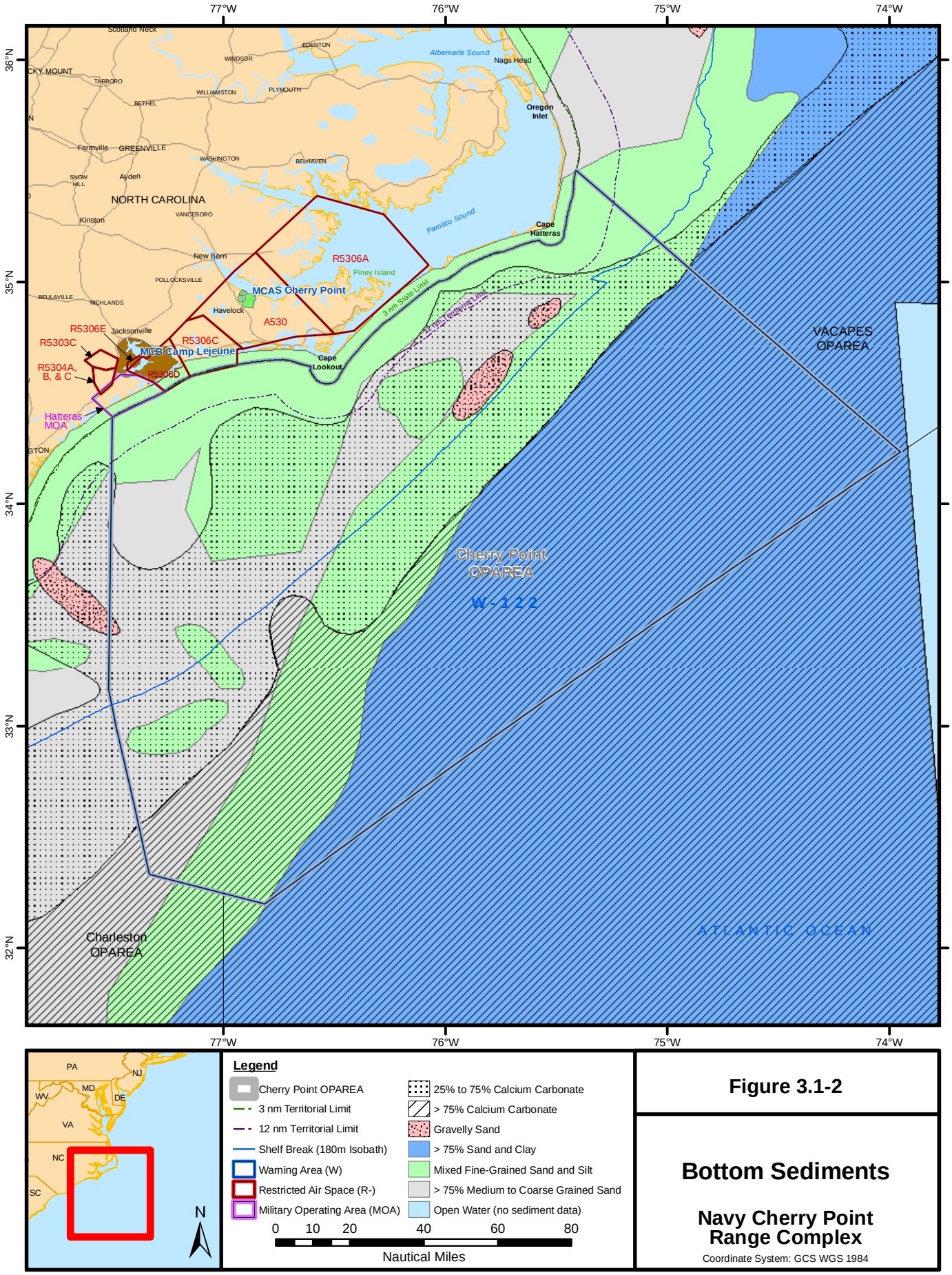


Figure 3.1-2

Bottom Sediments

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

Sediment stability is the degree to which the sediment bed would be mixed or eroded based on the physical characteristics of the sediments. If the stability is changed, natural processes such as wave action, or water flows could change the erosion or sediment deposition rates and then change the bathymetry of the area.

3.1.3 Environmental Consequences

The primary effect of the Navy and Marine Corps' training activities in the Navy Cherry Point Range Complex would be the explosions in the water and deposition of expended training materials on the ocean bottom and their accumulation over time. The numbers and sizes of explosions that are summarized in Table 2.2-7 were used to evaluate effects from explosions. Data from Tables 2.2-4, 2.2-5, 2.2-6, and 3.1-2 were used to determine the total amount 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.

The 2002 Biological Opinion on the Effects of Current Use and Modification of Training Areas, Dune Stabilization, and Continued Recreational Use of Onslow Beach, Marine Corps Base, Camp Lejeune (NMFS, 2002) made the following conclusions regarding the sand dunes on the beach:

> "Barrier islands and inlets are complex and dynamic coastal systems that are continually responding to sediment supply, waves, and fluctuations in sea level. The location and shape of the beaches of barrier islands perpetually adjusts to these physical forces. Waves that strike a barrier island at an angle, for instance, generate a longshore current that carries sediment along the shoreline. Cross-shore currents carry sediment perpendicular to the shoreline. Wind moves sediment across the dry beach, dunes and island interior. During storm events, overwash may breach the island at dune gaps or other weak spots, depositing sediments on the interior and backsides of islands, increasing island elevation and accreting the soundside shoreline.
>
> Tidal inlets play a vital role in the dynamics and processes of barrier islands. Sediment is transferred across inlets from island to island via the tidal shoals or deltas. The longshore sediment transport often causes barrier spits to accrete, shifting inlets toward the neighboring island. Flood tidal shoals that are left behind by the migrating inlet are typically incorporated into the soundside shoreline and marshes of the island, widening it considerably. Many inlets have a cycle of inlet migration, breaching of the barrier spit during a storm, and closure of the old inlet with the new breach becoming the new inlet. Barrier spits tend to be low in elevation, sparse in vegetation, and repeatedly submerged by high and storm tides."

Onslow Beach has instituted standard operating procedures designed to minimize the impacts of the use of the beach by military training vehicles and off road recreational vehicles (ORRV) to reduce unnatural sedimentation disturbance. These measures include the following:

1. Sandfencing will be erected in accordance with guidelines provided by the North Carolina Wildlife Resources Commission to achieve dune accretion.
2. ORRVs are prohibited from driving on vegetation, must stay seaward of posts positioned between the high tide line and the first line of vegetation, and must use only the two designated ingress/egress points to prevent damage to the dunes.
3. Dune construction (sand pushing) will be done in accordance with guidelines provided by Coastal Area Management Act (CAMA) and the U.S. Army Corps of Engineers.

4. Camp Lejeune will institute and maintain a beach Conservation Zone by installing posts to clearly mark the section of the fore dune where driving is permitted and where driving is prohibited. The following elements are included and are intended to maintain the validity of this system:
   a. Posts will be placed at intervals necessary to ensure that people operating vehicles unfamiliar with beach or sea turtle conservation cannot misinterpret the fact that entrance into the protected areas is prohibited;
   b. No vehicles will be allowed in segments of beaches where enough posts delineating permitted/prohibited areas are missing to create the situation where people operating vehicles unfamiliar with the beach or with sea turtle conservation can misinterpret the fact that entry into the Conservation Zone is prohibited;
   c. Vehicles needed to place and maintain permitted/prohibited area posts may not encroach into the protected areas. The Chief, Environmental Conservation Branch or his/her designee shall be present and shall supervise the use of auger equipment;
   d. From May 1 through November 15, all posting of permitted/prohibited driving areas will be checked by Camp Lejeune Environmental Conservation Branch personnel daily. Washed out or missing posts will be replaced within 24 hours of discovery;
   e. Prior to the establishment of the Conservation Zone, beginning in the year 2002 and at least annually thereafter, Camp Lejeune shall consult with the Service on the adequacy of the Conservation Zone, based upon the previous years' sea turtle nest data collection efforts and the experience of the previous years implementation effort (USFWS, 2002).

3.1.3.1 No Action Alternative

Explosions in the Water

Explosives would range from the 8-lb net explosive weight (NEW) charges in Hellfire missiles to the 944.7-lb NEW charges in the MK-84 bombs that would be dropped in bombing exercises. Figure 2.2-3 shows the various types and areas where explosive ordnance would be used.

All high-explosive (HE) MK-82, MK-83, and MK-84 bombs that would be dropped at sea would be used in areas of deep waters and would explode before reaching a depth that could damage the ocean floor or disturb deep sediments. Other HE explosives, including Hellfire missiles, TOW missiles, 5-inch rounds (FIREX with IMPASS) would also be used in deep water and explode near the surface. Therefore, explosions in deep marine waters of the Navy Cherry Point Study Area would not affect the bathymetry or sediments of the Study Area.

Each year, 20 explosions of charges up to 20-lb NEW would be conducted on the ocean bottom in shallow waters as part of mine neutralizations training exercises. Each charge would create a shallow depression in bottom sediments, and would suspend a substantial volume of sediment in the water column, causing a localized increase in turbidity. The turbidity increase would be short-lived, because larger particles would rapidly drop to the bottom and smaller particles would be dispersed by currents. Although the depressions would last longer, they would act as sediment traps, would soon be filled in, and would not have a lasting effect on bathymetry or sediments.

Deposition of Expended Training Materials

Tables 2.2-4, 2.2-5, and 2.2-6 provide details on the numbers and sizes of the training materials expended in each training area. Most at-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; however, these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport. Mine moorings, which are composed of 8 to 15 ft^3 of concrete, weighing 1,200 to 2,400 lbs, would have some temporary bottom

disturbance when dropped into the water from a boat. If the moorings get covered up or move due to currents, then the Navy would retrieve them and redeploy. 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 hazardous materials and hazardous constituents. Table 2.2-6 gives the detail of the sizes 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 Cherry Point OPAREA can be assessed in terms of the number of deposited items per unit area of bottom surface. A total of about 323,167 training items are currently expended in the Cherry Point OPAREA (see Table 3.1-2). Assuming an ocean floor area of about 18,617 nm^2, this amounts to approximately 17.4 items per nm^2 assuming an even distribution of operations (see Table 3.1-2). Section 3.2.3.1 includes a discussion of the fate and transport of materials in relation to the sea surface and ocean bottom.

Table 3.1-2 Training Materials in Navy Cherry Point Study Area

Number of Training Items	No Action	Alternative 1	Alternative 2
Entire Study Area (18,617 square nautical miles)			
Number of Items Proposed in the Entire OPAREA	323,167	448,210	448,186
Number of Items Per Square Nautical Mile	17.4	24.1	24.1
20 Year Aggregate Density Per Square Nautical Mile	348	482	482
Areas 4/5, 13/14 (3,361 square nautical miles)			
Number of Items Proposed in Areas 4/5, 13/14 [1/]	140	140	140
Number of Items Per Square Nautical Mile	0.04	0.04	0.04
20 Year Aggregate Density Per Square Nautical Mile (Naval gun shells including 5" and 76 mm)	0.8	0.8	0.8
Areas 9, 10, 11, 12 (2,936 square nautical miles)			
Number of Items Proposed in Areas 9, 10, 11, 12	4,008	4,816	4,816
Number of Items Per Square Nautical Mile	1.4	1.6	1.6
20 Year Aggregate Density Per Square Nautical Mile (Missiles (AIM 7 and AIM-9) and 20-25 Cannon shells	28	32	32
Areas 16, 17 (1,720 square nautical miles)			
Number of Items Proposed in Areas 16, 17	8	16	16
Number of Items Per Square Nautical Mile	0.005	0.01	0.01
20 Year Aggregate Density Per Square Nautical Mile (Hellfire and TOW Missiles)	0.1	0.2	0.2
Area 18 (820 square nautical miles)			
Number of Items Proposed in Area 18	145	145	0
Number of Items Per Square Nautical Mile	0.18	0.18	0
20 Year Aggregate Density Per Square Nautical Mile (MK-82, MK-83, and MK-84)	3.6	3.6	0
Cherry Point OPAREA (18, 19, 20, 21) (3,528 square nautical miles)			
Number of Items Proposed in Area 18, 19, 20, 21	6	8	8
Number of Items Per Square Nautical Mile	0.002	0.002	0.002
20 Year Aggregate Density Per Square Nautical Mile (HARM Missiles)	0.04	0.04	0.04
Warning Area 122 (1, 2, 3, 8, 9, 10, 15, 16, 17) (7,114 square nautical miles)			
Number of Items Proposed in Areas 1, 2, 3, 8, 9, 10, 15, 16, 17	151,202	252,004	252,004
Number of Items Per Square Nautical Mile	21.3	35.4	35.4
20 Year Aggregate Density Per Square Nautical Mile (AIM 9, 20-25 mm cannon shells, 50 cal. and 7.62 mm)	426	708	708

[1/] *See Figure 2.1-1*

Of the 323,167 training items, approximately 317,987 or 98 percent are cannon and small arms munitions such as 20 mm, 25 mm, .50 caliber, or 7.62 bullets. These munitions (including the case) are small, ranging from 2.75 to 5.5 inches in length (see Table 2.2-6). Due to the small size of the debris 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 expended from naval gunfire 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.

Expended training munitions debris 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 348 items per nm^2 (see Table 3.1-2). For some of the specific target areas where 5-inch guns, 76 mm shells, missiles, cannon shells, and bombs are utilized, the densities are considerable lower. In Areas 4/5 and 13/14, the aggregate density would be about 0.8 items per nm^2, and in Areas 9, 10, 11, and 12 the aggregate density would be about 28 items per nm^2. In Areas 16/17 the aggregate density would be about 0.1 items per nm^2 and for Area 18 the aggregate density would be 3.6 items per nm^2.

Each of these materials sinks to the ocean floor throughout the Cherry Point 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 territorial waters 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 military expended materials would be inert and thus, harmless, but some of the materials would consist of metals such as lead. In 2005, the Canadian Forces Maritime Experimental and Test Ranges (CFMETR) near Nanoose, British Columbia were analyzed for chemical effects associated with expendable components from activities involving sonobuoys, torpedoes, expendable mobile ASW training targets (EMATT), and auxiliary dry cargo carriers (ESG, 2005). These expended materials contain many of the same constituents as training materials used in the VACAPES OPAREA. In the CFMETR study, the analysis focused on lead, copper, lithium, and torpedo fuel.

The study found that metal constituents were most likely to concentrate in fine-grained particulate matter, especially when the particulate matter was smaller than 63 micrometers. The findings demonstrated that CFMETR operations did not cause a measurable effect on sediment quality (ESG, 2005). Based on a density of expended components in the Navy Cherry Point Study Area that would be lower than those in the CFMETR, military expended materials would not measurably affect sediment quality.

The stressor mine warfare deployment/recovery is created due to mine moorings, which are composed of 8-15 ft^3 of concrete, weighing 1,200-2,400 lbs, would have some temporary bottom disturbance when dropped into water from a boat. If the moorings get covered up or move due to currents, then the Navy would retrieve them and redeploy. With the small numbers of moorings, their small bottom footprint, and their temporary nature, these effects are not considered to be significant. The stressors of non-explosive practice munitions (NEPM), underwater detonations and high explosive ordnance, and military expended materials would not be expected to result in (based on the lower density of expended components in the Cherry Point OPAREA) either inert or toxic debris that would measurably affect sediment quality. This concentration of expended training munitions debris in territorial waters would have no impact on bottom topography and sediment quality under the No Action Alternative. This concentration of expended training munitions debris in non-territorial waters would not cause harm to bottom topography and sediment quality under the No Action Alternative.

In accordance with the NEPA, Navy training activities in territorial waters under the No Action Alternative would have no significant impact to bathymetry and sediment. In accordance with EO 12114, Navy training activities in non-territorial waters would not cause harm to bathymetry or sediment.

3.1.3.2 Alternative 1

Explosions in the Water

Explosives would range from the 8-lb NEW charges in Hellfire missiles to the 944.7-lb NEW charges in the MK-84 bombs that would be dropped in bombing exercises.

All HE MK-82, MK-83, and MK-84 bombs that would be dropped at sea would be used in areas of deep waters and would explode before reaching a depth that could damage the ocean floor or disturb deep sediments. Other HE explosives used under Alternative 1, including Hellfire missiles, TOW missiles, and 5" rounds from FIREX (with IMPASS) would be used in deep water and explode near the surface. Therefore, explosions in deep marine waters of the Navy Cherry Point Study Area would not affect the bathymetry or sediments of the Study Area.

Each year, 20 explosions of charges up to 20-lb NEW would be conducted on the ocean bottom in shallow waters as part of mine neutralizations training exercises. Each charge would create a shallow depression in bottom sediments, and would suspend a substantial volume of sediment in the water column, causing a localized increase in turbidity. The turbidity increase would be short-lived, because larger particles would rapidly drop to the bottom and smaller particles would be dispersed by currents. Although the depressions would last longer, they would act as sediment traps, would soon be filled in, and would not have a lasting effect on bathymetry or sediments.

Deposition of Expended Training Materials

The aggregate effects of expended materials from training activities on ocean bottom sediments in the Cherry Point OPAREA can be assessed in terms of the number of deposited items per unit area of bottom surface. A total of about 448,210 training items would be expended under Alternative 1. Assuming an ocean floor area of about 18,617 nm^2, this would be about 24.1 items per nm^2 (see Table 3.1-2).

Of the 448,210 training items, approximately 442,803 or 98 percent are cannon and small arms munitions such as 20 mm, .50 caliber, or 7.62 bullets. These munitions (including the case) are small, ranging from 2.75 to 5.5 inches in length (see Table 2.2-6). Due to the small size of the debris 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 expended from naval gunfire 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.

Expended training munitions debris 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 debris on the ocean floor would be about 482 items per nm^2 (see Table 3.1-2). For some of the specific target areas where 5-inch guns, 76 mm shells, missiles, cannon shells, and bombs are utilized, the densities are considerable lower. In Areas 4/5 and 13/14, the aggregate density would be about 0.8 items per nm^2, and in Areas 9, 10, 11, and 12 the aggregate density would be about 32 items per nm^2. In Areas 16/17 the aggregate density would be about 0.2 items per nm^2 and for Area 18 the aggregate density would be 3.6 items per nm^2.

The stressor mine warfare deployment/recovery is created due to mine moorings would remain at 420 units; the same as the No Action Alternative. NEPM, underwater detonations and high explosive ordnance, and military expended materials' (and associated stressors) debris would settle to the ocean

bottom and would be covered by sediment deposition over time. Most of the expended training munitions debris would be inert, and thus harmless, but some of the debris would consist of toxic metals such as lead. Neither inert nor toxic debris at this density would measurably affect sediment quality. At Onslow Beach the presence of training exercises, to include the use of amphibious vehicles, has existing mitigations in place as outlined in the No Action Alternative. There are not expected to be any impacts to sediment displacement due to the existing mitigations and the fact that the disturbed areas would recover quickly through natural sedimentation processes.

As described in the No Action Alternative, neither bullets and shells nor larger pieces from other military expended materials would affect sediment stability, and they eventually would be covered with sediment and incorporated into the ocean floor. Based on the studies at the CFMETR, the volume of military expended materials that would result from Alternative 1 would not measurably affect sediment quality.

In accordance with the NEPA, Navy training activities in territorial waters under Alternative 1 would have no significant impact to bathymetry or sediment. In accordance with EO 12114, Navy training activities in non-territorial waters would not cause harm to bathymetry or sediment.

3.1.3.3 Alternative 2 (Preferred Alternative)

Explosions in the Water

Under Alternative all BOMBEX training would be eliminated. Therefore, there would be no impact to bathymetry and sediments from HE bombs under this alternative. Other HE explosives would still be used under this alternative. Hellfire and TOW missiles and 5-inch HE rounds would be used in deep water and explode at or near the surface of the water. Therefore, explosions in deep marine waters of the Navy Cherry Point Study Area would not affect the bathymetry or sediments of the Study Area.

Each year, 20 explosions of charges up to 20-lb NEW would be conducted on the ocean bottom in shallow waters as part of mine neutralizations training exercises. Each charge would create a shallow depression in bottom sediments, and would suspend a substantial volume of sediment in the water column, causing a localized increase in turbidity. The turbidity increase would be short-lived, because larger particles would rapidly drop to the bottom and smaller particles would be dispersed by currents. Although the depressions would last longer, they would act as sediment traps, would soon be filled in, and would not have a lasting effect on bathymetry or sediments.

Deposition of Expended Training Materials

The aggregate effects of expended materials from training activities on ocean bottom sediments in the Cherry Point OPAREA can be assessed in terms of the number of deposited items per unit area of bottom surface. A total of about 448,186 training items would be expended under Alternative 2. Assuming an ocean floor area of about 18,617 nm^2, this would be about 24.1 items per nm^2 (see Table 3.1-2).

Of the 448,186 training items, approximately 442,833 or 99 percent are cannon and small arms munitions such as 20 mm, .50 caliber, or 7.62 bullets. These munitions (including the case) are small, ranging from 2.75 to 5.5 inches in length (see Table 2.2-6). Due to the small size of the debris 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 expended from naval gunfire 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.

Expended training munitions debris 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 debris on the ocean floor would be about 482 items per

nm^2 (see Table 3.1-2). For some of the specific target areas where 5-inch guns, 76 mm shells, missiles, cannon shells, and bombs are utilized, the densities are considerable lower. In Areas 4/5 and 13/14, the aggregate density would be about 0.8 items per nm^2, and in Areas 9, 10, 11, and 12 the aggregate density would be about 32 items per nm^2. In Areas 16/17 the aggregate density would be about 0.2 items per nm^2 and for Area 18 the aggregate density would be 0 items per nm^2.

NEPM, underwater detonations and high explosive ordnance, and military expended materials (and associated stressors) would experience slight increases of debris which would settle to the ocean bottom and would be covered by sediment deposition over time. Debris would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the expended training munitions debris would be inert, and thus harmless, but some of the debris would consist of toxic metals such as lead. Neither inert nor toxic debris at this density would measurably affect sediment quality. This concentration of expended training munitions debris in territorial waters would have no impact on bottom topography and sediment quality under Alternative 2. This concentration of expended training munitions debris in non-territorial waters would not cause harm to bottom topography and sediment quality under Alternative 2. At Onslow Beach the presence of training exercises, to include the use of amphibious vehicles, has existing mitigations in place as outlined in the No Action Alternative. There are not expected to be any impacts to sediment displacement due to the existing mitigations and the fact that the disturbed areas would recover quickly through natural sedimentation processes.

Mine Warfare Training Area Establishment (Non-Explosive Mine Shape Deployment/Recovery)

The stressor of mine warfare deployment/recovery is created due to mine moorings that would remain at 420 units; the same as the No Action Alternative and Alternative 1. As discussed in Chapter 2, a littoral Mine Warfare Training Area would be designed in nearshore waters in Onslow Bay under Alternative 2 (Figure 2.2-1). This section addresses potential effects on sediments associated with establishing and maintaining these training areas (i.e., non-explosive mine shape deployment/recovery). The potential effects of Mine Warfare Training Area establishment would be associated with deployment and recovery of non-explosive mine shapes.

As discussed in Chapter 2, the mine shape assembly would include a concrete anchor, mooring line (steel cable or chain), and the non-explosive training mine shape. Up to 105 non-explosive training mine shapes would be temporarily placed in the training area. The entire assembly (non-explosive training mine shape, mooring line, and anchor) would be deployed concurrently from a boat or aircraft and recovered following the exercise (usually within 7 to 30 days). Mine moorings, which are composed of 8-15 ft^3 of concrete, weighing 1,200-2,400 pounds, would have some temporary bottom disturbance when dropped into water from a boat. If the moorings get covered up or move due to currents, then the Navy would retrieve them and redeploy.

Initiation of this exercise would result in slight increases in local turbidity or create shallow depressions in bottom sediments; however, these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport. With the small numbers of moorings, their small bottom footprint, and their temporary nature, these effects are not considered to be significant.

As described in the No Action Alternative, neither bullets and shells nor larger pieces from other military expended materials would affect sediment stability, and they eventually would be covered with sediment and incorporated into the ocean floor. Based on the studies at the CFMETR, the volume of military expended materials that would result from Alternative 1 would not measurably affect sediment quality.

In accordance with the NEPA, Navy training activities in territorial waters under Alternative 2 would have no significant impact to bathymetry or sediment. In accordance with EO 12114, Navy training activities in non-territorial waters would not cause harm to bathymetry or sediment.

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 and Sediments 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 and Sediments resources would not cause harm.

Table 3.1-3 Summary of Environmental Effects of the Alternatives on the Bathymetry and Sediments in the Navy Cherry Point Study Area

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Mine Warfare Deployment/Recovery	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.
Weapons Firing/Non-explosive Practice Munitions		
Underwater Detonations and High Explosive Ordnance		
Military Expended Materials		
Impact Conclusion	The environmental effects of the No Action Alternative on Bathymetry and Sediments resources would have no impact in U.S. territory.	In non-territorial waters, the environmental effects of the No Action Alternative on Bathymetry and Sediments resources would not cause harm.
Alternative 1		
Mine Warfare Deployment/Recovery	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.
Weapons Firing/Non-explosive Practice Munitions		
Underwater Detonations and High Explosive Ordnance		
Military Expended Materials		
Impact Conclusion	The environmental effects of Alternative 1 on Bathymetry and Sediments resources would have no impact in U.S. territory.	In non-territorial waters, the environmental effects of Alternative 1 on Bathymetry and Sediments resources would not cause harm.
Alternative 2		
Mine Warfare Deployment/Recovery	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.
Weapons Firing/Non-explosive Practice Munitions		
Underwater Detonations and High Explosive Ordnance		
Military Expended Materials		
Impact Conclusion	The environmental effects of Alternative 2 on Bathymetry and Sediments resources would have no impact in U.S. territory.	In non-territorial waters, the environmental effects of Alternative 2 on Bathymetry and Sediments resources would not cause harm.

3.2 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

3.2.1 Introduction and Methods

This section addresses hazardous and non-hazardous components of the training operations described in this EIS/OEIS. Some items such as fuels, adhesives, and solvents required for maintenance and operation of vessels, machinery, and equipment are used by the Navy as well as by other organizations and individuals. Other items such as missiles and chaff are only used in military activities. Terms used to describe various items throughout this section are discussed below:

Military Expended Material (MEM) – Military expended material (MEM) refers to those munitions, items, devices, equipment and materials which 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.

According to a 2008 report compiled by the Interagency Marine Debris Coordination Committee (IMDCC), MEM from Navy training and testing missions is not considered a significant source of marine debris (IMDCC, 2008). In addition, an annual report from the Ocean Conservancy further details the main sources of marine debris resulting from the 2007 International Coastal Cleanup effort, with shoreline/recreational activities and smoking-related activities accounting for more than 90% of marine pollution worldwide (Ocean Conservancy, 2007). More specifically, the report states that land based activities in North Carolina, including picnics, festivals, sporting events, beach outings, and litter runoff from parking lots, streets, and storm drains account for more than 58% of marine pollution. Smoking–related products accounted for an additional 32% of all marine debris collected in North Carolina. In summary, neither of these studies point to the Navy as a primary contributor to the marine debris problem.

In addition to recovering spent training and testing materials whenever possible, proactive Best Management Practices (BMPs) instituted by the Navy play a crucial role in reducing or eliminating the amount of expended materials introduced into the environment. The Navy P2 Afloat Program details many pollution prevention practices, including shipboard recycling programs, use of non-polluting technologies and materials, reducing excess packaging materials, and eliminating expended plastics through the use of shipboard Plastic Waste Processors (http://205.153.241.230/p2_documents/ navy.html). In summary, this study does not point to the Navy as a primary contributor to the marine debris problem.

Military Expended Material Constituent (MEMC) – Any constituent released into the environment from the use of MEM is considered a military expended material constituent (MEMC). MEMC includes constituents from explosive and non-explosive materials and the emission, degradation, or breakdown products from such MEM.

Non-hazardous Components – 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 they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.

Hazardous Material – Hazardous materials are chemical substances that pose a risk 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, photographic materials, and chemicals and may be found in munitions and MEM. Hazardous materials are also used in munitions and targets because they are strong, lightweight, reliable, long-lasting, or low-cost.

Munitions Constituents – Materials originating from unexploded ordnance, expended military munitions, or other military munitions, including explosive and non-explosive materials and emission, degradation, or breakdown products of such ordnance and munitions, are called munitions constituents. Component hazardous materials are considered munitions constituents when missiles, munitions, and targets are used. Components that contain hazardous constituents include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads. Each constituent has the potential to affect human health and the environment through direct contact with individuals, water, soil, or air.

Hazardous Constituents – Hazardous constituents can generally be defined as hazardous materials present at low concentrations in a generally non-hazardous matrix, so their hazardous properties do not produce acute effects. The USEPA and the DoD have identified numerous waste streams from Navy and Marine Corps ships, boats, and amphibious vehicles that do or may contain hazardous constituents. Waste streams from Navy and Marine Corps ships, boats, and amphibious vehicles that may contain hazardous constituents include hull coating leachate, bilgewater/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.

Hazardous Waste – A hazardous waste may cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or pose a present or potential risk to human health or the environment when improperly treated, stored, transported, disposed, or otherwise managed. 40 CFR 260, *et seq*. codifies the Resource Conservation and Recovery Act (RCRA) and provides federal requirements for management of hazardous wastes. Individual states may also have specific regulations for hazardous waste management RCRA applicability ends at the shoreline.

Non-explosive, Practice Munitions (NEPM) – A term used when describing most common types of practice ordnance. NEPM in the OPAREA, including non-explosive training bombs, naval gun shells and missiles, quickly sink to the ocean floor where they cause very local disturbances without long term impacts. Over a long period of time, benthic organisms and marine communities use these items as hard substrate and develop localized communities. Refer to Section 3.6.3 Marine Communities and 3.9 Fish and Essential Fish Habitat for more information.

Military Munitions Rule – Military munitions are not considered hazardous waste under conditions stated in the USEPA Military Munitions Rule and the DoD Policy to Implement the EPA's Military Munitions Rule (1 July 1998). The Military Munitions Rule clarifies when conventional and chemical military munitions become a solid waste, which then may be regulated as hazardous waste under RCRA. Military munitions are not a waste when used for their intended purpose on an operational range. Military munitions on an operational range, when used for their intended purpose, are not considered a waste when recovered, collected, and destroyed during range clearance operations.

Used hazardous materials and chemical byproducts generated at sea are not considered hazardous waste until offloaded at port. Environmental compliance policies and procedures applicable to shipboard operations afloat are defined in applicable naval operations instruction manuals. These instructions 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.

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

3.2.1.1 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this EIS/OEIS includes several warfare areas (*e.g.,* Mine Warfare, Air Warfare, Surface Warfare, *etc*.) and most warfare areas include multiple types of training operations (*e.g.,* Surface-to-Air Gunnery Exercise, Surface-to-Air Missile Exercise, *etc*.). Likewise, several activities (*e.g.,* weapons firing, target deployment, *etc*.) are accomplished under each operation. Furthermore, MEM (*e.g.,* bombs, missiles, small caliber ammunition, marine markers, *etc*.) are common to multiple activities.

To address potential impacts, the approach to analysis includes characterizing the yearly test and training operations that may contribute MEM and MEMC to the Navy Cherry Point Study Area ocean environment. This section of the EIS/OEIS reviews the MEM and MEMC associated with training on the ocean range. Specific MEM categories analyzed include: bombs, missiles, targets and countermeasures, marine markers (smoke floats), naval gun ammunition, smalls arms and close-in weapons system ammunition, chaff, flares, lightsticks, and underwater detonations. For each category, a general description and quantity used is presented and followed by the anticipated "fate and transport" of the item. The "fate and transport" section describes what is expected to happen to the MEM and MEMC once introduced into the environment.

Study Area

In this EIS/OEIS, the MEM and MEMC study area is the same as the Navy Cherry Point Study Area defined in Section 1.5.

Data Sources

Prior Environmental Assessments, EISs, Marine Resource Assessments, studies, databases, and websites were reviewed. Numerous federal, state, and local regulations governing the handling, storage, and disposal of waste and hazardous materials (see Appendix K) were also researched.

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 the Navy Cherry Point Study Area operations. Table 3.2-1 provided below presents identified MEM stressors and their association with specific operations that would occur within the Navy Cherry Point Study Area. Checkmarked cells in

Table 3.2-1 indicate that MEM is associated with the operation and that activities and associated training item(s) are carried forward for detailed analysis in this EIS/OEIS.

Table 3.2-1 Potential Stressors Associated with Military Expended Material[15]

Warfare Area and Operation	Training Area(s)	Inert Mine Shape Deployment/Recovery	Weapons Firing/ Non-explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)					
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓		
Mine Neutralization	Onslow Bay UNDET Area	✓		✓	✓
Surface Warfare (SUW)					
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)		✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)		✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10,, 15, 16, 17)		✓	✓	✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA		✓	✓	✓
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA		✓	✓	✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA				
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA				
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)				
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)		✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)		✓		✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA				✓
Air Intercept Control	W-122		✓		✓
Electronic Combat (EC)					
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122				
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)				✓
Chaff Exercise- ship	Cherry Point OPAREA				✓
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)				✓

[15] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations, see Table 2.2-4 and Appendix D.

Table 3.2-1 Potential Stressors Associated with Military Expended Material (Continued)

Warfare Area and Operation	Training Area(s)	Inert Mine Shape Deployment/Recovery	Weapons Firing/ Non-explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Strike Warfare (STW)					
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Area 18, 19, 20, 21)		✓	✓	✓
Amphibious Warfare (AMW)					
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)		✓	✓	✓
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)		✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)				
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)				

3.2.2 Affected Environment

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 materials leaks and spills—especially of petroleum products—affect 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 a given time, nor on their distribution among the various categories of vessels.

Navy and Marine Corps ships, boats, and amphibious vehicles present within the Navy Cherry Point Study Area 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 Navy Cherry Point Study Area. Navy and Marine Corps operations 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.

Hazardous waste is present within the Navy Cherry Point Study Area, 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

Navy ships may not discharge overboard untreated used or excess hazardous material generated onboard the ship within 200 nm of shore. Ships retain used and excess hazardous material on board for shore disposal. Ships offload used hazardous material within five working days of arrival at a Navy port. The 2005 Hazardous Materials Minimization, Hazardous Waste Reutilization and Disposal Guide, available online at 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 Manual, which establishes Navy policy, guidance, and requirements for the operation of Navy and Marine Corps ships, boats, and amphibious vehicles. The vessels operating in the Navy Cherry Point Study Area would comply with the discharge requirements, minimizing or eliminating potential impacts from discharges from ships.

If a fuel spill occurs, the effects would be mitigated through compliance with standard spill-control responses and wildlife rescue procedures.

Navy ships may not discharge overboard untreated used or excess hazardous material generated onboard the ship within 200 nm of shore. Ships retain used and excess hazardous material on board for shore disposal. Ships offload used hazardous material within five working days of arrival at a Navy port. The 2005 Hazardous Materials Minimization, Hazardous Waste Reutilization and Disposal Guide, available online at 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 (33 U.S.C. 1901 to 1915) and the Federal Water Pollution Control Act (33 U.S.C. 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 Manual, which establishes Navy policy, guidance, and requirements for the operation of Navy vessels. The vessels operating in theVACAPES Range Complex would comply with the discharge requirements, minimizing or eliminating potential impacts from discharges from ships.

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 generally evaporates from the surface of water within 24 hours, 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.

Tables 2.2-4 and 2.2-5 list quantities of MEM by Navy range operation and training activity used during exercises at the Navy Cherry Point Study Area. Appendix D contains detailed weapons system descriptions. MEM and associated MEMC can leak or leach small amounts of toxic substances into the water as they degrade and decompose (see Table 3.2-2). These items decompose very slowly, so the volume of MEM 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 the expended material increase over time. Sediment transport via currents can eventually disperse these contaminants where they will be present at very low concentrations and, thus, are anticipated to have minimal effect on the environment. MEM and MEMC are described in subsequent paragraphs.

Table 3.2-2 Munitions Constituents of Potential Concern

Training Application/ Munitions Element	Munitions Constituent
Pyrotechnics Tracers Spotting Charges	Barium chromate Potassium perchlorate Chlorides Phosphorus Titanium compounds
Oxidizers	Lead oxide
Delay Elements	Barium chromate Potassium perchlorate Lead chromate
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 cyclotrimethylenetrinitramine (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: U.S. Navy Range Sustainability Environmental Program Assessment Policy Implementation Manual, November 2006*

Bioaccumulation, or the building up of a substance in the systems of living organisms (and thus, a food chain) due to ready solubility in living tissues, is not anticipated to be an issue when MEM or MEMC are introduced into the water. Although aquatic food chains are capable of accumulating certain

environmental contaminants to toxic concentrations, MEM and MEMC from Navy activities are not expected to contribute to bioaccumulation in the Study Area. In general, at least three properties are required for a contaminant to bioaccumulate in an aquatic food chain: 1) a high octanol-water partition coefficient, 2) chemical and metabolic stability in water and in organisms in the food chain, and 3) a low toxicity to organisms in the chain so that the chain is not broken by loss of an intermediate species. Most chemicals and metals introduced to the aquatic environment by environmental contamination (including Navy MEM and MEMC) fail to meet these requirements (Clarkson, 1995). Further, due to the expansive area of seaspace in the Cherry Point OPAREA, tidal surge and longshore currents, and sediment disturbance from ship traffic and other sources, MEM and MEMC would not provide a measurable contribution to bioaccumulation within the food chain of species found in the OPAREA. Consequently, the process of bioaccumulation or its effects are not further analyzed in this EIS/OEIS.

This EIS/OEIS does not contain MEM associated with sonar training. The Navy is currently preparing 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 AFAST EIS/OEIS is provided in Section 3.19, Summary of Sonar Effects.

3.2.3.1 No Action Alternative

Navy training operations conducted under the No Action Alternative use a variety of materials. Materials required on the Navy Cherry Point Study Area are broadly classified as shipboard materials necessary for normal operations and maintenance, such as fuel and paint and MEM. MEM includes both high explosive and non-explosive practice munitions.

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 Navy Cherry Point Study Area.

Bombs

Typically, bombing exercises (BOMBEX) at sea involve one or more aircraft bombing a target simulating a hostile surface vessel. Bomb bodies are steel and the bomb fins are either steel or aluminum. Based on the American Society for Testing and Materials (ASTM) standards specified for bomb construction, each of the iron bomb bodies or steel fins may also 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 (DoN, 2005d). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Practice bombs, also called bomb dummy units (BDU), are bomb bodies filled with an inert material (*e.g.,* concrete). A BDU mimics the weight, size, center of gravity, and ballistics of a high explosive bomb. Non-explosive practice mine shapes are similar in composition to BDUs—pieces of concrete or steel cases formed in the shape of a mine filled with concrete. Both could be used within the Navy

Cherry Point Study Area. These practice munitions may contain spotting charges/signal cartridges that produce a visual indication of impact.

Bombs used at the Navy Cherry Point Study Area during the No Action Alternative and their approximate weight, length, and diameter are provided in Table 3.2-3.

Table 3.2-3 Bombs Deployed Under the No Action Alternative on the Navy Cherry Point Study Area

Bomb Type	Type	Net Explosive Weight (NEW) (lbs)	~Length (feet)	~Diameter (inches)
MK-82 or GBU-30/38	High Explosive	192.2	7.5	11
MK-83 or GBU-32	High Explosive	415.8	9.9	14
MK-84	High Explosive	944.7	12.8	18
MK-76	Non-explosive Practice (also used as mine shape)	n/a	2.1	4
BDU-45	Non-explosive Practice (also used as mine shape)	n/a	5.5	11

Eighteen percent of the 799 bombs dropped in the No Action Alternative exercise at the Navy Cherry Point Study Area are high explosive. Bombs with high explosive ordnance would be 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, 2005b). Propelled fragments would be produced by an exploding bomb.

Eighty two percent of the bombs used in the No Action Alternative Navy Cherry Point Study Area exercises would be practice bombs without explosive warheads.

Bombs Fate and Transport

Small fragments of detonated bombs would settle to the sea floor. Unrecovered 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. Due to the large ocean area of the Navy Cherry Point Study Area, expended ordnance scattered on the ocean floor would be widespread and have a minimal impact on the benthic environment. Initial chemical by-product concentrations released during bomb detonation disperse rapidly in water and are considered negligible (DoN, 2005b).

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. 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.

Missiles

Missiles would be fired by aircraft, ships, and Naval Special Warfare (NSW) operatives at a variety of airborne and surface targets on the Navy Cherry Point Study Area. In general, the single largest hazardous constituent of missiles is solid propellant primarily composed of rubber (polybutadiene) mixed with ammonium perchlorate (*i.e.,* solid double-base propellant; aluminum and ammonia propellant grain; and arcite propellant grain). Hazardous constituents are also used in igniters, explosive bolts, batteries (potassium hydroxide and lithium chloride), and warheads (*i.e.,* PBX-N high explosive components; PBXN-106 explosive; and PBX (AF)-108 explosive). Chromium or cadmium may also be found in anti-corrosion compounds coating exterior missile surfaces.

In the event of an ignition failure or other launch mishap, the rocket motor or portions of the unburned propellant may impact the environment. Experience with Hellfire missiles shows that if the rocket motor generates sufficient thrust to overcome the launcher hold-back, all the rocket propellant is consumed. In rare cases where the rocket does not generate sufficient thrust to overcome the hold-back (hang fire or miss fire), some propellant may remain unburned but the missile remains on the launcher. Jettisoning the launcher is a possibility for hang fire or miss fire situations, but in most cases the aircraft returns to base where the malfunctioning missile is handled by explosives ordnance disposal personnel.

Table 3.2-4 below provides the approximate dimensions, weight, number, and type of missiles that would be fired during operations in the No Action Alternative missile exercises at the Navy Cherry Point Study Area.

Table 3.2-4 Missiles Fired Under the No Action Alternative at the Navy Cherry Point Study Area

Missile Name	Designation	Type		Net Explosive Weight (NEW) (lbs)	~Length (feet)	~Diameter (inches)
Sparrow	AIM-7	Air-to-Air	NEPM	88	12	8
Sidewinder	AIM-9	Air-to-Air	HE & NEPM	25	9.4	5
Hellfire	AGM-114	Air-to-Surface	HE	8	5.6	7
High-speed Anti-radiation Missile (HARM) (detonates 30-60ft above surface target)	AGM-88	Air-to-Surface	HE	45.2	13.6	10
Tube-launched, Optically tracked, Wire-guided (TOW)	BGM-7/M-220	Air-to-Surface	HE	15.3	4	6
Standard Missile-2	SM-2	Surface-to-Air	HE	137	14.7	13.5
Sea Sparrow	RIM-7	Surface-to-Air	HE	90	12	8

HE = High Explosive
NEPM = Non-explosive Practice Munitions

Approximately 21 percent of the 24 missiles fired on the Navy Cherry Point Study Area carry inert warheads with no hazardous constituents. High explosive missiles fired would be Hellfire, TOW, Sidewinder, HARM, Sea Sparrow, and Standard missiles.

Missiles Fate and Transport

Inert missiles do not explode upon contact with the target or sea surface. The main environmental effect would be the physical structure of the missile itself entering the water. Practice missiles do not use rocket motors and therefore do not have potentially hazardous rocket fuel.

Exploding warheads may be used in air-to-air, surface-to-air, and air-to-surface missile exercises, but to avoid damaging the aerial target, the missiles typically explode at an offset to the target in the air, disintegrates, then, falls into the ocean. High explosive Hellfire missiles used in air-to-surface exercises explode at or just below the water surface (DoN, 2006a). HARM missiles, even though they are air-to-surface missiles, are designed to detonate 30-60 ft above a barge target. Therefore, HARM missiles are considered air-to-air for purposes of this assessment.

The principal source of potential impact to water and sediment quality would be unburned solid propellant residue. Solid propellant fragments would sink to the ocean floor and undergo changes in the presence of seawater. The concentration decreases over time as the leaching rate decreases and further dilution occurs. The aluminum remains in the propellant binder and is eventually oxidized by seawater to aluminum oxide. The remaining binder material and aluminum oxide pose no threat to the marine environment (DoN, 1996). Section 3.3, Water Resources, discusses missile propellant in the marine environment in further detail.

The TOW missile system has two thin (5.75 mils or 0.146 mm diameter) wires that provide a passive line for transmission of steering commands from the aircraft to the missile. Two wire dispensers containing 3,750 m each of single-strand wire with a minimum tensile strength of 10 pounds are mounted on the rear of the missile. The length of wire dispensed would generally be equal to the distance the missile travels to impact the target and any undispensed wire would be contained in the dispensers upon impact.

Once the missile is fired, the enamel coated, copper-plated, high carbon steel wire sinks to the seabed and is not recovered. While degradation rates for the wire may vary due to changing environmental conditions in seawater, assuming a sequential failure and/or degradation of the enamel coating (Degradation Time (DT) ~ 2 month), the copper plating (DT ~ 1.5 – 25 months) and the core carbon-steel (DT ~ 8 to 18 months), a minimum of about 12 months and a maximum of about 45 months is required for total degradation of the guide wires. See Appendix L for additional information regarding the corrosion and degradation of TOW missile guide wires in marine environments.

Targets

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. Aerial and surface targets would be deployed on the Navy Cherry Point Study Area in the No Action Alternative. Small concentrations of fuel and ionic metals are released during battery operation.

A typical aerial target drone is powered by a jet fuel engine, generates radio frequency (RF) signals for tracking purposes, and is equipped with a parachute to allow recovery. Drones 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 Navy Cherry Point Study Area would include AST/ALQ/ESM pods, Banner drones, BQM-74E drones, Cheyenne, Lear Jets, and Tactical Air-Launched Decoys (TALD). The only expended target is the TALD. The TALD is a non-powered, air-launched, aerodynamic vehicle. It provides false imagery to defense acquisition systems by using chaff/electromagnetic and radar signature augmentation. It is approximately 7.6 feet long, 10 inches high and 10 inches wide. It weighs about 400 pounds and is constructed of extruded aluminum. The use of TALDs would not change in Alternative 1 or the Preferred Alternative (Alternative 2).

Surface targets would 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 (as known as a "killer tomato"). Floating debris, such as styrofoam, may be lost from target boats.

One hundred five targets would be used during exercises within the Navy Cherry Point Study Area for the No Action Alternative.

Target Fate and Transport

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 materials are defined as the parts of a device made of non-reactive material. Typical non-reactive material includes 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 they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.

An extensive study conducted in Canada (Environmental Sciences Group, 2005) at Canadian Forces Maritime Experimental and Test Ranges 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.

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-25 marker consists of a cylindrical outer tube about 18.5 inches long and 3 inches in diameter. It weighs 3.7 pounds and produces a yellow flame and white smoke for 10 to 20 minutes. It contains red phosphorus and a seawater-activated battery (The Ordnance Shop, 2007a). Sea water batteries use magnesium anodes, sea water as the electrolyte, and oxygen dissolved in the sea water as oxidant.

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 (The Ordnance Shop, 2007b).

Two hundred thirty marine markers would be used during exercises within the Navy Cherry Point Study Area for the No Action Alternative.

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.

Unburned 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.

Seawater-activated batteries would be expended during their normal service life and would not present a significant impact to the environment (Environmental Sciences Group, 2005).

Naval Gun Ammunition

Naval gun fire within the Navy Cherry Point Study Area would use non-explosive and explosive 5-inch and 76-mm rounds. Seventy percent of training rounds are non-explosive and contain an iron shell and sand, iron grit, or cement filler. RDX) is used in explosive rounds. An estimated 3,078 rounds are fired annually during the Navy Cherry Point Study Area exercises that use 5-inch guns.

Unexploded shells and non-explosive ordnance practice shells would not be recovered and would sink to the ocean floor. Solid metal components (mainly iron) of unexploded ordnance and non-explosive ordnance would also sink.

Naval Gun Ammunition Fate and Transport

Explosive 5-inch shells are typically fuzed to detonate within 3 feet of the water surface. Shell fragments rapidly decelerate through contact with the surrounding water and settle to the sea floor. Unrecovered ordnance also sinks to the bottom. Iron 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 contaminants from unexploded ordnance, non-explosive ordnance, and fragments is not expected to result in measurable degradation of marine water quality. Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Unexploded 5-inch shells and non-explosive ordnance practice shells would not be recovered and would sink to the ocean floor. The RDX material of unexploded ordnance would not typically be exposed to the marine environment. Should the RDX be exposed on the ocean floor, it would break down within a few hours (DoN, 2001). Over time, the RDX residue would be covered by ocean sediments or diluted by ocean water.

Small Arms and Close-In Weapons System Ammunition

Ammunition used in 50-caliber and 7.62-mm small arms cartridges often contains lead cores. The 20-mm and 25-mm cannon shells used in Small Arms and Close-In Weapons Systems (CIWS) training are primarily steel; 20 mm projectiles used in CIWS training are typically inert tungsten. Depleted Uranium, is being phased out of the inventory, and is not used in training events. A total of 99,259 rounds would be fired in the No Action Alternative.

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

Expended .50-caliber and 7.62-mm bullets may release small amounts of iron, aluminum, copper and tungsten into the sediments and the overlying water column as bullets corrode. Iron, aluminum, copper, and tungsten are elements that exist naturally in the environment. The presence of these metals in water is mainly due to erosion of soil and rock. Increased concentrations of metals in sediments would be restricted to a small zone around the bullet, and releases to the overlying water column would be quickly diluted (DoN, 2005c). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

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% 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 Air Combat Maneuver (ACM) training and Electronic Combat Operations (EC OPS) throughout the Navy Cherry Point Study Area. All chaff is accounted for under Chaff Exercises. Under the No Action Alternative, it is estimated that 591 exercises would be held per year, releasing about 6,946 rounds (cartridges) of chaff in the Navy Cherry Point Study Area.

Chaff Fate and Transport

When deployed, a diffuse cloud of fibers 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).

Based on the dispersion characteristics of chaff, large areas of open water within the Navy Cherry Point Study Area 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 five 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 at the Navy Cherry Point Study Area to attract heat-seeking missiles. Infrared decoy flares are also called "self protection flares." They consist of an aluminum case approximately 8 inches long with a 1-1.5-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, 2008). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

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-inch 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 are used during ACM training, EC OPS, and IMPASS training. All flares are accounted for under Flare Exercises. 2,100 flares were 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, 2008).

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 Navy Cherry Point Study Area.

Underwater Detonations

Most underwater detonations during Navy Cherry Point Study Area operations would be associated with mine neutralization exercises. Explosive ordnance disposal (EOD) detachments place explosive charges next to or on inert practice mines. Charges used by EOD divers consist of five-, ten-, or 20-pound explosives. These charge sizes reflect the size of charges EOD divers use to detonate mines in combat or real-world conditions.

The combustion products from the detonation of high explosives are commonly found in sea water—carbon monoxide (CO), carbon dioxide (CO_2), hydrogen (H_2), water (H_2O), nitrogen (N_2), and ammonia (NH_3). The primary contaminant that would be released from explosives used in mine warfare training are nitroaromatic compounds such as trinitrotoluene (TNT), cyclotrimethylenetrinitramine (Royal Demolition Explosive or RDX), and octogen (High Melting Explosive or HMX) (URS *et al*. 2000). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Under the No Action Alternative, 20 20-pound charges would be used per year.

Underwater Detonations Fate and Transport

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. Therefore, no adverse effects from chemical by-products would be expected. Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

3.2.3.2 Alternative 1

Navy Cherry Point Study Area training operations would increase by varying degrees from current levels in support of the Fleet Response Training Plan (FRTP). MEM use under Alternative 1, as compared to the No Action Alternative would be as follows:

- use of high explosive bombs would remain the same as in the No Action Alternative;
- use of non-explosive practice bombs would increase by 10 percent;
- use of high explosive missiles would increase 121 percent;
- use of non-explosive practice missiles would increase 200 percent;

- use of targets would increase by 19 percent;
- use of marine markers would increase by 9 percent;
- use of high explosive rounds would remain the same;
- use of non-explosive practice naval gun ammunition would increase by 11 percent;
- use of small arms and CIWS ammunition would increase by 12 percent;
- use of chaff rounds would increase by 12 percent;
- use of flares would increase by 11 percent; and
- use of 20-pound charges would remain the same as under the No Action Alternative.

As indicated in Tables 2.2-4 and 2.2-5, amounts of MEM would increase in rough proportion to the overall increases in training operations. A summary of ordnance use and increase by training area is provided in Table 2.2-6.

Vessels, aircraft, and other military assets employed in these operations would carry and use hazardous materials for routine operation and maintenance. Increases in hazardous materials transport, storage, and use to support increased training operations under Alternative 1 would be managed in compliance with applicable laws and regulations. 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 significant harm or effect on the environment is 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. The amounts of hazardous waste generated by training operations under Alternative 1 would be incrementally greater than those under the No Action Alternative. All hazardous waste would continue to be managed in compliance with applicable laws and regulations. No changes in hazardous waste management are anticipated for operating Navy and Marine Corp assets under Alternative 1.

Proposed Increases in Training Operations

Amounts of MEM would increase in rough proportion to the overall increases and decreases in these training operations. Navy and Marine Corps ships, boats, and amphibious vehicles, aircraft, and other military assets engaged in these operations would use minor quantities of hazardous materials and generate minor quantities of used hazardous materials during routine ship operations. These materials would be managed in accordance with applicable laws and regulations. Hazardous materials inventories would be replenished, and used hazardous materials would be offloaded while the vessels are in port.

Expand Warfare Missions to Conduct Maritime Security Surface Strike Group Training

Maritime Security (MS) Surface Strike Group (SSG) training is not measurably different than training that already occurs within the Navy Cherry Point Study Area. Essentially, it is a repackaging of cruiser/destroyer training operations such that a three-ship SSG practices operating as an autonomous entity. MS SSG training does not involve the expenditure of ordnance. None of the MS SSG training would have a measurable effect on MEM, hazardous materials use, or hazardous waste generation under Alternative 1.

Accommodate Mission Requirements Associated with Force Structure Changes

Conduct MH-60R/S Training. The Navy proposes to conduct the MH-60R/S training missions in the Navy Cherry Point Study Area in accordance with the recent restructuring of Navy helicopter forces around the two linchpin airframes, the MH-60S and MH-60R (DoN, 2002).

Organic Mine Countermeasures. Navy and Marine Corps ships, boats, and amphibious vehicles, aircraft, and other military assets engaged in these operations would use minor quantities of hazardous materials and generate minor quantities of used hazardous materials during routine operations. These materials would be managed in accordance with applicable laws and regulations. The introduction of

Organic Mine Countermeasures (OMCM) requires a change in tactics, techniques, procedures, and training for Mine Countermeasures (MCM). Under Alternative 1, Mine Countermeasure capability would be embedded in a task group. Multi-purpose helicopters (MH-60S), submarines, and surface combatants within the task group would be outfitted with OMCM systems. These systems include mine hunting sonar (AQS-20), influence mine sweeping tow array (OASIS), and anti-mine ordnance systems (AMNS). Potential effects associated with the active sonar component of AQS-20 and AMNS are analyzed separately in the AFAST EIS and summarized in Section 3.19 of this EIS/OEIS.

3.2.3.3 Alternative 2 (Preferred Alternative)

Navy Cherry Point Study Area training operations would increase by varying degrees from current levels in support of the Fleet Response Training Plan (FRTP). MEM use under the Preferred Alternative (Alternative 2) would be the same as Alternative 1 except that the use of high explosive bombs would decrease by 100 percent and the use of non-explosive practice bombs would increase above the No Action Alternative by 24 percent.

As indicated in Tables 2.2-4 and 2.2-5, amounts of MEM would increase and decrease in rough proportion to the overall increases and decreases in training operations. A summary of ordnance use and increase by training area is provided in Table 2.2-6.

The designation of a new training area for deploying temporary mine shapes within the Navy Cherry Point Study Area in also anticipated in Alternative 2.

Vessels, aircraft, and other military assets employed in these operations would carry and use hazardous materials for routine operation and maintenance. Increases in hazardous materials transport, storage, and use to support increased training operations under Alternative 2 would be managed in compliance with applicable laws and regulations. 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 applicable laws and regulations. No changes in hazardous materials management practices are anticipated under Alternative 2.

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 effects.

3.2.5 Summary of Environmental Effects (NEPA and EO 12114)

Hazardous materials, waste, and MEM used and generated during the Navy Cherry Point 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.

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 includes virtually all missiles, munitions, and targets used at the Navy Cherry Point Study Area. 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 expended 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 they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds. 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.

MEM 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 material expended in the Navy Cherry Point Study Area 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 (CO), carbon dioxide (CO_2), hydrogen (H_2), water (H_2O), nitrogen (N_2), and ammonia (NH_3). The primary contaminant that would be released from explosives used in mine warfare training are nitroaromatic compounds such as TNT, 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 3.2-5, less than significant overall impacts from hazardous materials or waste management are anticipated under the No Action Alternative, Alternative 1, or the Preferred Alternative (Alternative 2.) Expended MEM would be deposited in offshore areas, become buried in the sea floor sediments, and have no measurable environmental effects. 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 3.2-5 Summary of Environmental Effects of the Alternatives in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (U.S. Territorial Waters)	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Military Expended Material including Non-Explosive Practice Munitions	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.
Underwater Detonations and High Explosive Ordnance	Negligible effects.	Negligible effects.
Impact Conclusion	Less than significant impact.	Less than significant harm.
Alternative 1		
Military Expended Material including Non-Explosive Practice Munitions	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.
Underwater Detonations and High Explosive Ordnance	Negligible effects.	Negligible effects.
Impact Conclusion	Less than significant impact.	Less than significant harm.
Alternative 2 (Preferred Alternative)		
Military Expended Material including Non-Explosive Practice Munitions	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.
Underwater Detonations and High Explosive Ordnance	Negligible effects.	Negligible effects.
Impact Conclusion	Less than significant impact.	Less than significant harm.

3.3 WATER RESOURCES

3.3.1 Introduction and Methods

Water resources on land include surface and subsurface water bodies. Since land ranges in the Navy Cherry Point Range Complex are not being evaluated as part of this EIS/OEIS, water resources such as lakes, ponds, rivers, streams, groundwater, and aquifers are not discussed unless they specifically pertain to an activity in the proposed action or are linked to the marine environment. The marine environment refers to offshore, high salinity waters, and is further defined by prevailing currents, harbor flushing hydraulics, and tidal variations.

Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities. This section includes analysis of impacts on water resources. Natural processes and human activities influence existing environmental conditions, or the environmental baseline, for water quality. Human activities affect water quality from sources such as storm water runoff and from activities in ports and marinas. Other sources of pollution include municipal discharges, industrial discharges, private, commercial, and public vessels, and the oil and gas industry.

3.3.1.1 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this EIS/OEIS includes several warfare areas (*e.g.,* Mine Warfare, Anti-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.,* vessel maneuver, target deployment, weapons firing, *etc.*) are accomplished under each operation. Most of the specific activities accomplished under a given operation are not unique to that operation. For example, many of the operations included in the alternatives involve Navy and Marine Corps vessel maneuvers and aircraft overflights. Accordingly, the analysis for water resources is organized by specific activity rather than warfare area or operations.

For the purposes of this analysis, water quality is evaluated with respect to possible release of potential pollutants from aircraft and surface and subsurface vessels. To address potential impacts, the approach to analysis includes characterizing the yearly testing and training operations that may contribute expended materials to the Navy Cherry Point Range Complex ocean environment. These include missile flights; target expenditures; ship, boat, and aircraft operations; and weapons firing associated with various training operations. This section of the EIS/OEIS reviews the water resources and impacts to water quality associated with training in the Navy Cherry Point Range Complex. A full discussion of military expended materials is presented in Section 3.2, Hazardous Materials and Hazardous Waste.

Study Area

In this EIS/OEIS, the water resources/water quality Study Area for the Navy Cherry Point Range Complex includes the Navy's sea ranges and adjacent waters (waters from the shoreline seaward). The Cherry Point OPAREA includes offshore surface and subsurface extending southeast along the coast seaward for 103 nautical miles (nm) from 3 nm off the coast from North and South Carolina (see Figure 1.5-1).

Under customary international law, U.S. territory extends out into the ocean a distance of 3 nm from the coastline. 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 to 12 nm 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. The Proclamation thus did not alter existing legal obligations under NEPA or other federal environmental statutes. As a matter of policy,

however, the Department of the Navy has elected to apply NEPA to the 12-nm limit established by the Proclamation. Impacts to these areas and those portions of the inner sea range within these boundaries are subjected to analysis under NEPA. Impacts in the areas outside U.S. territorial waters are analyzed using the procedures set out in EO 12114 and associated implementing regulations.

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 for the Cherry Point OPAREA, as well as prior EAs and EISs, were reviewed and are cited as appropriate.

Significance Criteria and Impact Thresholds

Numerous federal, state, and local regulations govern the protection of water resources. A detailed discussion of water resources regulations related to the Navy Cherry Point Range Complex is located in Appendix K, Regulatory Framework. The primary objective of these regulations is to protect public health and the environment, as well as biological resources. A significant impact would result if the use or generation of expended materials resulted in impairment of water resources or a violation of any of the laws cited in Appendix K.

3.3.1.2 Warfare Areas and Associated Environmental Stressors

Aspects of the proposed actions likely to act as stressors to water resources were identified by conducting an analysis of the warfare areas, operations, and specific activities included in the alternatives. Table 3.3-1 summarizes this analysis and shows the primary stressors to water quality associated with each operation (see Appendix D for detailed descriptions of operations).

Table 3.3-1 Summary of Potential Stressors to Water Quality[16]

Warfare Area and Operation	Training Area(s)	Seafloor Disturbance or Localized Turbidity Increases	Weapons Firing/ Non-explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)					
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓		
Mine Neutralization	Onslow Bay UNDET Area	✓		✓	✓
Surface Warfare (SUW)					
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)	✓	✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)	✓	✓	✓	✓

[16] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations, see Table 2.2-4 and Appendix D.

Table 3.3-1 Summary of Potential Stressors to Water Quality (Continued)

Warfare Area and Operation	Training Area(s)	Seafloor Disturbance or Localized Turbidity Increase	Weapons Firing/ Non-explosive Ordnance Use	Underwater Detonations and Explosive Ordnance	Expended Materials
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)		✓	✓	✓
Surface Warfare (SUW) (Continued)					
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA		✓	✓	✓
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA		✓	✓	✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA				
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA				
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)				
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)		✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)	✓		✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA				✓
Air Intercept Control	W-122				
Electronic Combat (EC)					
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122				
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)				✓
Chaff Exercise- ship	Cherry Point OPAREA				✓
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)				✓
Strike Warfare (STW)					
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, 21)	✓	✓	✓	✓
Amphibious Warfare					
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)		✓	✓	✓
FIREX – Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)		✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓			
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓			

Stressors that would likely affect water quality include: (1) seafloor disturbance or localized turbidity increases, (2) live/inert ordnance strikes by bombs, gun fire, and small arms gun fire; (3) explosions

from live ordnance and underwater detonation; and (4) expendable materials and debris. Table 3.3-2 also identifies the expended training materials associated with stressors identified previously in Table 3.3-1, and provides the distances from shore where the exercises take place and the percentage of training events that take place at these distances.

Table 3.3-2 Expended Training Item Associated with the Navy Cherry Point Range Complex Operations

Operation	Training Area Proximity	Expended Training Item
Mine Countermeasures Exercise (MCM)	Inside 3 nm 25% 3-12 nm 75%	Non-explosive practice munitions
Mine Neutralization	3-12 nm 100%	30-mm cannon shell (inert) 20-lb net explosive weight charge
Bombing Exercise (Air-to-Surface) (at sea)	Outside 12 nm 100%	MK-76 (NEPM) MK-82 BDU-45 (NEPM) MK-83 (NEPM) MK-82 (HE) bomb MK-83 (HE) bomb MK-84 (HE) bomb GBU-30/38 (HE) bomb GBU-32 (HE) bomb Marine marker smoke float
Missile Exercise (MISSILEX) (Air-to-Surface)	Outside 12 nm 100%	AGM-114 Hellfire TOW Missile (HE)
Gunnery Exercise (GUNEX) (Air-to-Surface)	Outside 12 nm 100%	20-mm cannon 25-mm cannon .50-caliber gunshell 7.62-mm gunshell
Gunnery Exercise (Surface-to-Surface) (Ship)	3-12 nm 10% Outside 12 nm 90%	5-inch gunshell 76-mm gunshell 25-mm gunshell .50-caliber gunshell 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
GUNEX (Surface-to-Surface) - Boat	Inside 3 nm 25% 3-12 nm 75%	.50-caliber gunshell 7.62-mm gunshell 9-mm gunshell M-16, M-4, M-249, M-240G rounds M-40 (308-caliber)
GUNEX (Air-to-Air)	Outside 12 nm 100%	20-mm cannon 25-mm cannon
MISSILEX (Air-to-Air)	Outside 12 nm 100%	AIM-7 Sparrow (NEPM) AIM-9 Sidewinder (HE)
MISSILEX (Surface-to-Air)	Outside 12 nm 100%	SM-2 (HE) Sea Sparrow (HE)
Chaff and/or Flare Exercise - Aircraft	3-12 nm 10% Outside 12 nm 90%	Flares Chaff
Chaff Exercise - Ship	3-12 nm 10% Outside 12 nm 90%	Chaff
HARM Missile Exercise (HARMEX) (Air-to-Surface)	Outside 12 nm 100%	AGM-88 HARM Missile (HE)
FIREX (Land)	Impact point is inland	5-inch gunshell (HE)
FIREX with IMPASS	Outside 12 nm 100%	5-inch gunshell (HE and NEPM)
Amphibious Assault/Amphibious Raid	Onslow Bay from Onslow Beach seaward 25 nm	Vehicular tracks

3.3.2 Affected Environment

The affected environment for purposes of water quality includes the Cherry Point OPAREA and adjacent waters. As mentioned in Chapters 1 and 2, the Navy Cherry Point Range Complex includes land areas, but these areas are not analyzed in this EIS/OEIS. The area of the Navy Cherry Point Range Complex assessed in this EIS/OEIS is almost entirely offshore training sea space, undersea space, and special use airspace. For water quality purposes, the majority of area assessed is the 18,617 nm^2 of sea space, which begins 3 nm from shore where state waters end; however, the nearshore environment is also included in this analysis.

The physical oceanography of the Study Area can be characterized in terms of its bathymetry, or bottom topography, and its circulation. Sediment transport and deposition and bottom composition also are elements of physical oceanography. Bathymetry and bottom composition are addressed in Section 3.1, Bathymetry and Sediments. Water characteristics, sediment transport, deposition and circulation are discussed below, along with marine water quality. Fate and transport of military expended materials are discussed in Section 3.2, Hazardous Materials and Hazardous Waste.

3.3.2.1 Marine Water Quality

The Cherry Point OPAREA is located in the offshore surface and subsurface operating area extending southeast along the coast seaward for 103 nm from three nm off the coast of North Carolina and South Carolina.

Cape Hatteras, North Carolina is generally considered to be a transition zone between the warm, tropical waters found to the south and the cool, temperate waters to the north. Cape Hatteras separates the oceanic provinces of the South-Atlantic Bight (SAB) from those of the Mid-Atlantic Bight (MAB). The SAB encompasses the area from the Florida Straights to Cape Hatteras, while the MAB extends from Cape Hatteras to the southwestern flank of Georges Bank (Schmitz *et al*., 1987; Churchill *et al*. 1993 as cited in DoN, 2002a). The majority of the Cherry Point OPAREA is located in the SAB, with the exception of a small area located north of Cape Hatteras in the MAB province (surface OPAREA grid block 1 - see Figure 1.1-1). Thus, both oceanic provinces influence the physical environment of the OPAREA.

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.

Currents

Ocean currents are influenced by solar heating, winds, gravity, Coriolis, and surface circulation forces. The Coriolis effect moves water to the right in the northern hemisphere. Together, these forces create gyres; gyres produce large circular currents in ocean basins. In the North Atlantic Ocean, this gyre system is composed of four distinct currents: the Gulf Stream, and the North Atlantic, Canary, and North Equatorial Currents. Additional surface water masses found in the Cherry Point OPAREA are Chesapeake Bay plume water, Delaware Bay plume water, and mid-Atlantic shelf water (or Virginia Coastal Water) (DoN, 2002a).

The Gulf Stream exerts a considerable influence on the oceanographic conditions in the Cherry Point OPAREA. In general, the Gulf Stream flows roughly parallel to the coastline from the Florida Straits to Cape Hatteras, where it is deflected from the North American continent and flows northeastward past the Grand Banks (Figure 3.3-1). The Gulf Stream is approximately 31 miles wide and 3,280 feet deep in the Cherry Point OPAREA. Surface velocity ranges from 2 to 5 nm per hour with a temperature range from 25 to 28°C (Mann and Lazier, 1991 as cited in DoN, 2002a). The position of the Gulf Stream is variable, possibly due to water column stratification and other factors including instability of its mean path in the Cape Hatteras area (Schmeits and Dijkstra, 2000 as cited in DoN, 2002a).

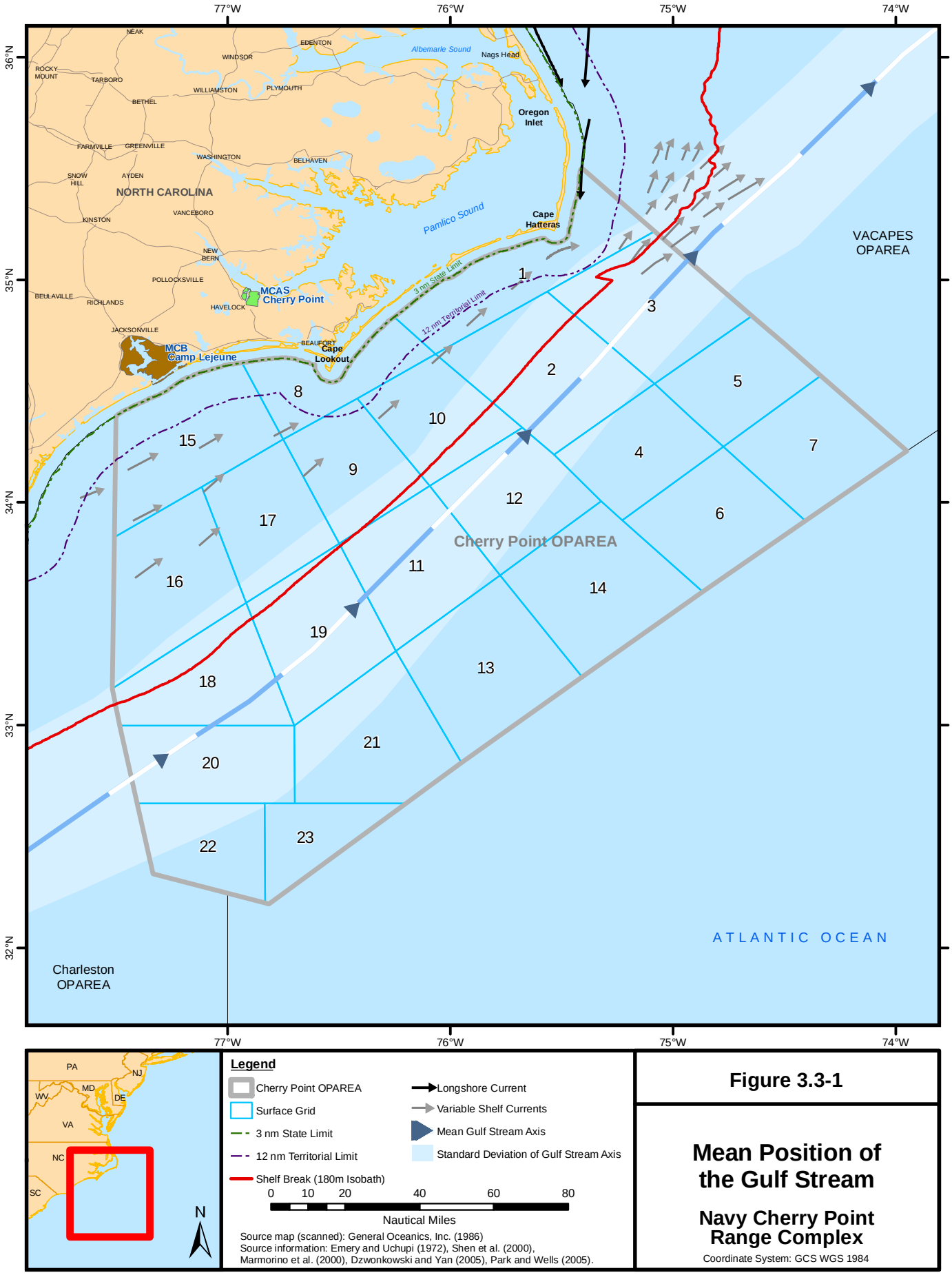


Figure 3.3-1

Mean Position of the Gulf Stream

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

Temperature and Salinity

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.

The average temperature of waters of the Cherry Point OPAREA is relatively warm (25°C) and saline (28 to 36 practical salinity units [psu] average). Nearby rivers provide the waters in the OPAREA with freshwater, nutrients and sediments. Barrier islands are located along the length of the State's coast, and Onslow Bay and Raleigh Bay are located near the shoreline of the Cherry Point OPAREA (DoN, 2002a).

3.3.2.2 Water Quality Baseline Conditions

Water quality in the Cherry Point OPAREA is affected by human activities in the heavily developed south-Atlantic coastal areas. The U.S. Environmental Protection Agency's (USEPA) 2002 National Water Quality Inventory found that just over half of the estuarine areas assessed were polluted to the extent that their use was compromised, either for aquatic life, drinking water, swimming, boating, or fish consumption (USEPA, 2002). 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).

Point source pollution comes from identifiable sources. The major point sources of pollution to the nation's waterways include 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 (USCOP, 2004).

Nonpoint source pollution arises when rainfall and snowmelt carry contaminants over land, into streams and groundwater, and down to coastal waters. Nonpoint 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 nonpoint source pollution entering rivers, estuaries, coastal waters, and ultimately the oceans is from agricultural and storm water runoff (USCOP, 2004).

Storm water runoff (nonpoint sources) is a leading cause of water quality problems along the Carolina coast; however, mercury was identified as a major contaminant in fish tissue in all North Carolina coastal river basins. Atmospheric deposition was found to be the significant contributor of mercury contamination (NC DENR/DWQ, 2002). In the coastal areas most proximate to the study area, the primary sources of pollution are new development/ construction, impervious surfaces, stormwater outfalls, and inadequate human and animal waste management (NC DENR/DWQ, 2007a). The EPA reports that about 94 percent of the estuaries and sounds in North Carolina fully support designated uses (USEPA, 2002; USEPA, 2007a).

Water resources contributing to marine water quality in the study area include the following (NC DENR/DWQ, 2000; NC DENR/DWQ, 2007b; NC DWQ, 2007c):

Pasquotank River Basin - encompasses 3,635 square miles of low-lying lands and open waters, including Albemarle Sound, in North Carolina's northeast outer coastal plain.

Chowan River Watershed - lies in portions of Virginia and North Carolina. The basin is monitored for benthic macroinvertebrates, fish assessments, aquatic toxicity and ambient monitoring. Ambient monitoring data shows that dissolved oxygen levels are naturally low since they are influenced by swamp and wetland conditions, which can lower dissolved oxygen concentrations and decrease pH. Turbidity, total suspended solids, and copper were generally low.

White Oak River Basin - lies entirely within the outer coastal plain and includes four separate river systems and their tributaries: New River; White Oak River; Newport River; and the North River (Figure 3.3-2).

Neuse River Basin - the Neuse River flows approximately 200 miles from Orange and Person Counties to the Pamlico Sound. Agricultural land use comprises approximately a third of the basin, an equally large portion of the basin is in forest. The remaining area is comprised of wetlands, open water, scrub growth, barren land, and developed land. The primary pollutants in the Neuse River are sediment, organics, and nutrients from agricultural runoff (Neuse River Education Team, 2008).

Cape Fear River Basin - North Carolina's largest river basin. A portion of the Cape Fear Estuary is impaired for aquatic life due to violations of the dissolved oxygen standard. Sources of the low dissolved oxygen levels include discharges of oxygen-consuming waste into this segment and to tributary streams. There is also a considerable volume of blackwater that may contribute natural sources of oxygen-consuming materials. This portion of the estuary is influenced by tides and high flows from the entire basin, and therefore, goes through many extreme changes in water column chemistry over the course of a year (NC DENR/DWQ, 2007d).

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 marine water quality.

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, which may impact marine water quality. Although no such sites have been identified within the Navy's sea ranges, the potential for one or more hazardous waste deposits to affect marine water quality cannot be discounted.

Commercial and Navy vessel shipboard waste and non-hazardous waste streams 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.

A No Discharge Zone (NDZ) is an area of a waterbody or an entire waterbody into which the discharge of sewage (whether treated or untreated) from all vessels is completely prohibited. These zones are designed to give states an additional tool to address water quality issues associated with sewage contamination. There are no NDZs within the study area (USEPA, 2007b).

Table 3.3-3 Waste Discharge Restrictions for Navy Ships

Zone (nm from shore)	Type of Liquid Waste	
	Black Water (Sewage)	**Gray Water**
U.S. Waters (0-3 nm)	No discharge.	If vessel is equipped to collect gray water, pump out when in port. If no collection capability exists, direct discharge permitted.
U.S. Contiguous Zone (3-12 nm)	Direct discharge permitted.	Direct discharge permitted.
>12 nm from shore	Direct discharge permitted.	Direct discharge permitted.
Zone	**Type of Liquid Waste**	
	Oily Waste	**Garbage (Non-plastic)**
U.S. Waters (0-3 nm)	Discharge allowed if waste has no visible sheen. If equipped with Oil Content Monitor (OCM), discharge <15 ppm oil.	No discharge.
U.S. Contiguous Zone (3-12 nm)	Same as 0-3 nm.	Pulped garbage may be discharged.
>12 nm from shore	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.	Direct discharge permitted.
Zone	**Type of Solid Waste**	
	Garbage (Plastic) (Non-food-contaminated)	**Garbage (Plastic) (food-contaminated)**
U.S. Waters (0-3 nm)	No discharge.	No discharge.
U.S. Contiguous Zone (3-12 nm)	No discharge.	No discharge.
12-50 nm from shore	No discharge.	No discharge.
>50 nm from shore	Retain last 20 days before return to port. Discharge if necessary.	Retain last three days before return to port. Discharge if necessary.
Source: Northern Division 1996; Office of the Chief of Naval Operations 1994		

3.3.3 Environmental Consequences

Navy and Marine Corps training activities in open ocean areas involve the use of fuel, lubricants, explosives, propellants, batteries, oxidizers, and other hazardous substances. The Navy and Marine Corps make every effort to minimize its use of hazardous materials during training, and recovers and reuses unexpended training materials to the extent practicable to avoid impacts to water quality.

Expended training material can leak or leach small amounts of toxic substances into the water as they degrade and decompose. These items decompose very slowly, so the volume of expended 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 the expended material increase over time, possibly inhibiting benthic flora and fauna. 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. Munitions constituents were presented in Table 3.2-2.

3.3.3.1 No Action Alternative

The following paragraphs discuss the potential effects to water quality of various training items used within the Navy Cherry Point Range Complex. Refer to Section 3.2.3.1 for further detailed discussions of hazardous materials, hazardous waste, and expended materials resulting from the No Action Alternative.

Bombs

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, 2005a). Propelled fragments would be produced by an exploding bomb. Eighty-two percent of the bombs used under the

No Action Alternative would be practice bombs without explosive warheads. Eighteen percent of the 799 bombs deployed under the No Action Alternative for the Navy Cherry Point Range Complex would be high explosive.

Typically, bombing exercises (BOMBEX) at sea involve one or more aircraft bombing a target simulating a hostile surface vessel. Practice bombs are also called bomb dummy units (BDU) and are considered non-explosive practice munitions (NEPM). 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 mimics the weight, size, center of gravity, and ballistics of a high explosive bomb. BDUs would be used within the Navy Cherry Point Range Complex. These practice munitions may contain spotting charges/signal cartridges that produce a visual indication of impact.

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. Eighty-two percent of the bombs used under the No Action Alternative would be practice bombs without explosive warheads, as such, steel non-explosive practice bombs will settle to the seafloor. All these materials will slowly deteriorate with time and, given that they will be spread out over a relatively large geographic area (W-122 Area 18, 19, 20, 21), their potential impact on the environment is considered to be negligible. Bombs used in the Navy Cherry Point Range Complex under the No Action Alternative are listed in Chapter 2, and their approximate weight, length, and diameter are provided in Section 3.2.

Missiles

In general, the single largest contamination constituent of missiles is solid propellant. Hellfire missiles use a modified double-based propellant. Two typical compositions for modified double-base propellants are: nitrocellulose (20%), nitroglycerine (30%), triacetin (6%), ammonium perchlorate (11%), aluminum (20%), HMX (11%), and a stabilizer (2%); or nitrocellulose (22%), nitroglycerine (30%), triacetin (5%), ammonium perchlorate (20%), aluminum (21%), and a stabilizer (2%).

Other missiles use composite propellant, which consists of a polymer structure and an oxidizer, typically, ammonium perchlorate. Other contaminants associated with missiles include: igniters, explosive bolts, batteries (potassium hydroxide and lithium chloride), and warheads (*i.e.*, PBX-N high explosive components; PBXN-106 explosive; and PBX (AF)-108 explosive).

The principal source of potential impacts to water and sediment quality will be the unburned solid propellant residue, as well as other contaminants used in igniters, explosive bolts, batteries, and warheads. However, the rocket motor is typically fully expended prior to the missile reaching the target. Also, if it is a high explosive missile, the warhead is detonated prior to hitting the ground/water. In the few cases of any remaining unburned propellant, the fragments would sink to the ocean floor and undergo changes in the presence of seawater.

Testing has demonstrated that water penetrates only 0.06 inches into the propellant during the first 24 hours of immersion, and that fragments will very slowly release ammonium and perchlorate ions (Aerospace Corporation, 1998). These ions will be expected to be rapidly diluted and disperse in the surrounding water such that local concentrations will be extremely low. However, assuming that all propellant on the ocean floor would be in the form of 4-inch cubes, only 0.42 percent would be wetted during the first 24 hours. If all the ammonium perchlorate leached out of the wetted propellant, then approximately 0.01 lb would enter the surrounding seawater. The concentration would decrease over time as the leaching rate decreases and further dilution occurs. The aluminum would remain in the propellant binder and eventually be oxidized by seawater to aluminum oxide. The remaining binder material and aluminum oxide would not pose a threat to the marine environment. Therefore, effects from missile propellant may have temporary, minimal impacts on water quality.

Currently, ingestion of drinking water is the only viable exposure route for humans to perchlorate. Although the USEPA has published a reference dose in the Integrated Risk Information System (IRIS) specifically for the drinking water exposure route for humans, the environmental effects of perchlorate in the marine environment remain largely unknown and un-regulated. Navy and Marine Corps training at sea with munitions containing perchlorate would not present a significant source of perchlorate to the marine environment, and therefore not have a significant effect on the environment as: 1) most, if not all, of the propellant would be consumed during use; 2) all perchlorate salts are readily soluble so any residual perchlorate remaining in the spent missile, or on fragments, would rapidly disperse through dilution; and 3) the most currently accepted, peer-reviewed screening value for aquatic, ecological receptors is significantly higher than the human health drinking water equivalent level (DWEL) (Dean, *et al*., 2004).

Targets and Countermeasures

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. Surface targets would be deployed on the Navy Cherry Point Range Complex during training operations in the No Action Alternative. 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 (Environmental Sciences Group, 2005).

Surface targets would include Integrated Maritime Portable Acoustic Scoring and Simulator Systems (IMPASS) 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 (as known as a "killer tomato"). Floating debris, such as styrofoam, may be lost from target boats.

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, 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 they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.

An extensive study conducted in Canada (Environmental Sciences Group, 2005) at Canadian Forces Maritime Experimental and Test Ranges 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.

Marine Markers (Smoke Floats)

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, 2006).

Seawater-activated batteries would be expended during their normal service life and would not present a significant impact to the environment.

Naval Gun Fire

Naval gun fire within the Navy Cherry Point Range Complex would use non-explosive and explosive. Unexploded shells and non-explosive ordnance practice shells would not be recovered and would sink

to the ocean floor. Solid metal components of unexploded ordnance and non-explosive ordnance would also sink.

RDX is a component of ordnance used in naval gun fire. RDX of unexploded ordnance would not typically be exposed to the marine environment. Should the RDX be exposed on the ocean floor, it would break down within a few hours (DoN, 2001). Over time, the RDX residue would be covered by ocean sediments or diluted by ocean water. Explosion products containing RDX have been shown to have no adverse water contamination effects, because they are either harmless or are produced in such small amounts relative to their toxicity that they would be diluted and/or dissipated in the water to non-toxic levels very quickly (NAVFAC Northwest, 2000).

Any changes in water quality would be negligible based on the dispersed nature of the expended rounds, slow breakdown rates, and enormous dilution capacity of the surrounding sea water. Therefore, indirect changes in water quality would not occur.

Small Arms and Close-In Weapons System Fire

Ammunition used in 50-caliber and 7.62-mm small arms cartridges often contain lead cores. The 20-mm, 25-mm, and 30-mm projectiles used are typically inert tungsten or other inert metal. Expended bullets may release small amounts of iron, aluminum, and copper into the sediments and the overlying water column as bullets corrode. Although, elevated levels of these elements can cause toxic reactions in exposed animals, 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, 2005).

As with naval gun fire, any changes in water quality would be negligible based on the dispersed nature of the expended rounds, slow breakdown rates, and enormous dilution capacity of the surrounding sea water. Therefore, indirect changes in water quality would not occur.

Chaff

Defensive chaff (MK-214 seduction chaff or MK-216 distraction chaff) would be deployed from ships during training exercises in the Cherry Point OPAREA. Chaff would also be deployed from aircraft (RR-144 A/AL) in the Navy Cherry Point Range Complex. Under the No Action Alternative, it is estimated that approximately 300 canisters of MK-214 and 96 canisters of MK-216 chaff would be deployed from ships and 6,550 canisters of aircraft chaff would be deployed in the Navy Cherry Point Range Complex.

Chaff is an aluminum coated glass fiber used as a defensive mechanism to reflect radar. All components of the aluminum coating are present in seawater in trace amounts, except magnesium, which is present at 0.1 percent. The stearic acid coating is biodegradable and nontoxic. The potential for chaff to have a long-term adverse impact on water quality is very unlikely, and chemicals leached from the chaff will also be diluted by the surrounding seawater, thus reducing the potential for concentrations to build up to levels that can have effects on sediment quality and benthic habitats.

Pyrotechnic ejection uses hot gases generated by an explosive impulse cartridge. The gases push a small plastic piston down a chaff-filled tube eight inches long with a 1-inch square cross-section. This ejects a small plastic end cap, followed by the chaff fibers. The tube remains in the aircraft. For each chaff cartridge used, material that is ejected consists of two 1-inch square pieces of plastic l/8-inch thick (the piston and the end cap) and a felt spacer.

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% 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.

A typical bundle of training chaff contains approximately five million fibers, each composed of glass silicate with an aluminum coating. Aluminum and silicon comprise the most common minerals in the earth's crust, aluminum oxide and silicon dioxide. Since ocean water is in constant exposure to crustal materials, there is little reason to believe that the addition of small amounts of chaff would have any effect on either water or sediment composition (Hullar *et al.,* 1999). Chaff is generally resistant to chemical weathering and likely remains in the environment for long periods of time. As it is much like aluminosilicate minerals, the influence on the physical environment will be small, and likely limited to settling with bottom geology (DND, 2007; Farrell and Siciliano, 2007).

The physical environment may be affected by the leaching of metals from the chaff particles. However, the concentration of chaff needed to cause any kind of significant environmental impact far exceeds the amount that actually enters the water during air combat maneuvers. Sediment in the bottom of the ocean is composed of silicate minerals arising from various geomorphic processes. Minerals such as aluminum also enter the water through hydrothermal vents and the geologic processes themselves. The ions that can be leached from the chaff particles render such a small concentration in the at-sea environment (because of the large volume of water in comparison the actual number of chaff particles is so great) that the influence of aluminum ions entering the water is of smaller quantity than the processes that introduce metallic ions in the water naturally (DND, 2007).

Flares

Flares are used to attract heat-seeking missiles and thus called 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. Under normal operations, the only material that would enter the water would be a small, round plastic end-cap (approximately 1.4 inch diameter). Under the No Action Alternative, approximately 2,100 flares would be used during annual training operations. The plastic end-caps would be distributed throughout mainly in W-122 (Areas 1, 8, 15, and 16)), therefore the amount of debris would be negligible and would not substantially affect water quality resources..

Underwater Detonations

Most underwater detonations during Navy Cherry Point Range Complex operations would be associated with mine neutralization exercises. Explosive ordnance disposal (EOD) detachments place explosive charges next to or on inert practice mines. Charges used by EOD divers in the Navy Cherry Point Range Complex consist of 20-lb explosives. The charge size reflects the size of charges EOD divers use to detonate mines in combat or real-world conditions. Underwater explosions would also occur during the SEAL Basic Underwater Demolitions (BUD) courses, and SEAL platoon training exercises. Navy SEAL underwater demolitions and EOD operations usually take place in shallow water.

Under the No Action Alternative, it is estimated that 20 exercises would be held per year.

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 contaminants that would be released from explosives used in mine warfare training are nitroaromatic compounds such as trinitrotoluene (TNT), cyclotrimethylenetrinitramine (Royal Demolition Explosive or RDX), and octogen (High Melting Explosive or HMX) (URS, 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 chemicals rapidly disperse in the ocean. Therefore, no adverse effects from chemical by-products 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 1,200 to 4,800 feet (200 to 800 fathoms).

Amphibious Assault and Raid Exercises

Impacts to water quality in Cherry Point OPAREA (Area 15B) and littoral area to Onslow Beach would be attributable to using vehicles during amphibious assault and raid exercises in the nearshore environment resulting from amphibious warfare training. A total of 10 amphibious assault and 24 amphibious raid exercises would be conducted under the No Action Alternative.

Use of the amphibious warfare systems could temporarily alter water quality conditions of the Cherry Point OPAREA and Onslow Beach. Proposed operations could have an impact due to any of these systems releasing chemical contaminants such as petroleum or diesel fuel, hydraulic fluid, or grease, which could cause a temporary increase in the presence of polycyclic aromatic hydrocarbon (PAH) compounds in the water column during and temporarily after a training exercise.

3.3.3.2 Alternative 1

Navy Cherry Point Range Complex training and testing activities involving potential water quality impacts would remain the same or increase by varying degrees from current levels in support of the Fleet Response Training Plan (FRTP). Only the number of training operations would increase; no new training activities (*i.e.*, weapons firing, target deployment, *etc.*) would be introduced.

Proposed Increases in Training Operations

Navy and Marine Corps vessels, aircraft, and other military assets engaged in the training and testing would use expendable materials during routine ship operations, which could potentially impact water quality.

Changes in training and testing associated with Alternative 1 are provided in Table 2.2-4, ordnance use is detailed in Table 2.2-6; in summary, under Alternative 1, changes in activities with potential impacts to water quality include the following:

- use of high explosive bombs would remain the same as in the No Action Alternative;
- use of non-explosive practice bombs would increase by 10 percent;
- use of high explosive (HE) missiles would increase 121 percent (19 HE missiles annually under No Action Alternative, 42 HE Missiles annually under Alternative 1);
- use of non-explosive practice missiles would increase 300 percent;
- use of targets would increase by 24 percent;
- use of marine markers would increase by 9 percent;
- use of high explosive rounds would remain the same;
- use of non-explosive practice naval gun ammunition would increase by 11 percent;
- use of small arms and CIWS ammunition would increase by 12 percent;
- use of chaff rounds would increase by 12 percent;
- use of flares would increase by 11 percent; and
- use of 20-lb charges would remain the same as under the No Action Alternative.

Military training activities in the Cherry Point OPAREA, especially the use of live ordnance, are potential sources of water quality pollutants. All of the underwater detonation operations in the Cherry Point OPAREA occur in the underwater detonation (UNDET) area (see Figure 2.2-1). 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. Although use of HE missiles would increase 121

percent under Alternative 1, the number of additional HE missiles used annually would increase by 23. The additional surface-to-air missiles would be used throughout the Cherry Point OPAREA. The increase in HE missiles equates to less than 0.0012 missiles per nm^2 per year. As such, there would not be a measurable effect to water quality as a result of the proposed additional missile use. Training and testing impacts to water quality associated with Alternative 1 would not be measurably different than the No Action Alternative.

Expand Warfare Missions

Conduct Maritime Security Surface Strike Group (SSG) Training. Maritime Security (MS) SSG training is not substantially different than training that already occurs within the Navy Cherry Point Range Complex. Essentially, it is a repackaging of cruiser/destroyer training operations such that a three-ship SSG practices operating as an autonomous entity. MS SSG training does not involve the expenditure of ordnance. MS SSG training associated with Alternative 1 would not have a measurable effect on water resources or water quality.

Accommodate Mission Requirements Associated with Force Structure Changes

Conduct MH-60R/S Training. The Navy proposes to conduct the MH-60R/S training missions in the Navy Cherry Point Range Complex in accordance with the recent restructuring of Navy helicopter forces around the two linchpin airframes, the MH-60S and MH-60R (DoN, 2002b).

Organic Mine Countermeasures. Navy vessels, aircraft, and other military assets engaged in these operations would use minor quantities of hazardous materials during routine operations, which could affect water quality. These materials and protection of water resources would be managed in accordance with applicable regulations (see Appendix K).

The introduction of Organic Mine Countermeasures (OMCM) requires a change in tactics, techniques, procedures, and training for Mine Countermeasures (MCM). Under Alternative 1, Mine Countermeasure capability will be embedded in a task group. In addition, nine mine neutralization exercises (sorties) using the RAMICS/ALMDS system would be conducted in Alternative 1.

Use of the mine sweeping systems could alter conditions in bottom sediment of Onslow Bay and Onslow Beach when the water column is shallow. Proposed operations could have an impact due to any of these systems streamed through the water, which could cause a temporary increase in turbidity and total suspended solids in the water column during and temporarily after a training exercise.

Although the areas of Onslow Bay and Onslow Beach where these operations would be conducted lies within North Carolina state territorial waters, the potential sediment disturbance would not impair water resources or exceed state or federal water quality standards; thus, a less than significant impact on water quality is anticipated.

Airborne Mine Neutralization System (AMNS) is a mine neutralization system that will be deployed from an MH-60S to explosively neutralize mines identified by minehunting systems. The AMNS operator, controlling the system from the helicopter, uses the vehicle's sonar to reacquire the target. Once acquired, the operator uses video to guide the target into a position for firing a self-contained shaped charge that neutralizes the mine. Nine mine neutralization exercises (sorties) using the AMNS system would be conducted in Alternative 1.

RAMICS is a targeting, fire control, and gun system that fires inert, non-explosive rounds at a mine moored near the surface of the water. The associated system, ALMDS, uses the Light Detection and Ranging (LIDAR) laser system from the MH-60S to identify the mine and direct RAMICS gun fire to destroy the mine. RAMICS/ALMDS systems would be deployed in the MINEX area, Onslow Bay (Cherry Point OPAREA 15B and littoral area to Onslow Beach) (see Figure 2.2-1). Nine mine neutralization exercises (sorties) using RAMICS/ALMDS would be conducted in Alternative 1.

Amphibious assault and amphibious raid exercises would remain the same as the No Action Alternative.

3.3.3.3 Alternative 2 (Preferred Alternative)

Under Alternative 2, Navy Cherry Point Range Complex training operations would increase or decrease by varying degrees from current levels in support of the FRTP. The increases and decreases are described in Chapter 2 and summarized in Tables 2.2-4, and 2.2-5. A new Mine Warfare Training Area would be set up in Onslow Bay. Figures 2.2-1 and 2.2-2 show the locations of these areas. Only the number of training operations would change; no new training activities would be introduced. Potential impacts to water quality resulting from expended materials use would be essentially the same as Alternative 1.

Under Alternative 2, no HE bombs would be deployed. Under Alternative 2, HE missile use would be the same as described for Alternative 1.

Airborne Mine Neutralization System is a mine neutralization system that will be deployed from an MH-60S to explosively neutralize mines identified by minehunting systems. The AMNS operator, controlling the system from the helicopter, uses the vehicle's sonar to reacquire the target. Once acquired, the operator uses video to guide the target into a position for firing a self-contained shaped charge that neutralizes the mine. Twenty seven mine neutralization exercises (sorties) using the AMNS system would be conducted in Alternative 2 (the Preferred Alternative).

RAMICS is a targeting, fire control, and gun system that fires inert, non-explosive rounds at a mine moored near the surface of the water. The associated system, ALMDS, uses the LIDAR laser system from the MH-60S to identify the mine and direct RAMICS gun fire to destroy the mine. RAMICS/ALMDS systems would be deployed in the MINEX area, Onslow Bay (Cherry Point OPAREA 15B and littoral area to Onslow Beach) (see Figure 2.2-1). Twenty seven mine neutralization exercises (sorties) using RAMICS/ALMDS would be conducted in Alternative 2 (the Preferred Alternative).

Impacts to water quality in Onslow Bay and Onslow Beach would be attributable to using the MK-103, MK-105, AQS-24A, AQS-20A and OASIS minesweeping systems in the nearshore environment resulting from mine countermeasure training. Use of the mine sweeping systems could alter conditions in bottom sediment of Onslow Bay and Onslow Beach when the water column is shallow. Proposed operations could have an impact due to any of these systems streamed through the water, which could cause a temporary increase in turbidity and total suspended solids in the water column during and temporarily after a training exercise.

Although the areas of Onslow Bay and Onslow Beach where these operations would occur lies within North Carolina state territorial waters, the majority of Navy's activities are conducted in the offshore OPAREAs (18,617 nm^2 of sea space) as such, the potential sediment disturbance would be temporary in a given area and would not impair the water resource or exceed state or federal water quality standards; thus, no significant impact on water quality is anticipated under Alternative 2.

Impacts to water quality in Cherry Point OPAREA (Area 15B) and littoral area to Onslow Beach attributable to vehicular use during amphibious assault and raid exercises in the nearshore environment resulting from amphibious warfare training would be the same as under the No Action Alternative or Alternative 1.

Military training activities in the Cherry Point OPAREA, especially the use of live ordnance, are potential sources of water quality pollutants. Under Alternative 2, the underwater detonation operations in the Cherry Point OPAREA would occur within a smaller UNDET Area (see Figure 2.2-1) and the number of operations would be less than Alternative 1. 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. Therefore, the impact on water resources and water quality is less than significant under Alternative 2.

3.3.4 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 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.

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 includes all missiles, munitions, and targets used at the Navy Cherry Point Range Complex. A review of the use of military expended materials was conducted and the analysis is provided in Section 3.2, Hazardous Materials and Hazardous Waste.

Impacts to water quality in Onslow Bay and Onslow Beach would be attributable to using the MK-103, MK-105, AQS-24A, AQS-20A and OASIS minesweeping systems in the nearshore environment resulting from mine countermeasure training. Use of the mine sweeping systems could alter conditions in bottom sediment of Onslow Bay and Onslow Beach when the water column is shallow. Proposed operations could have an impact due to any of these systems streamed through the water, which could cause a temporary increase in turbidity and total suspended solids in the water column during and temporarily after a training exercise.

Although the areas of Onslow Bay and Onslow Beach where these operations would occur lies within North Carolina state territorial waters, the potential sediment disturbance would not impair water resources or exceed state or federal water quality standards; thus, no significant impact on water quality is anticipated under Alternative 2.

Impacts to water quality in Cherry Point OPAREA (Area 15B) and littoral area to Onslow Beach attributable to vehicular use during amphibious assault and raid exercises in the nearshore environment resulting from amphibious warfare training would be the same as the No Action Alternative.

Expended material would introduce small amounts of potentially hazardous chemicals into the marine environment. Any accidental spills would be handled according to the shipboard contingency plan. The analysis of all current and proposed operations indicates that concentrations of constituents of concern associated with material expended in the Navy Cherry Point Range Complex are well below water quality criteria established to protect aquatic life.

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, RDX, and octogen (High Melting Explosive or HMX) (URS, 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 3.3-4, less than significant overall impacts from hazardous materials on water quality 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 would have no substantial effects to water quality. 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 3.3-4 Summary of Environmental Effects of the Alternatives on Water Quality in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Seafloor Disturbance or Localized Turbidity Increase	Temporary, short-term, minor and localized changes in turbidity from seafloor disturbance.	Temporary, short-term, minor and localized changes in turbidity from seafloor disturbance.
Non-Explosive Practice Munitions	Long-term, minor, and localized accumulation of expended materials on the ocean floor.	Long-term, minor, and localized accumulation of expended materials on the ocean floor.
Underwater Detonations and High Explosive Ordnance	Temporary, short- term, minor, and localized changes 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	Temporary, short- term, minor, and localized changes 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
Military Expended Materials	Temporary, short- term, minor, and localized changes 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.	Temporary, short- term, minor, and localized changes 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.
Impact Conclusion	Less than significant impact.	Less than significant harm.

Table 3.3-4 Summary of Environmental Effects of the Alternatives on Water Quality in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 1		
Seafloor Disturbance or Localized Turbidity Increase	Temporary, short-term, minor and localized changes in turbidity from seafloor disturbance. Impact similar to No Action Alternative.	Temporary, short-term, minor and localized changes in turbidity from seafloor disturbance. Impact similar to No Action Alternative.
Non-Explosive Practice Munitions	Long-term, minor, and localized accumulation of expended materials on the ocean floor. Increase in accumulation of expended NEPM over No Action Alternative.	Long-term, minor, and localized accumulation of expended materials on the ocean floor. Increase in accumulation of expended NEPM over No Action Alternative.
Underwater Detonations and High Explosive Ordnance	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Slight increase compared to No Action Alternative. Long-term, minor, and localized accumulation of expended materials on the ocean floor.	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Slight increase compared to No Action Alternative. Long-term, minor, and localized accumulation of expended materials on the ocean floor
Military Expended Materials	Temporary, short- term, minor, and localized changes 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. Slight increase compared to No Action Alternative.	Temporary, short- term, minor, and localized changes 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. Slight increase compared to No Action Alternative.
Impact Conclusion	Less than significant impact.	Less than significant harm.
Alternative 2 (Preferred Alternative)		
Seafloor Disturbance or Localized Turbidity Increase	Temporary, short-term, minor and localized changes in turbidity from seafloor disturbance. Impact similar to No Action Alternative.	Temporary, short-term, minor and localized changes in turbidity from seafloor disturbance. Impact similar to No Action Alternative.
Non-Explosive Practice Munitions	Long-term, minor, and localized accumulation of expended materials on the ocean floor. Impact similar to Alternative 1.	Long-term, minor, and localized accumulation of expended materials on the ocean floor. Impact similar to Alternative 1.

Table 3.3-4 Summary of Environmental Effects of the Alternatives on Water Quality in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Underwater Detonations and High Explosive Ordnance	Temporary, short- term, minor, and localized changes 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. Less impact than No Action or Alternative 1.	Temporary, short- term, minor, and localized changes 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. Less impact than No Action or Alternative 1.
Military Expended Materials	Temporary, short- term, minor, and localized changes 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. Slight increase compared to No Action.	Temporary, short- term, minor, and localized changes 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. Slight increase compared to No Action.
Impact Conclusion	Less than significant impact.	Less than significant harm.

3.4 AIR QUALITY

3.4.1 Introduction and Methods

Air quality in a 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;
- Sulfur dioxide;
- Nitrogen oxides;
- Ozone;
- Suspended particulate matter with a diameter of 10 microns or less, and 2.5 microns or less; and
- Lead.

The USEPA has established National Ambient Air Quality Standards (NAAQS) for these "criteria pollutants" that represent ambient concentrations 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 carbon dioxide, sulfur dioxide, lead, and some particulates, are emitted directly into the atmosphere from emission sources. Secondary pollutants, such as ozone, nitrogen oxides, and some particulates, are formed through atmospheric photochemical reactions that are influenced by meteorology, ultraviolet light, and other atmospheric processes.

Wind direction determines the 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 turbulence and pollutants released near the ground will disperse more rapidly. However, air pollutants emitted by elevated stack sources may be more rapidly transported to the ground during high winds and can actually lead to higher ground-level pollutant concentrations. At low wind speeds, pollutants emitted from sources near the ground, such as vehicle exhaust, will 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 because of 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 is 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.

Generally, the air quality of the Navy Cherry Point Study Area is very good. This conditions results from the relatively low number of air pollutant sources, size and topography of the Study Area, and prevailing meteorological conditions.

3.4.1.1 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 U.S.C. Part 7401, *et seq.*). Activities under the CAA have included:

- Establishing the NAAQS;
- Classifying the attainment status of areas relative to the NAAQS;
- Developing schedules and strategies to meet the NAAQS; and
- Regulating emissions of criteria pollutants and air toxics to protect public health and welfare.

Under the CAA, states are allowed to adopt ambient air quality standards and other regulations, provided they are at least as stringent as federal standards. Within the Navy Cherry Point Range Complex, implementation of the CAA is carried out by the North Carolina Department of Environment and Natural Resources (NC DENR).

The USEPA requires each state to prepare a state implementation plan (SIP) that describes how that state will achieve compliance with the NAAQS. An 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 air quality regulations promulgated under the CAA that are potentially applicable to the proposed action include the NAAQS and General Conformity Rule.

NAAQS

The CAA requires the USEPA to set primary and secondary NAAQS for the six pollutants considered harmful to public health and the environment (40 CFR Part 50). These standards for each of the states within the Navy Cherry Point Range Complex are presented in the NAAQS table in Appendix K. 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 and damage to animals, crops, vegetation, and buildings.

General Conformity Rule

Section 176(c)(1) of the CAA, the General Conformity Rule, requires federal agencies to ensure that their actions conform to applicable implementation plans for achieving and maintaining the NAAQS for criteria pollutants. To ensure compliance with the General Conformity Rule, a federal action must not contribute to new violations of ambient air quality standards, increase the frequency or severity of existing violations, or delay timely state and/or regional attainment of standards.

The USEPA rule implementing the conformity requirements, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans," is codified in 40 CFR Parts 51 and 93. 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 an SIP has been revised and approved by the 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 its requirements. Each federal agency taking an action subject to the General Conformity Rule must make a conformity determination (40 CFR 93.154).

A conformity review, with documentation, must be completed for every Navy action that generates air emissions in nonattainment or maintenance (former nonattainment) areas. The conformity review can be satisfied by a determination that the action is not subject to the General Conformity Rule, a record of non-applicability, or a conformity determination.

In some cases, the Navy can make a determination that a proposed action is not subject to the General Conformity Rule. Actions not subject to the rule include:

- Actions that occur in attainment areas, and that do not generate emissions in nonattainment 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 an action, the determination that the proposed action is not subject to the General Conformity Rule is described in that documentation. Otherwise, no documentation is required. This EIS/OEIS includes the determination that all actions occurring in the attainment areas (*i.e.*, the coastal counties of North Carolina) are not subject to the General Conformity Rule.

3.4.1.2 Assessment Methods and Data Used

The method used in this EIS/OEIS to assess air quality impacts associated with existing and proposed Navy and Marine Corps training and testing within the Navy Cherry Point Study Area included the following the 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 Study Area and the existing meteorological conditions;
- Analyze the types of emission sources associated with training and testing within the Navy Cherry Point Study Area;
- Review existing air quality assessments associated with individual Navy and Marine Corps platforms and weapons systems;
- Determine overall air quality impacts associated with existing Navy and Marine Corps training and testing within the Study Area given the regulatory framework; and
- Determine overall air quality impacts associated with the proposed increases in Navy and Marine Corps training and testing within the Study Area given the regulatory framework.

3.4.1.3 Warfare Areas and Associated Environmental Stressors

The warfare areas and emission sources (environmental stressors) associated with training in the Navy Cherry Point Range Complex are identified in Table 3.4-1. These sources will be analyzed in this section to determine their environmental consequences.

These sources/stressors may be associated with the training platform, weapon system used in the exercise, and/or target or support craft. The table also identifies whether training exercises that produce emissions occur within and/or beyond 12 nm from shore, and whether they take place below and/or above 3,000 feet. Emissions above 3,000 feet would be above the atmospheric inversion layer and, therefore, would not affect local air quality.

As shown in Table 3.4-1, in general, helicopter and amphibious boat exercises take place closer to the shore, while fixed wing aircraft and large ship exercises take place at a great distance from shore. Training events involving expenditure of large explosives also typically occur at least 12 nm offshore. This is important from an air quality perspective because it helps one understand which Navy exercise emission sources would contribute to the overall air quality for human receptors. For example, large ship gun firing exercises (*e.g.*, GUNEX [Surface-to-Surface]) are always conducted at least 12 nm from shore. Emissions associated with these events would be minor cruiser or destroyer engine exhaust and gun barrel exhaust from firing the 5-inch guns. Another example would be amphibious ship and helicopter engine emissions in connection with the amphibious events (amphibious raid and amphibious assault). A portion of these events occur within 3 nm of the shore and all occur below 3,000 feet. When these emissions occur near shore they have the chance (depending on wind direction) to mix with the air breathed by life ashore. Table 3.4-1 summarizes the emissions sources associated with each training

operation. These sources will be analyzed thoroughly in this section and conclusions as to the environmental consequences of the emissions will follow.

Table 3.4-1 Warfare Areas and Associated Air Quality Environmental Stressors

		Stressors				Location			
Warfare Area and Operation	**Training Areas**	**Surface Vessel Emissions**	**Helicopter Emissions**	**Fixed-Wing Aircraft Emissions**	**Ordnance or Target Emissions**	**Below 3,000 feet**	**Above 3,000 feet**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**
Mine Warfare (MIW)									
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓			✓		✓	✓
Mine Neutralization	Onslow Bay UNDET Area	✓	✓		✓	✓		✓	
Surface Warfare (SUW)									
Bombing Exercise (A-S)	W-122 (Area 18)			✓	✓		✓		✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Areas 16 and 17)		✓		✓	✓			✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17		✓	✓	✓	✓		✓	✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓			✓	✓			✓
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA	✓				✓			✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA	✓				✓			✓
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA	✓	✓			✓			✓
Air Warfare (AW)									
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)			✓			✓	✓	✓
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)			✓			✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)			✓	✓		✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓		✓	✓	✓	✓		✓
Air Intercept Control	W-122			✓			✓		✓
Electronic Combat (EC)									
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122	✓		✓		✓	✓	✓	✓
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓		✓	✓	✓	✓

Table 3.4-1 Warfare Areas and Associated Air Quality Environmental Stressors (Continued)

		Stressors				Location			
Warfare Area and Operation	**Training Areas**	**Surface Vessel Emissions**	**Helicopter Emissions**	**Fixed-Wing Aircraft Emissions**	**Ordnance or Target Emissions**	**Below 3,000 feet**	**Above 3,000 feet**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**
Chaff Exercise- ship	Cherry Point OPAREA	✓				✓			✓
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	✓	✓	✓	✓	✓
Strike Warfare (STW)									
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, 21)			✓	✓		✓		✓
Amphibious Warfare (AMW)									
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)	✓			✓	✓		✓	✓
FIREX with Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)	✓			✓	✓			✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓				✓		✓	✓
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓				✓		✓	✓

3.4.2 Affected Environment

The affected environment for purposes of air quality includes: the Special Use Airspace (SUA) associated with the Cherry Point OPAREA, and the air above adjoining cities/counties in North Carolina, whose air mixes with the Navy and Marine Corps training space in the Navy Cherry Point Range Complex. As mentioned in Chapters 1 and 2, the Study Area of the Navy Cherry Point Range Complex assessed in this EIS/OEIS includes offshore training sea space, undersea space and SUA (W-122) (See Section 1.5 for details). For air quality purposes, the majority of area assessed is that 18,966 nm^2 of SUA located above the Cherry Point OPAREA (W-122), which is where most Navy and Marine Corps aircraft training events occur within the Study Area. W-122 begins 3 nm from shore, where state waters and CAA applicability ends. Because some training also occurs in the nearshore environment between the Cherry Point OPAREA and the North Carolina shoreline, this area is also assessed. Finally, consideration is given to potential impacts to adjacent state Air Quality Control Regions (AQCR).

Regional Climate

As mentioned in the introduction to this section, the climate of the region plays an important role in determining air quality. Class 3 (6.4-7.0 mph at 50 m height) and above wind resource occurs at exposed areas throughout much of the United States, except the southeastern United States where Class 3 and above is restricted to exposed mountain summits and ridge crests in the Appalachians and coastal areas from North Carolina northward (Renewable Resource Energy Center, 2007).

The weather in the Navy Cherry Point Study Area is characterized by a temperate climate with relatively mild winters, hot humid summers, and precipitation throughout the year. The average annual temperature is near 62 degrees Fahrenheit (°F) with high summer temperatures near 90 °F and low winter temperatures near 45 °F. Annual precipitation is over 50 inches and average relative humidity is 75 percent. The climate is influenced by the Atlantic Ocean and the Gulf Stream, and the Study Area is occasionally affected by tropical storms and hurricanes during the period from June through November each year. The mild temperatures and moderate wind conditions play a role in determining the existing air quality in the EIS/OEIS Study Area. Typically, steady westerly winds keep emissions generated offshore from affecting the onshore air quality.

North Carolina Air Quality

The proposed action Study Area includes offshore waters adjacent to portions of North Carolina. The nearest North Carolina counties to the Study Area are Dare, Hyde, Onslow, Pender, Jones, Craven, Pamlico and Carteret County. Dare and Hyde Counties are part of the Northern Coastal Plain Intrastate AQCR (40 CFR Part 81.149). Onslow, Pender, Jones, Craven, Pamlico and Carteret Counties are part of the Southern Coastal Plain Intrastate AQCR (40 CFR Part 81.152). Pursuant to 40 CFR Part 81.334, each of the North Carolina counties bordering the Study Area has been designated as being in "attainment" for all criteria pollutants. See Figure 3.4-1 for location of the state's adjacent AQCRs and those counties therein bordering the Study Area.

3.4.3 Environmental Consequences

The evaluation of potential air quality impacts includes two separate analyses.

- Effects of air pollutant emissions from Navy Cherry Point Study Area operations occurring within U.S. territory (within 12 nm of the coastline) are assessed under NEPA.
- Effects of air pollutant emissions from Navy Cherry Point Study Area operations occurring outside U.S. territory are assessed under EO 12114.

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 those areas within U.S. territorial waters were included in the evaluation. For the purposes of assessing air quality effects under EO 12114, only those aircraft, vessels, and ordnance/targets operations occurring at or below 3,000 feet and outside of U.S. territorial waters were considered in the evaluation.

The NEPA analysis involved 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 and include hazardous air pollutants not covered under the NAAQS. In particular, these would include unspent missile fuel vapors. These emissions would be minor and would not result in significant impacts because of the distance from humans that could be affected by air toxics and the low levels of emissions.

The NEPA analysis does not include a CAA General Conformity Determination because North Carolina's adjacent AQCRs have been designated in attainment for all criteria pollutants. The EIS/OEIS Study Area lies adjacent to following AQCRs: Northern Coastal Plain AQCR and the

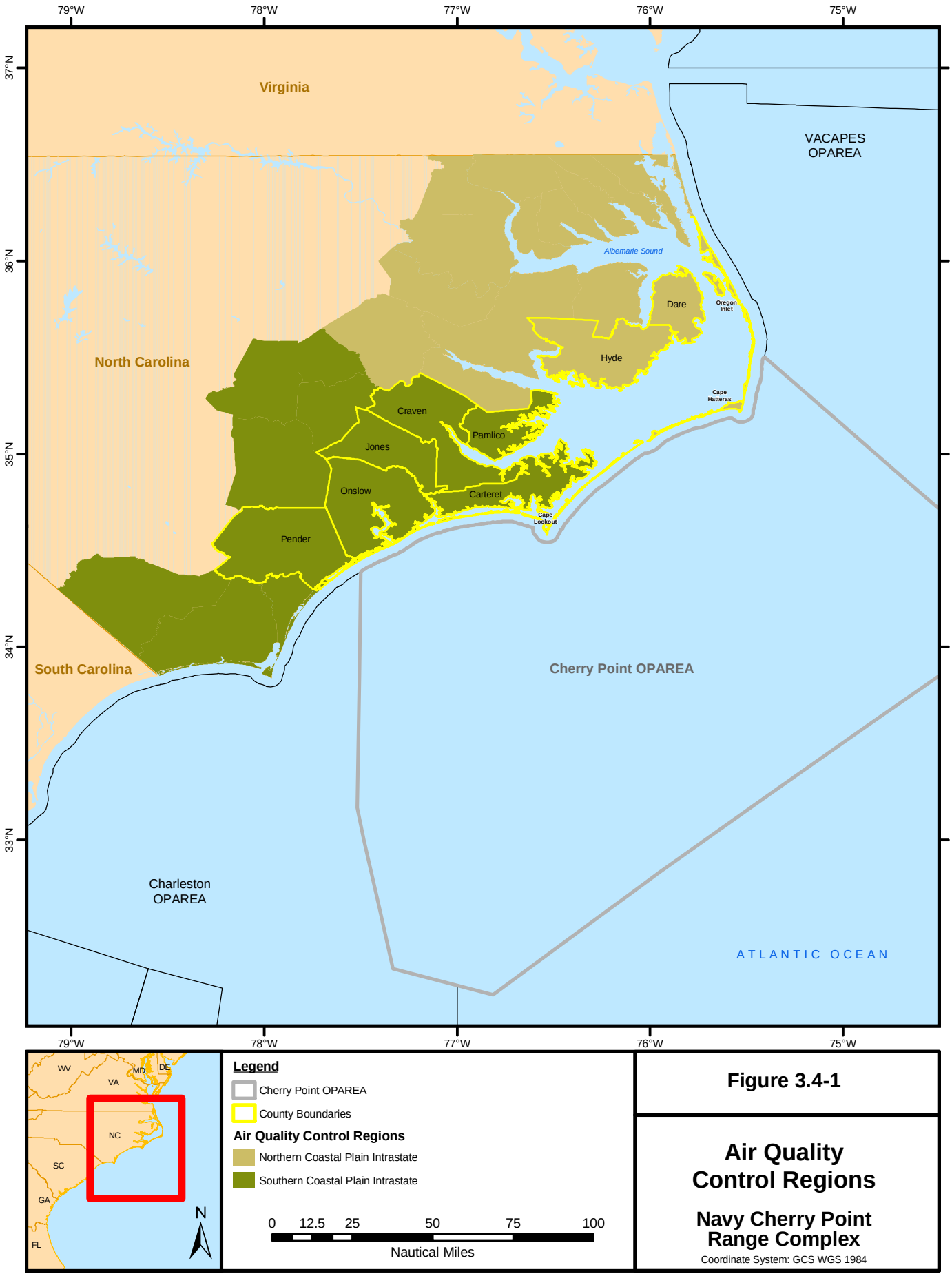


Figure 3.4-1

Air Quality Control Regions

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

Southern Coastal Plain AQCR. Pursuant to 40 CFR Part 81.334, each of these AQCRs has been designated as being in "attainment" for all criteria pollutants. Thus, the proposed action, which takes place in North Carolina, is not subject to the General Conformity Rule. The Conformity Review is satisfied by this determination and a Conformity Determination is not otherwise necessary.

Surface Ship Emissions

Marine vessel traffic in the Cherry Point OPAREA comprises military ship and boat traffic, including support vessels providing services for military training exercises and tests. A number of non-military commercial vessels and recreational vessels are regularly present within the Cherry Point OPAREA. These vessels were not evaluated in the air quality analysis because they are not part of the Navy's action.

Evaluating marine vessel emissions typically involves examining, for each type of vessel, its type of operation, number of hours of operation, type of propulsion engine, and type of generator used onboard. The types of surface ships and numbers of operations for the No Action Alternative are derived from U.S. Fleet Forces statistics, scheduling data, and interviews with the Navy and Marine Corps commands overseeing unit level and major exercise training. For Alternatives 1 and 2, operational estimates of future ship use percentages were obtained based on evolutionary changes in the Navy force structure and mission assignments. Where there were no major changes in types of ships, future operations estimates were based on the percentage distribution of historical operations.

Because no time is spent by surface ships within a nonattainment AQCR, there was no need to investigate the time spent within particular locations, at what power level, or the path taken by vessels within the range complex. Only four training events involve some surface craft operations within 3 nm of the shoreline (Mine Countermeasures, Mine Neutralization, Amphibious Assaults and Amphibious Raids). These events involve boat engine emissions off the coast of North Carolina. All these events occur infrequently (approximately one event per month). For Amphibious Raids and Amphibious Assaults only one-third of any event is actually spent within 3 nm of the shore. The remaining event time is spent farther offshore in preparation for the shoreward movement.

Other Study Area events may also have target support craft involvement (*e.g.,* GUNEX [Surface-to-Surface]). These too, would present insignificant air quality impacts. Target support ship emissions would occur infrequently (as needed for events) and would produce engine emissions at least 12 nm from shore. Overall on average, Navy training events involving surface ships are projected to remain similar to baseline levels under any alternative. Associated ship engine emissions are, thus, expected to remain relatively constant.

Aircraft Emissions

Evaluating aircraft emissions involves evaluating, for each aircraft type, its type of operations, number of hours of operation, type of engine, and mode of operation. Aircraft emit the following CAA criteria pollutants: nitrogen oxides, carbon monoxide, sulfur dioxide and particulate matter. They also emit volatile organic compounds (VOC), which are precursors to the NAAQS criteria pollutant, ozone.

Emissions occurring above 3,000 feet are usually above the mixing layer, which is capped by the atmospheric inversion. Therefore, these emissions would not have any effect on local air quality. Fixed wing aircraft flights, for the most part originate from onshore air stations (*e.g.,* NAS Oceana, MCAS Cherry Point), but some originate from aircraft carriers offshore. It was assumed that all fixed wing aircraft would be traveling from their home base to the Navy Cherry Point Study Area SUA at an elevation above 3,000 feet, and that transit to and from the range would not affect local air quality. A recent study of aircraft emissions in W-122 was performed by the Air Force in connection with the F-22 beddown decision. Table 3.4-2 sets forth the estimated emissions of Navy, Marine Corps, and Air Force aircraft in W-122 during calendar year 2007.

Table 3.4-2 Estimated Baseline Emissions in W-122

W-122			Estimated Emissions (tons per year) during Calendar Year 2007				
Aircraft	**Annual Sorties**	**% Time below mixing height**	**CO**	**VOCs**	**NO_x**	**SO_2**	**PM_{10}**
AV-8	3,472	17	0.27	0.01	2.37	0.01	0
B-737	880	0	0	0	0	0	0
KC-130	375	80	3.12	0.6	16.9	0.06	1.21
C-130	44	80	0.37	0.07	1.98	0.007	0.14
EA-6B	1,625	12	3.57	0.75	9.42	0.05	0
F-18	1,200	17	0.78	0.06	13.6	0.02	0.38
F-14	634	11	0.36	0.02	2.86	0.008	0.05
F-16	5,331	17	0.58	0.47	50.8	0.08	0.17
F-22	601	5	0.08	0.03	3.37	0.005	0.01
P-3	636	17	1.12	0.22	6.1	0.02	0.43
Totals	14,798		10.25	2.23	107.4	0.26	2.39

Source: USAF, 2001.

Notes: A composite set of emission factors and fuel flow rates for each pollutant at each power setting was developed based on recently published modal emission factors for the F100 series of engines using JP-8 as a fuel. The F100 series engines are the power plants of both the F-15 and F-16 aircraft. This series of engines closely represents the function of the F119 engine and the power settings anticipated to be used by the F-22.

Aircraft training in the Navy Cherry Point Study Area involves several types of aircraft. In general, helicopter training takes place closer to shore, while fixed wing training takes place farther from shore. Approximately 90 percent of the emissions shown in Table 3.4-2 are released beyond 12 nm from shore, a great distance from the onshore AQCRs. The primary training events producing these emissions are air combat maneuvers, and electronic combat.

Fixed-wing aircraft primarily conduct training operations in areas of the Navy Cherry Point Range Complex beyond the 12 nm U.S. territorial limits. Air quality may be temporarily affected in locations where a high number of aircraft simultaneously engage in practice operations, but such consequence would be of limited duration and emissions would quickly disperse. Significant impacts to air quality beyond the U.S. territorial limits also are not expected because of the high altitude of fixed-wing training operations (above 3,000 feet). Such high-altitude aircraft emissions are associated with training events, including: ACM, MISSILEX (Air-to-Air), GUNEX (Air-to-Air), and BOMBEX (Air-to-Surface).

Commercial air services (CAS) aircraft participate in Electronic Combat (EC), Air Intercept Control (AIC), GUNEX (S-A), GUNEX (A-A), and Detect-to-Engage (DTE) training events. CAS aircraft will be operated primarily above the 3,000 foot atmospheric inversion layer. Emissions from CAS aircraft are similar to Navy fixed-wing aircraft. As mentioned in Chapter 2, CAS aircraft displace Navy fixed-wing aircraft used in such CAS supported events and thus do not add to overall event emissions.

Aircraft operating in the Navy Cherry Point Range Complex SUA generally have reciprocating, turboprop, or jet engines. Most of these aircraft use JP-5 or JP-8 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 can be associated with the generation of ground-level ozone. However, the volume of aircraft operations in the Navy Cherry Point Range Complex SUA is relatively small, and adjacent areas of North Carolina are “in attainment” areas for ozone. Therefore, emissions related to aircraft training activities in the Navy Cherry Point Range Complex SUA are not anticipated to have an

adverse impact on the study area environment. As shown in Table 3.4-2, VOC emissions in W-122 are very low.

Emissions from Weapons and Explosives

Other common chemical emissions associated with Navy training are explosive compounds and oxidation products. Oxides of carbon, nitrogen, and water are formed during this process, which reduces the likelihood of parent chemicals (trinitrotoluene and cyclonite) entering surrounding environments. Other nitroaromatic compounds such as octogen, 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 (DoN, 2002b citing the Navy Ordnance Environmental Safety Office). The one to two percent of explosive component not consumed is generally dispersed, with most falling to the water in the immediate vicinity of the blast and the balance being dispersed in the air, where it is subject to dilution by wind currents and weather conditions.

Many of the smokes and fumes given off by pyrotechnics and screening devices are nontoxic and only mildly irritating to the eyes and nasal passages when encountered in relatively light concentrations out-of-doors. However, heavy concentrations in closely confined spaces 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, out-of-doors, and at great distances from land, associated air emissions would be non-toxic to residents in the Navy Cherry Point Study Area.

Air emissions from an Army Hellfire missile launch, helicopter motor combustion, and warhead detonation were calculated in the *Life Cycle Environmental Assessment for Hellfire Modular Missile System, August 1994* (Department of the Army, 1994). The highest percentage (by weight) of motor combustion and warhead detonation products consists of nitrogen, water, carbon dioxide, carbon monoxide, elemental carbon, and ammonia at totals between 95 percent (motor combustion) to 99.51 percent (warhead detonation). Air emissions that make up the additional 0.49 percent to 4.1 percent are from aluminum oxide, lead, hydrogen cyanide, ethane, hydrogen, and methane. Because of the low concentrations and rapid dispersal of Hellfire combustion and detonation products, it was determined that Hellfire testing would have no significant impact on air quality (Department of the Army, 1994). Hellfire, TOW and other missiles used in the Navy Cherry Point Study Area are expected to have similarly benign impacts on regional air quality.

Underwater detonations (UNDET) associated with EOD mine neutralization training utilize C4, which consists of RDX plus a small amount of polyisobutylene binder. The principal explosive byproducts are water, carbon dioxide, carbon monoxide, nitrogen, and hydrogen. Underwater explosions create 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 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 UNDET explosive byproducts are not expected to significantly impact the regional air quality. The proposed new mine neutralization systems, including the Airborne Mine Neutralization System (AMNS) and Rapid Airborne Mine Clearance System (RAMICS), do not have air emissions associated with their use, other than the helicopter platforms used to deploy them.

Combustion products from BQM-74 target launches are predominantly aluminum oxide, carbon monoxide, hydrogen chloride, water, nitrogen, carbon dioxide, and hydrogen (NASA, 2003a). The following Table 3.4-3 provides estimates of emissions associated with existing and proposed BQM-74 target launches. As shown in the table, the emissions generated by the drone targets are minimal.

Table 3.4-3 Emissions Estimates for BQM-74 Target Drone Launches in the Cherry Point OPAREA

		Emissions in tons/year			
Target	**Number Fired/Launched**	**CO**	**NO_x**	**SO_x**	**PM_{10}**
BQM-74 Drone Targets	No Action **10 drones**[17]	0.001418	0.004255	0	0.003546099
	Alt 1 and Alt 2 **28 drones**[18]	0.0039704	0.011914	0	0.0099288
Source: Adapted from DoN, 2002a.					

The air quality impacts of chaff were evaluated by the USAF 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 that 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. Therefore, it appears that chaff deployment would not result in an exceedance of the NAAQS (USAF, 1997). Chaff Exercises in the Navy Cherry Point Study Area are conducted relatively infrequently, and are typically conducted more than 3 nm from shore. These facts further reduce any potential for impacts to NAAQS.

The volume of emissions from ordnance and explosives has a minimal impact on regional air quality. In conformance with NEPA evaluation procedures, no significant impact is expected to the regional air quality and, under EO 12114, no significant harm is expected to the air quality above non-territorial waters.

3.4.3.1 No Action Alternative

The No Action Alternative consists of maintaining the current levels of training and testing in the Navy Cherry Point Study Area. Thus, there would be no change in current levels of emissions associated with training or testing operations. Current ship emissions are limited and predominantly released at least 12 nm from shore. Current aircraft emissions are due mostly to air combat maneuvers and electronic combat training. These events also typically occur at least 3 nm from shore and over 3,000-foot altitude (above the mixing layer).

The cities/counties in North Carolina adjoining the Study Area are currently designated in attainment for all criteria pollutants. This is reflective of good regional air quality. Included within this characterization of regional air quality are the existing Navy and Marine Corps aircraft and surface ship emissions. A continuation of baseline training and testing levels adjacent to the coastal counties in North Carolina would not be subject to the General Conformity Rule because the training occurs in or adjacent to locations designated as attainment areas for all criteria pollutants.

[17] Assumes 1 drone used per missile launched in either air-to-air or surface-to-air missile exercises.
[18] Assumes 1 drone used per missile launched in either air-to-air or surface-to-air missile exercises.

The offshore reaches of the Cherry Point OPAREA (beyond 12 nm) are not classified for priority pollutants under the CAA. Therefore, the CAA 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, the No Action Alternative is not likely to significantly impact the existing air quality of the Navy Cherry Point Study Area. Furthermore, the No Action Alternative is not likely to significantly harm the existing air quality of the Navy Cherry Point Study Area.

3.4.3.2 Alternative 1

Under Alternative 1 there would be minor increases in air pollutants associated with nearly every training event within the Study Area. Some events conducted within the Navy Cherry Point Study Area would not increase under Alternative 1 (*e.g.*, Mine Countermeasures, EOD Mine Neutralization, FIREX [Land], FIREX with IMPASS, Air Intercept Control, and amphibious events) and thus no increase in emissions would be expected from these events. For other events (*e.g.*, Chaff and Flare Exercises) slight increases in ship and aircraft emissions would occur under Alternative 1. Few of these events are conducted on an annual basis, and these emissions would continue to occur predominantly at least 3 nm from shore, beyond impact to AQCRs ashore. Aircraft emissions under Alternative 1 would increase mostly due to air combat maneuvers and electronic combat training (approximately 300 additional sorties above baseline levels). Air quality impacts, however, are expected to be minimal because these events also typically occur at least 3 nm from shore and at over 3,000-foot altitude (above the mixing layer).

CAS usage would increase under Alternative 1 over current levels (Table 2.2-3). Two hundred thirty eight additional sorties are proposed in connection with CAS supported events (i.e., EC, close air support, and GUNEX (A-A)) under Alternative 1. CAS supported events would occur primarily above 3,000 feet and more than 12 nm from the shore. Thus, no significant impacts to air quality are expected from CAS flights or CAS supported events.

The CAA General Conformity Rules do not apply to the proposed Navy and Marine Corps actions conducted in North Carolina as all adjacent counties and air quality control regions are designated in attainment for all criteria pollutants. The air quality impacts from surge level operations would be primarily from aircraft emissions, and associated mobile source emissions from support craft. 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). Most 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 Navy Cherry Point Study Area. Furthermore, the actions considered under Alternative 1 are not likely to significantly harm the existing air quality of the Navy Cherry Point Study Area.

3.4.3.3 Alternative 2 (Preferred Alternative)

Under Alternative 2, there would be similar emissions of air pollutants within the range complex as those considered in Alternative 1. Under Alternative 2, range complex training events would remain at similar levels as evaluated under Alternative 1. For example, CAS flights and CAS supported events would have the same emissions under Alternative 2 and stated in Alternative 1. The emissions produced under Alternative 2 would be minor, dispersed, and would be short-term in nature. As shown in Table 3.4-1, electronic combat and ACM training typically takes place above 3,000 feet, and associated emissions would not affect human receptors.

Under Alternative 2, increases in helicopter emissions associated with mine countermeasures training would occur partially within 3 nm and partially outside 3 nm from shore. The increase in helicopter emissions would be limited in time to those periods of major exercises. Because these major exercise events occur infrequently, the increase in helicopter emissions would be temporary and insignificant. The air quality impacts within the proposed MIW Training Area would therefore be insignificant. Offsetting this slight increase in helicopter emissions would be a slight decrease in certain fixed wing aircraft and ordnance emissions. Because BOMBEX (A-S) training with high explosives is proposed for elimination under Alternative 2, 95 fewer sorties would occur. Airborne explosive by-products associated with high explosive BOMBEX (A-S) would also be eliminated under Alternative 2.

The CAA General Conformity Rules do not apply to the proposed Navy and Marine Corps actions under Alternative 2 as all adjacent counties and air quality control regions in North Carolina are designated in attainment for all criteria pollutants. Therefore, the actions considered under Alternative 2 are not likely to significantly impact the existing air quality of the Navy Cherry Point Study Area. Furthermore, the actions considered under Alternative 2 are not likely to significantly harm the existing air quality of the Navy Cherry Point Study Area.

3.4.4 Unavoidable Significant Environmental Effects

Under either proposed action alternative, the participation of additional helicopter and fixed wing aircraft in Navy and Marine Corps training within the Navy Cherry Point Study Area would result in minor, short-term effects, such as minor increases of aircraft air emissions within the airsheds, but there would be 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 increases in air emissions above baseline (No Action Alternative) conditions. Within U.S. territory, emission increases are mainly associated with increased helicopter and fixed wing aircraft emissions. Outside U.S. territory, emission increases are mainly associated with increased surface vessel operations and additional contributions from fixed wing 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 testing events analyzed in this Navy Cherry Point EIS/OEIS within or adjacent to North Carolina occur within areas designated by the USEPA as attainment areas for all criteria pollutants. Therefore, the General Conformity Rule would not apply.

The majority of training event types and the majority of training event operations/sorties occur more than 12 nm from the shore, and would not affect the air quality for human receptors. Furthermore, the vast majority of aircraft training emissions occur above 3,000 feet (above the atmospheric inversion layer), and would be without impact on the local air quality.

As shown in Table 3.4-4, implementation of the No-Action Alternative, Alternative 1 or Alternative 2 would not likely result in significant adverse impacts to regional air quality. Implementation of the No-Action Alternative, Alternative 1 or Alternative 2 would not likely result in significant harm to the air quality above non-territorial waters.

Table 3.4-4 Summary of Environmental Effects of the Alternatives on Air Quality in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Surface ship emissions	Minor localized emissions. Coastal counties in NC are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Helicopter emissions	Minor localized emissions. Coastal counties in NC 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. Coastal counties in NC are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Ordnance or target emissions	Negligible emissions.	Negligible emissions at-sea.
Impact Conclusion	No significant impacts to air quality.	No significant harm to air quality.
Alternative 1		
Surface ship emissions	Minor localized emissions. Coastal counties in NC are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Helicopter emissions	Minor localized emissions. Coastal counties in NC 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. Coastal counties in NC are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Ordnance or target emissions	Negligible emissions.	Negligible emissions at-sea.
Impact Conclusion	No significant impacts to air quality.	No significant harm to air quality.
Alternative 2		
Surface ship emissions	Minor localized emissions. Coastal counties in NC are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Helicopter emissions	Minor localized emissions. Coastal counties in NC 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. Coastal counties in NC are in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to air quality.
Ordnance or target emissions	Negligible emissions.	Negligible emissions at-sea.
Impact Conclusion	No significant impacts to air quality.	No significant harm to air quality.

3.5 AIRBORNE NOISE ENVIRONMENT

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).

The analysis presented in this section is limited to impacts resulting from airborne noise. Impacts of military-generated underwater sound 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).

3.5.1.1 Sound Characteristics

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 Pascal is equal to one Newton (N) of force distributed over one square meter ($1Pa = 1N/m^2$). The maximum sound 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 we hear 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 the sound we hear.

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. Speed of sounds through air are primarily influenced by air

temperature, and negligibly by the air's relative humidity and pressure, averaging about 1,115 ft/s (340 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 0ºC (32ºF) water is 4,600 ft/s (1,402 m/s) and in 20ºC (68ºF) water is 4,862 ft/s (1,533 m/s).

The speed of sounds in solids is a more complex matter, with longitudinal and transverse waves traveling at different speeds depending on the density of the material as well as its geometry and molecular structure.

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 human individuals, a sound wave pressure of 20 micro Pascals (µPa) represents the hearing threshold. As sound stimuli increases 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.

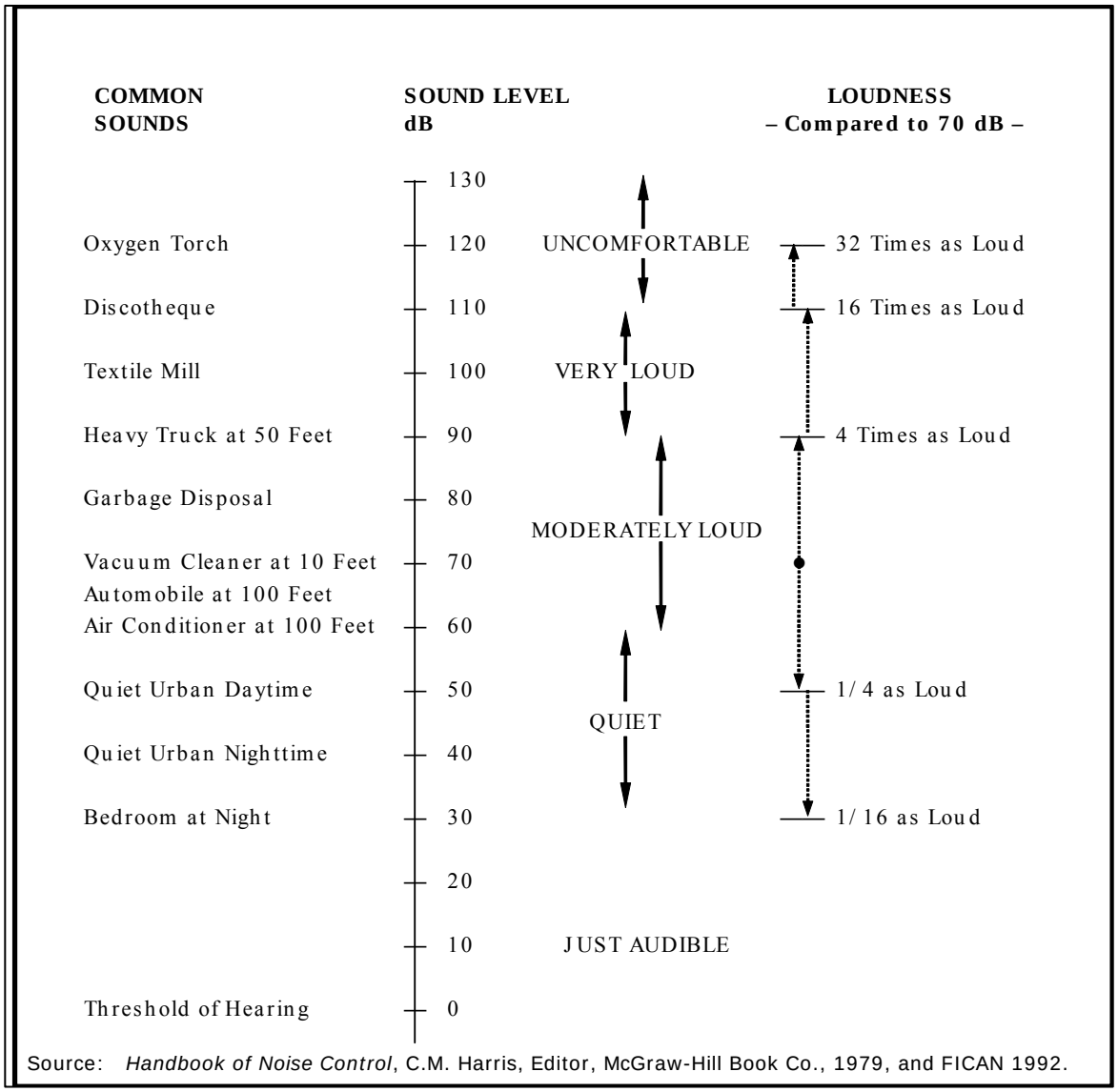
SPLs are measured by sound level meters, which typically contain filters that reduce the meter's sensitivity to frequencies of little or no relevance to the receptor. The method commonly used to quantify environmental sounds consists of determining all frequencies according to a weighting system that 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 (<20Hz), 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 sound pressure levels 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

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. Therefore, in accordance with the inverse square law, sound levels attenuate (decrease) more and more rapidly as the distance from the source increases.

The distinctions between airborne sound and underwater sound transmission are based on the different physical characteristics of the two media. In general, sound is transmitted much more efficiently in water than in air. A simple rule-of-thumb is to add 62 dB to airborne sound levels to get the underwater equivalents.

3.5.1.2 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 Zone (RAICUZ) program found in OPNAV Instruction 3550.1A (DoN, 2008). RAICUZ Program implementation includes developing current and future Range Compatibility Zones 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, 2008). However, because no air-to-ground training ranges are considered under this EIS/OEIS, the RAICUZ program is inapplicable here. All training spaces considered within this EIS/OEIS are over water.

The DoD has a similar program for air stations, called the Air Installation Compatibility Use Zone (AICUZ) program (DoN, 2002b). 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.

Although not within the boundaries of the Navy Cherry Point Study Area and not analyzed in this EIS/OEIS, MCAS Cherry Point is mentioned here due to its proximity to the Study Area and because the aircraft stationed there are frequent users of the Navy Cherry Point Study Area. The Marine Corps first published an AICUZ study for MCAS Cherry Point in 1975. The study was updated in 1981, 1988, and 2002. The current AICUZ noise contours are based on an average number of annual operations

(DoN, 2003). Noise contours were also modeled for the year 2000 at MCAS Cherry Point. The area of 75 dB or greater is predominantly over the airfield. Noise contours up to 65 dB extend into Havelock, North Carolina and portions of Craven County.

3.5.1.3 Assessment Methods and Data Used

The method used in this EIS/OEIS to assess the noise environment impacts associated with existing and proposed Navy and Marine Corps training and testing within the Navy Cherry Point Study Area, 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 Study Area;
- Analyze the various types of noise sources associated with training and testing within the Navy Cherry Point Study Area (*e.g.*, continuous versus impulsive noises);
- Review existing noise studies performed in connection with homebasing decisions, individual exercises, or tests;
- Determine the overall noise environment impacts associated with existing Navy training and testing within the range complex given the regulatory/procedural framework; and
- Determine the overall noise environment impacts associated with the proposed Navy and Marine Corps training and testing within the range complex given the regulatory/procedural framework.

It was determined that no noise modeling or monitoring was specifically required for a complete and thorough analysis.

The analysis presented in this section is limited to impacts of airborne sound on humans. Impacts of military-generated sound, including underwater sound, on natural resources are addressed in Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), 3.9 (Fish), 3.10 (Seabirds and Migratory Birds), and 3.19 (Atlantic Fleet Active Sonar Training).

3.5.1.4 Warfare Areas and Associated Environmental Stressors

Table 3.5-1 illustrates the warfare areas (and training operations) that occur within the Navy Cherry Point Study Area and the associated noise stressors. The table also indicates the location of the noise in terms of distance from shore-based receptors, and in terms of altitude above receptors.

Table 3.5-1 Warfare Areas and Associated Noise Stressors

		Stressors				Location			
Warfare Area and Operation	**Training Areas**	**Surface Vessel Noise**	**Helicopter Noise**	**Fixed-Wing Aircraft Noise**	**Ordnance or Target Noise**	**Below 3,000 feet**	**Above 3,000 feet**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**
Mine Warfare (MIW)									
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓			✓		✓	✓
Mine Neutralization	Onslow Bay UNDET Area	✓	✓		✓	✓		✓	

Table 3.5-1 Warfare Areas and Associated Noise Stressors (Continued)

		Stressors				Location			
Warfare Area and Operation	**Training Areas**	**Surface Vessel Noise**	**Helicopter Noise**	**Fixed-Wing Aircraft Noise**	**Ordnance or Target Noise**	**Below 3,000 feet**	**Above 3,000 feet**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**
Surface Warfare (SUW)									
Bombing Exercise (A-S)	W-122 (Area 18)			✓	✓		✓		✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Areas 16 and 17)		✓		✓	✓			✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17		✓	✓	✓	✓		✓	✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓			✓	✓			✓
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA	✓				✓			✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA	✓				✓			✓
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA	✓	✓			✓			✓
Air Warfare (AW)									
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)			✓			✓	✓	✓
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)			✓			✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)			✓	✓		✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓		✓	✓	✓	✓		✓
Air Intercept Control	W-122			✓			✓		✓
Electronic Combat (EC)									
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122	✓		✓		✓	✓	✓	✓
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓		✓	✓	✓	✓
Chaff Exercise- ship	Cherry Point OPAREA	✓				✓			✓
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	✓	✓	✓	✓	✓
Strike Warfare (STW)									
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, 21)			✓	✓		✓		✓

Table 3.5-1 Warfare Areas and Associated Noise Stressors (Continued)

		Stressors				Location			
Warfare Area and Operation	**Training Areas**	**Surface Vessel Noise**	**Helicopter Noise**	**Fixed-Wing Aircraft Noise**	**Ordnance or Target Noise**	**Below 3,000 feet**	**Above 3,000 feet**	**Overland or < 12 nm from Shore**	**> 12 nm from Shore**
Amphibious Warfare (AMW)									
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)	✓			✓	✓		✓	✓
FIREX with Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)	✓			✓	✓			✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓				✓		✓	✓
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓				✓		✓	✓

3.5.2 Affected Environment

Various activities and processes, both natural and anthropogenic, above and below the water's surface, contribute to the sound profile of the ocean environment. This Section 3.5 focuses on sound above the water's surface and its potential impacts to human receptors. Later sections of this EIS/OEIS describe the potential impacts of underwater sound on human divers and marine species. Section 3.5.2.1 describes the affected sound environment offshore, while Section 3.5.2.2 describes the affected sound environment near shore.

3.5.2.1 Cherry Point OPAREA

Ambient Sound Sources in the Ocean Environment

Ambient airborne sound in the ocean environment typically consists of continuous noise sources emanating from breaking waves and wind. In general, ambient 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). Intermittent airborne noise sources 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 Navy Cherry Point Study Area emanates from multiple sources including naval ship power plants, military aircraft, targets, bombs, small arms, gunfire, and water-based demolitions. Sound from military sources in the Navy Cherry Point Study Area is virtually all transitory, and can be widely dispersed or concentrated in small areas for varying periods. Sound from military sources also varies in a west (shore) to east (offshore) direction across the Cherry Point OPAREA. Noise generated from Navy and Marine Corps activities in the east (offshore) area is dominated by continuous sources, such as fixed wing aircraft noise, and intermittent/impulsive gunfire and bomb explosions. Navy and Marine Corps noise generated in the west (shore) area is dominated by a mix of helicopter and fixed wing aircraft noise, and surface ship engine noise.

Aircraft Overflights

Aircraft overflights in the Navy Cherry Point Study Area contribute sound to the ocean environment. Motors, propellers, or rotors provide the major contributions, while aerodynamic turbulence also can contribute. In general, helicopters produce higher intensity sounds than fixed wing aircraft (Richardson *et al.,* 1995). Helicopter training activities are a common source of airborne sound in offshore areas. 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 expanse of the open ocean, but can be highly concentrated in time and location near MCAS Cherry Point. Representative sound levels associated with military aircraft and other military-generated sound sources are depicted in Table 3.5-2.

Table 3.5-2 Representative Aircraft and Ordnance Sound Sources in the Navy Cherry Point Study Area

Noise Source	Sound Level (dBA)	Typical Noise Environment
Jet Aircraft under Military Power	144 @ 50 ft.	Cherry Point OPAREA at Aircraft Carrier
Jet Aircraft under Afterburner	148 @ 50 ft.	Cherry Point OPAREA at Aircraft Carrier
HE Bombs 500 lb (at impact)	110 @ 50 ft.	Cherry Point OPAREA
HE Bombs 1,000 lb (at impact)	125 @ 50 ft.	Cherry Point OPAREA
SH-6019 Helicopter Hovering	90 @ 50 ft.	Cherry Point OPAREA
HC Smoke Charge MK-58, 25	60 @ 50 ft.	Cherry Point OPAREA
Chaff Packets (at impact) Aircraft ALE-37	90 @ 50 ft.	Cherry Point OPAREA
Naval Gun Ammunition five in/54	110 @ 50 ft.	Cherry Point OPAREA
Cannon Shells 20mm (at source)	105 @ 50 ft.	Cherry Point OPAREA
Cannon Shells 25mm (at source)	110 @ 50 ft.	Cherry Point OPAREA
7.62mm M60 Machine Gun	90 @ 50 ft.	Cherry Point OPAREA
.50 cal Machine Gun	98 @ 50 ft.	Cherry Point OPAREA
Aircraft Defensive Flares	65 @ 50 ft.	Cherry Point OPAREA

Notes: 50 feet and 1,000 feet are standard reference distances. AB – afterburner; BDU - Bomb Dummy Unit; cal - caliber; dBA - decibels, A-weighted; ft - feet; lb - pound; mm – millimeters.
Source: Investigative Science and Engineering (ISE), 1997; CDR Solberg (USFF), 2008.

In addition to Navy aircraft, commercial air services (CAS) aircraft also produce airborne noise. CAS aircraft include Lear jets, tankers, small propeller drive aircraft, and Kafir jets. The noise generated by these CAS aircraft would occur during Electronic Combat (EC), Air Intercept Control (AIC), and GUNEX (A-A) events. Most noise generated by these CAS aircraft would occur above 3,000 feet and greater than 12 nm from shore.

[19] Noise Data for the SH-60 platform is considered comparable to the MH-60 platform.

Table 3.5-3 provides additional information on individual aircraft noise levels at various altitudes for two common aircraft types flown within the Navy Cherry Point Study Area.

Table 3.5-3 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
F/A-18E/F	83% NC	360	97	90.1	93	84.6	89	80.3	86	76.8

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; KIAS: Knots Indicated Air Speed
Source: Flyover Noise Calculator, Version 1.0.2, beta, USAF/AFRL/HECB, Wright-Patterson AFB, OH, May 2002.

Sonic Boom Noise

Supersonic aircraft flights can occur from time to time in the Navy Cherry Point Study Area. Such flights are usually limited to altitudes above 30,000 feet and/or locations more than 30 nm from shore. 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 will be (NASA, 2008).

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 sonic boom beneath an aircraft is about 1 mile for each 1,000 feet of altitude. For example, an aircraft flying supersonic straight and level at 50,000 feet can produce a sonic boom carpet about 50 miles 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 (NASA, 2008).

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 these factors can be significant, but their influence is small 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 (NASA, 2008). A detailed discussion of sonic booms is provided in Appendix H.

Ordnance Use

Sound also results from ordnance use in the Cherry Point OPAREA. Representative ordnance sound levels are depicted in Table 3.5-2.

Missile and Target Launches

Sound associated with missile and target launches occurs in the Cherry Point OPAREA during scheduled events. Due to safety concerns over launch activities, a buffer zone of several square miles is always instituted and enforced. Sound due to missile and target launches is typically at a maximum at the point of initiation of the booster rocket, and rapidly fades as (1) the missile or target reaches optimal thrust conditions; and (2) the missile or target reaches a downrange distance where the booster burns out and the sustainer engine continues. For example, the A-weighted sound pressure levels (SPL) observed for the BQM-34 ranged from 145 dB re 20 µPa at 50 feet from the source to 84 dB re 20 µPa 3,000 feet from the source (DoN, 2002a). The BQM-34 may be used in the Cherry Point OPAREA (though much less frequently than the smaller BQM-74).

Figure 3.5-2: BQM-74 Launch from Surface Vessel

In the Navy Cherry Point Range Complex, the BQM-74 is the typical target. It can be launched from sea or air. It is launched from surface vessels (Figure 3.5-2) (*e.g.*, the Theater Support Vessel 1 Prevail) via a rail by a solid rocket booster and sustained by a small conventional jet engine. The typical time that such target drones are launched is during the Composite Training Unit Exercises (COMPTUEX) conducted a few times per year. Missiles are launched from surface ships, high-altitude fixed wing aircraft and from helicopters in the offshore area. These events occur on remote range areas that are restricted from the public, so they often go unobserved and unheard.

The sound of a Hellfire missile detonation is described in the Overseas Environmental Assessment of Testing the Hellfire Missile System's Integration with the MH-60 Helicopter (NAVAIR, 2005). The greatest sound intensity generated from the firing of a Hellfire missile is approximately 149 dB re 1 µPa at 15 feet altitude (NAVAIR, 2005). Due to the great distance from shore where these events occur, these explosions are not likely to impact human sound receptors ashore..

Non-Explosive Impact Noise

Non-explosive impact sound in the Cherry Point OPAREA is generally from high-velocity "dummy" projectiles and NEPM training bombs. Sounds of this type 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.*, impulse sound) that it produces negligible amounts of acoustic energy. These events occur on remote range areas 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.

Explosives

Explosives detonated underwater introduce loud, impulsive, broadband sounds into the marine environment. 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 most explosive sources used in military activities in the Cherry Point 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 Cherry Point OPAREA

Ordnance	Net Explosive Weight	Detonation Depth
5" Naval gunfire	8 lbs	1 ft depth
Hellfire AGM-114 missile	8 lbs	At or just below Surface
TOW missile	15.3 lbs	At or just below Surface
AIM-9 Sidewinder	88 lbs	N/A - High altitude above surface
SM-2 missile (RIM-66/RIM-67)	137 lbs	N/A - High altitude above surface
Sea Sparrow (RIM-7)	90 lbs	N/A - High altitude above surface
AGM-88 HARM	48 lbs	30-60 ft above surface
MK-82 bomb	192.2 lbs	Surface to 3.28 ft depth
MK-83 bomb	415.8 lbs	Surface to 3.28 ft depth
MK-84 bomb	944.7 lbs	Surface to 3.28 ft depth
Underwater Demolition Charges	20 lbs	Mid-Column to Bottom

The airborne noise associated with the above-water detonations (*e.g.*, GUNEX [S-S], BOMBEX, MISSILEX) typically occur at least 12 nm from shore.

3.5.2.2 Nearshore Noise and Sensitive Receptors

For the purpose of this study, sensitive receptors include people living or working off a military reservation and natural resources that could suffer adverse effects from airborne noise. While military activities might expose persons on recreational or commercial vessels near the Outer Banks of North Carolina or in the Cherry Point OPAREA to noise, Navy standard operating procedures (SOP) designed to protect the civilian population from military activities at-sea minimize the likelihood of a negative exposure. In the nearshore environment, noise-sensitive areas could include developed areas with land uses such as residences, businesses, schools, churches, libraries and hospitals, and undeveloped areas such as parks. Shore-based noise-sensitive areas nearest to the Navy Cherry Point Study Area are the communities of Sneads Ferry, Chadwick Acres, Beaufort, Morehead City, Atlantic Beach, Pine Knoll Shores, Indian Beach, Emerald Isle, Bogue, and Cape Carteret, and Hammocks Beach State Park. Sensitive receptors at these locations may occasionally hear sound emanating from training and testing operations in Onslow Bay associated with small craft and helicopters conducting mine or amphibious warfare training, or fixed or rotary wing aircraft overflights into offshore training areas. High altitude fixed wing aircraft flights and ordnance operations occur too far off-shore for sensitive receptors on-shore to hear.

Noise from helicopters and landing craft, particularly Landing Craft Air Cushion [LCAC], predominate during amphibious training events. Table 3.5-2 states that the noise of a hovering helicopter is 90 dBA at 50 feet. That noise level will attenuate to less than 62 dBA in less than one mile. LCAC noise has been previously studied in the EIS for the Establishment of an Alternative Location of an LCAC Operational Base on the East Coast of the United States (DoN, 1983). According to the EIS, LCACs produce approximately 75 dBA of noise in a one-half mile radius around the amphibious vessel. The 70 dB noise contour extends out approximately 1 mile on each side of the LCAC. The 65 dB noise contour extends out approximately 1.5 miles on each side of the LCAC. LCAC movements associated with amphibious training in the Navy Cherry Point Study Area would be directed toward MCB Camp Lejeune and Onslow Beach. The closest sensitive receptors to the amphibious landing beach are in

Sneads Ferry and Chadwick Acres, approximately 3-4 miles away. Both are outside the 65 dB LCAC noise contour and therefore not expected to experience a significant noise impact.

Likewise, the closest noise-sensitive areas to the proposed mine warfare training area are at least four miles away in Chadwick Acres and Hammocks Beach State Park. At that distance, the sound of a low-flying helicopter is not audible to a sensitive receptor on-shore, and the proposed action will not increase the vibrations or noise levels currently experienced at Hammocks Beach State Park or Chadwick Acres.

The Navy tries to reduce the impacts of noise on civilian populations. The FACSFAC VACAPES Operations Manual reminds pilots to avoid populated areas, prohibits use of afterburners in certain areas, and other actions that could cause increased noise levels. The majority of noise complaints received at MCAS Cherry Point originate from the Emerald Isle area in Carteret County and relate to training operations at MCALF Bogue. The air operations duty officer receives all the noise complaints and initiates the noise complaint response procedure. Information is recorded from the caller, and copy of the complaint form is forwarded to the Community Plans and Liaison (CP&L) office. The CP&L office contacts the complainant to follow up on the status of the complaint. If flight procedures were violated, appropriate air wing commanders are notified for review and determination of appropriate action (DoN, 2003).

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 and Marine Corps training and testing in the Navy Cherry Point 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 Navy Cherry Point Study Area) precautions are taken pursuant to SOPs to prevent such exposure (see Section 3.18). Most Navy and Marine Corps aircraft training in the Navy Cherry Point Study Area (including its commercial air services support) occurs either at least 12 nm from shore or at high altitudes (*e.g.*, ACM), 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 (including both helicopter and fixed wing aircraft). High altitude overflights associated with electronic combat and air combat maneuvers may not generate noise that reaches ambient levels at the receptors. LCAC operations have been occurring in the Navy Cherry Point Study Area and MCB Camp Lejeune for decades. The highest noise associated with LCAC operations is focused on the MCB Camp Lejeune amphibious landing beach, and thus minimizes impacts to area residents. The nearest sensitive receptors experience dB levels lower than those which typically may evoke a noise complaint. Noise complaints will continue to be fielded for response by the community planning liaison. 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 and Marine Corps training and testing under the No Action Alternative is not likely to produce significant harm to the airborne noise environment above non-territorial waters.

3.5.3.2 Alternative 1

Under Alternative 1, the number of Navy and Marine Corps training operations and testing would increase and along with it would be an expected increase in noise levels. However, the increase in

operations would not be expected to result in substantial increases in overall noise levels. As noted, extensive precautions are taken to eliminate exposure of non-military personnel to unwanted sound from military activities. As with the No-Action Alternative, noise-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. For example, increases in Air Combat Maneuvers and Electronic Combat sorties would occur at altitudes above 25,000 ft and great distances from shore.

Certain events (i.e., EC, AIC, and GUNEX (A-A)) using commercial air services (CAS) will increase by 238 sorties under Alternative 1. The CAS flights typically occur at altitudes over 3,000 feet and greater than 12 nm from shore. Shore-based sensitive receptors are not expected to be impacted by the noise generated. Thus, CAS flights and CAS supported events are not expected to produce significant impacts to the airborne noise environment under Alternative 1.

Over half of the Navy and Marine Corps training event types occur at least 12 nm from shore. Increases in these training events in the Navy Cherry Point Study Area under Alternative 1 are not likely to produce significant noise impacts to human receptors because the distance between the noise generating sources and the human receptors is so great that the noise attenuates. This noise attenuation is expected with regard to the full spectrum of noise sources generated far offshore, including aircraft and ordnance-related sources. Most training with explosives occurs beyond 12 nm from shore for safety purposes. Several training events under Alternative 1 would not increase in number, and therefore no increased noise would be expected from such events (*e.g.*, EOD Mine Neutralization training, Air Intercept Control, FIREX with IMPASS, and amphibious training). Amphibious operations, including LCAC noise under Alternative 1 would be concentrated toward MCB Camp Lejeune, thus limiting the potential for off-base noise impacts. Under Alternative 1, although half of the training event types would experience a slight increase in occurrence over baseline levels, they are still within the range of historical operational levels and increases in associated noise would likely not be perceptible.

Therefore, the impact on the human noise environment from Alternative 1 is expected to be less than significant. Navy and Marine Corps training and testing under Alternative 1 is not likely to produce significant harm to the airborne noise environment above non-territorial waters.

3.5.3.3 Alternative 2 (Preferred Alternative)

The types of effects on humans from noise generated by military activities under Alternative 2 would be similar to those under Alternative 1. For example, CAS flights and CAS supported events are the same under Alternative 1 as under Alternative 2. No significant impacts to the airborne noise environment are expected from these events which take place at high altitude and at a great distance from shore based sensitive receptors. As with the No-Action Alternative and Alternative 1, 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. Under Alternative 2, only two Navy and Marine Corps training event types would experience a further increase in occurrence over Alternative 1 (*i.e.*, Mine Countermeasures and Mine Neutralization). These two events are conducted using the helicopter platform during major range events. Because these major events occur infrequently, any associated increase in noise would be temporary and insignificant. These events also typically take place at least 3 nm from shore. Therefore, the nearest sensitive receptors in Sneads Ferry, Chadwick Acres or North Topsail Beach should not expect to experience noise levels above 60 dB (the noise level of a typical suburban area).

Electronic Combat and ACM training typically occurs at least 3 nm from shore, thus limiting noise impacts. Amphibious training operations proposed under Alternative 2 are similar to Alternative 1, and no additional noise impacts would be expected. The increases in event occurrences under Alternative 2, therefore, are not likely to be perceived by human receptors ashore. With regard to potential exposure of non-military personnel in ocean areas (such as fishermen in the Navy Cherry Point Study Area) precautions are taken pursuant to SOPs to prevent such exposure (see Section 3.19). Non-military

personnel in the Navy Cherry Point Study Area, therefore, would not likely be exposed to aircraft engine noise or explosive-related noise from these events. BOMBEX (A-S) training with high explosives is proposed for elimination under Alternative 2. Elimination of this type of training will eliminate noise which would otherwise have been produced by fixed wing aircraft and explosive ordnance. This decrease in continuous (aircraft) and impulsive (detonations) noise will occur primarily in the Cherry Point OPAREA.

Proposed Navy and Marine Corps training and testing near shore within the Navy Cherry Point Study Area under Alternative 2 is expected to increase over baseline levels. There would likely be a slight increase in noise levels associated with riverine craft small arms fire, and helicopter noise associated with chaff and flare exercises. Furthermore, there would likely be a slight increase in helicopter noise associated with mine warfare training at the Navy's proposed MIW Training Area. Because these sound-generating events are intermittent and 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 from Alternative 2, therefore, is less than significant. Navy and Marine Corps training and testing under Alternative 2 is not likely to produce significant harm to the airborne noise environment above non-territorial waters.

3.5.4 Unavoidable Significant Environmental Effects

Increases in operational activity in the Navy Cherry Point Study Area will increase airborne noise levels. However, because Navy and Marine Corps training takes place in remote and cleared areas, airborne noise levels would 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 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), and 3.9 (Fish). There are not expected to be any unavoidable significant environmental effects associated with noise generated by the proposed action.

3.5.5 Summary of Environmental Effects (NEPA and EO 12114)

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to the area sound environment. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to the airborne noise environment above non-territorial waters. 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 Navy Cherry Point Study Area 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;
- Noise would be generated in training areas that have been in similar use for more than 50 years - no new public areas would be exposed to noise from training and testing activities; and
- The incremental increases in the numbers of range events would not substantially increase long term average noise levels; hourly average equivalent noise levels are and would remain relatively low.

Table 3.5-5 summarizes the airborne noise effects for the No Action, Alternative 1, and Alternative 2.

Table 3.5-5 Summary of the Environmental Effects of the Alternatives on the Airborne Noise Environment of the Navy Cherry Point Study Area

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (Territorial Waters, 0 to 12 nm)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
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.
Ordnance or 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.
Ordnance or 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.
Ordnance or 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 Navy Cherry Point Study Area: plankton and macroalgae, benthic communities, and artificial habitats. National Marine Sanctuaries are also addressed in this section. Seagrasses are not addressed because they are generally limited to nearshore estuarine environments and no known open-ocean seagrass meadows exist in North Carolina or the Study Area (DoN, 2003). 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 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 13089, *Coral Reef Protection*, are discussed in Appendix K.

3.6.1.2 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this EIS/OEIS includes several warfare areas (*e.g.,* Mine Warfare, Anti-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.,* vessel movements, 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 vessel movements and aircraft overflights. Accordingly, the analysis for marine communities 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:

- 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 EIS/OEIS.
- Identify resources that may occur in the action 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 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 Study Area for marine communities is described in Section 1.5 and is shown in Figure 1.5-1.

Data Sources

A comprehensive and systematic review of relevant literature and data was conducted to complete this analysis for marine communities and 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, 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 source of information used to describe the affected environment for marine communities was the Navy's Marine Resources Assessment (MRA) report for Cherry Point OPAREA (DoN, 2008). The MRA report provides compilations 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 document.

Factors Used to Assess 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 EIS/OEIS. As summarized in Table 3.6-1, potential stressors to marine communities include vessel movements (disturbance and collisions), aircraft overflights (disturbance), towed Mine Warfare devices (strikes), temporary mine shape deployment/recovery (habitat alteration), non-explosive practice munitions (NEPM) (strikes), underwater detonations and high explosive (HE) ordnance, and military expended materials (ordnance related materials, targets, chaff, self-protection flares, and marine markers). 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 operations 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 EIS/OEIS.

Table 3.6-1 Summary of Potential Stressors to Marine Communities[20]

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)										
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓		✓	✓			
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓		✓	✓	✓	✓	✓
Surface Warfare (SUW)										
Bombing Exercise (Air-to-Surface)	W-122 (Area 18)			✓				✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Areas 16 and 17)			✓				✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17)			✓				✓		✓
GUNEX (Surface-to-Surface) Ship	Navy Cherry Point OPAREA	✓	✓					✓		✓
GUNEX (Surface-to-Surface) USMC Small Arms Training	Navy Cherry Point OPAREA	✓	✓					✓		✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO) - Ship	Navy Cherry Point OPAREA	✓	✓							
MSO to include VBSS/MIO - Helo	Navy Cherry Point OPAREA	✓	✓	✓						

[20] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations see Table 2.2-4 and Appendix D.

Table 3.6-1 Summary of Potential Stressors to Marine Communities (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Air Warfare (AW)										
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)			✓						
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)			✓				✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)			✓				✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓	✓					✓
Air Intercept Control	W-122	✓	✓	✓						
Electronic Combat (EC)										
Electronic Combat Operations (EC OPS)	Navy Cherry Point OPAREA and W-122	✓	✓	✓						
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15 & 16)			✓						✓
Chaff Exercise- ship	Navy Cherry Point OPAREA	✓	✓							✓
Flare Exercise- aircraft	W-122 (Areas 1, 8, 15 & 16)			✓						✓

Table 3.6-1 Summary of Potential Stressors to Marine Communities (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Strike Warfare (STW)										
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, & 21)			✓					✓	✓
Amphibious Warfare (AMW)										
Firing Exercise (FIREX) (Land)	Firing point: Navy Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)	✓	✓					✓		
FIREX - Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Navy Cherry Point OPAREA (Areas 4/5 & 13/14)	✓	✓					✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓						
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓						

3.6.2 Affected Environment

3.6.2.1 Plankton and Macroalgae

Plankton are organisms that float or drift with the sea and cannot maintain distribution against the movement of water masses (Parsons *et al*., 1984). Plankton include phytoplankton (plant-like/algae), zooplankton (animals), ichthyoplankton (fish eggs and larvae, a form of zooplankton), and bacterioplankton (bacteria). In general, this group of organisms is very small or microscopic, although there are exceptions. Jellyfish and pelagic *Sargassum*, for example, are unable to move against the surrounding currents and are considered part of the plankton group even though some jellyfish can grow to approximately 10 feet in diameter.

Phytoplankton are single-celled organisms that are similar to plants because they use sunlight and chlorophyll to photosynthesize. At the base of the marine food chain, phytoplankton are very important to the overall productivity of the ocean. Their 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). Phytoplankton distribution is patchy, occurring in environments that have optimal light, temperature, and nutrient conditions. In general, the concentration of phytoplankton is higher in nearshore areas where there is input of nutrients from land sources. In continental shelf and slope waters, the concentration of phytoplankton generally decreases with distance from shore and with increasing bottom depth. Concentrations can be higher in upwellings and eddies along the Gulf Stream.

Phytoplankton concentration can be estimated by measuring the concentration of chlorophyll *a* from satellite-based detectors of ocean color (Schalles, 2006). Chlorophyll *a* concentrations in the vicinity of the Study Area do not vary much seasonally, indicating that nutrient concentrations are relatively stable year-round and that the seasonally fluctuating water temperatures in the Study Area do not significantly limit growth. Important sources of nutrients in the region include discharge from the Pamlico and Neuse rivers, which empty into Pamlico Sound (Lohrenz *et al*., 2003). The highest concentrations of surface chlorophyll *a* occurring near the Study Area are found in Pamlico Sound where average values exceed 10 mg/m^3 throughout the year. Concentrations decrease abruptly away from the coast to less than 1 mg/m^3 beyond the shelf break in all seasons. Within the Study Area transient upwelling events associated with the intrusion of Gulf Stream waters onto the Florida-Hatteras Shelf can also result in increases in certain phytoplankton taxa (Lohrenz *et al*., 2003). Because these events are of short duration and vary spatially they do not appear on long term averages of satellite data. Outflow from the Pamlico and Neuse rivers onto the shelf is markedly reduced by Pamlico Sound, restricting transport of nutrients directly onto the shelf. Consequently, phytoplankton production in areas such as Onslow Bay is limited, and observations have been made that suggest primary production in Onslow Bay is dominated instead by benthic microalgae (Mallin *et al*., 2005).

Zooplankton are a taxonomically and structurally diverse group of aquatic animals. They range in size from microscopic, unicellular organisms such as protozoans to large, multicellular organisms such as jellyfish (Wiebe *et al.,* 1987). Although many are able to swim sizable distances at moderate speeds, their large-scale horizontal distributions are determined by ocean currents and the suitability of the physical, chemical, and biological components of their environment. Zooplankton cannot photosynthesize and thus often rely on phytoplankton as a source of food. Zooplankton may be herbivorous (consuming plants), carnivorous (consuming animals), detrivorous (consuming dead organic material), or omnivorous (consuming a mixed diet). Examples of zooplankton include foraminifera, pteropods, copepods, and myctophid fish. Zooplankton are likely to be concentrated in areas of increased primary productivity such as along frontal boundaries and eddy peripheries associated with the Gulf Stream (Oschlies and Garcon, 1998). 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 oceanographic fronts such as the confluence of cold-core and warm-core (anticyclonic) eddies consistently exceeds biomass within warm-core eddies (Wormuth *et al*., 2000; Quattrini *et al*., 2005).

Ichthyoplankton are the eggs and larvae of fish found mainly in the upper 656 feet of the water column. The eggs are passive and drift in the ocean along with the water currents. Most fish larvae have almost no swimming ability initially; however, half way through their development they are active swimmers. Ichthyoplankton are a relatively small but vital component of total zooplankton. They feed on smaller plankton and are prey for larger animals (Southwest Fisheries Science Center, 2007). Large frontal eddies associated with Gulf Stream meandering can transport ichthyoplankton normally associated with Gulf Stream waters into mid-shelf waters (Powell *et al*., 2000; Quattrini *et al*., 2005). Larval survival and recruitment success of shelf-spawned estuarine species are likely tied to oceanographic processes on the inner shelf related to upwelling and downwelling rather than simply to wind-driven recruitment mechanisms (Garland and Zimmer 2002; Shanks *et al*., 2003).

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). Containing mostly oxygen, these floats 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. Throughout the Sargasso Sea and Gulf Stream, these mats frequently aggregate into large windrows in response to wind forcing, or shear forcing along frontal boundaries (Coston-Clements *et al*., 1991). Pelagic *Sargassum* also occurs in continental shelf waters of the U.S. Atlantic coast although no abundance or specific distribution information exists for the coastal region. The Gulf Stream is a dispersal mechanism for pelagic *Sargassum*, so it is quite likely that *Sargassum* would be found within the Study Area (DoN, 2008). Large mats of *Sargassum* are reported from an area on the western boundary of the Gulf Stream where the cool waters from the Labrador Current and the warm waters of the Gulf Stream meet, resulting in a high concentration of many forms of marine life (Golder, 2004).

3.6.2.2 Benthic Communities

Overview

Benthic habitats are composed of a variety of sediments, substrates, and marine life that are commercially and economically valuable. Physical and biological ocean processes influence the types of infauna/flora, epifauna/flora, and demersal organisms that populate these habitats. Benthic organisms, such as crustaceans, echinoderms, anthozoans, annelids, mollusks, and ground fish, play a major role in altering underlying benthic substrates and in breaking down organic material which provides sustenance for economically important species of pelagic fish (Sumich, 1988). Benthic communities can be limited by sedimentation. Increased sedimentation caused by storms, currents and waves, and anthropogenic disturbances, such as coastal development, dredging, and runoff, cold-water influxes from storms, and red tides can negatively impact the benthic fauna and flora, which in turn affects foodwebs and ecosystems (Jones *et al*., 1985; Liddell *et al*., 1997; Rogers 1990).

Live/Hard Bottom Communities

Hard bottom is a type of benthic habitat that can support sessile fauna, flora, and demersal fish species (Jones *et al*., 1985; Cahoon *et al*., 1990). Hard bottom is made up of three dimensional geologic structures (*i.e*., limestone outcroppings, coquina shells, dead coral skeletons) and human-made structures such as artificial reefs and shipwrecks (Street *et al*., 2005), and is usually covered with a thin layer of sand (Emery and Uchupi, 1972). Living organisms found on hard bottom substrates that constitute live/hard bottom communities include sea fans, sea whips, ascidians, bryozoans, hard/soft

corals, hydroids, anemones, encrusting algae, sponges, macroalgaes, crustaceans, sea turtles, and commercial/recreational fish (Jones *et al*., 1985).

Within the Study Area there is considerable hard bottom that was mapped by various scientists and summarized in a database by the Southeast Area Monitoring Program in 2001 from North Carolina to northeastern Florida (SEAMAP, 2001). The Bureau of Land Management in 1978 also performed benthic surveys along the continental shelf from North Carolina to Florida and mapped hard bottom communities (Figures 3.6-1 and 3.6-2). Coral, coral reefs, and live or hard bottom essential fish habitat has also been identified in the Study Area (Figure 3.6-3).

Within the Study Area and vicinity, live hard bottom communities are found at depths between 3 and 500+ m (SAFMC, 1998; Street *et al*., 2005). Thirty percent of the shelf area within a 200 m isobath from North Carolina to Cape Canaveral, Florida (South Atlantic Bight) is live hard bottom habitat, most of which is macroalgae (SAFMC, 1998). The benthic fauna (~211 species) that live on the continental shelf off the coast of North Carolina, in particular around Cape Hatteras, experience dramatic seasonal changes and a narrowing continental shelf that creates challenging conditions (Cerame-Vivas and Gray, 1966). Reefs composed of lower Miocene marl overgrown by encrusting algae and various calcareous organisms exist throughout the shelf region in the northern part of the Study Area (Emery and Uchupi, 1972). Common species found inhabiting (in and around) the reefs in the northern shelf regions of the Study Area (*i.e.*, north of Cape Hatteras) are sponges, arthropods, gastropods, and echinoderms (Cerame-Vivas and Gray, 1966). This region has more temperate fauna and lower species diversity due to a lack of warm water from the Gulf Stream Current which is farther out in the Atlantic and does not cross over the shelf as it does south of Cape Hatteras (Cerame-Vivas and Gray, 1966). The benthic fauna of the shelf region south of Cape Hatteras consists of more subtropical species due to a wider continental shelf, increased hard bottom, and warmer water mixing from the Gulf Stream Current (Menzies, 1966). The benthic fauna here includes sponges, hard and soft corals, bryozoans, annelids, mollusks, arthropods, and echinoids (Cerame-Vivas and Gray, 1966; Menzies, 1966). Higher abundances of benthic fauna tend to aggregate not only on hard bottom but also near (1 to 75 m) hard bottom in the adjacent soft sediment due to the availability of prey associated with the hard bottom and the season (*i.e*., higher abundances of fauna in spring and fall) (Kirby-Smith, 1989; Posey and Ambrose, 1994). Overall, the benthic distribution associated with hard bottom in the Study Area (*i.e.*, inner- and mid-shelf) and vicinity is composed of warm water and cold water fauna that maintain high diversity throughout the year (Kirby-Smith, 1989).

Corals (Hard and Soft) and Sponges

Corals are sessile invertebrates in the Phylum Cnidaria and classes Hydrozoa (fire and lace corals) and Anthozoa (subclasses Octocoralia and Hexacoralia) (Veron, 2000). Reef building corals are hexacorals and belong to the order Scleractinia. Octocorals include gorgonians, soft corals, and telastaceans. Corals exist throughout the worlds oceans at all depths (Veron, 2000). The most widely known corals are the true stony corals or scleractinians (*i.e.*, hermatypic hard corals), which are coral reef frame builders. Tropical coral reefs are typically found in oligotrophic, shallow water (mostly up to a 50 m water depth) within a latitudinal range of 30°N and 30°S (Kaplan, 1982; Spalding *et al*., 2001). No tropical coral reefs exist within the Study Area or vicinity. However, temperate hard and soft corals (non-reefal) are found on the shelf that not only use photosynthesis as a mode of nutrition, but also consume zooplankton (Hunstman and Macintyre, 1971; BLM, 1976; Reed, 1980; Miller, 1995). Deep sea corals (ahermatypic) are also found along the continental slope in the Study Area (George, 2002; Ross, 2004; FFWCC, 2005).

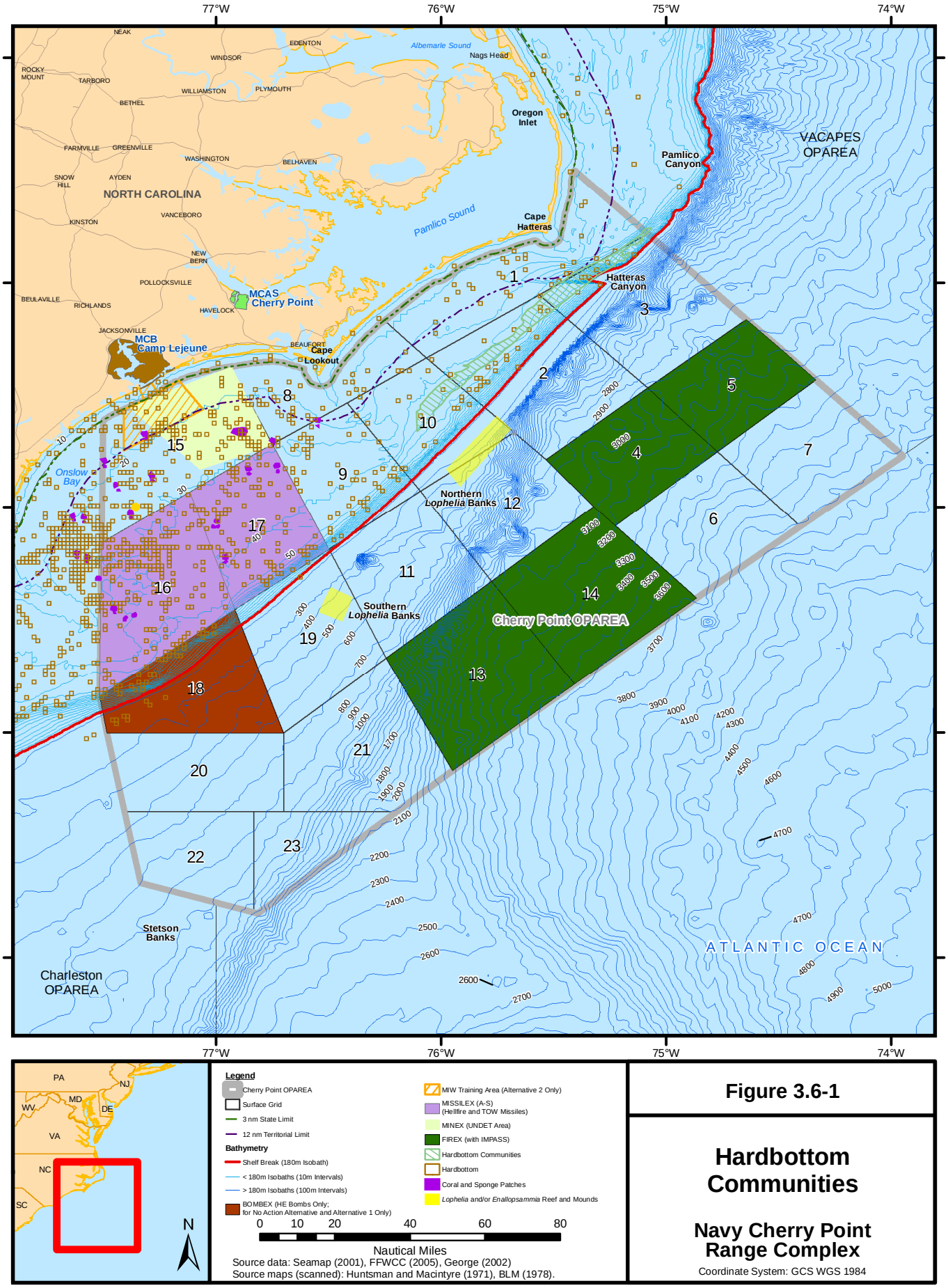


Figure 3.6-1

Hardbottom Communities

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

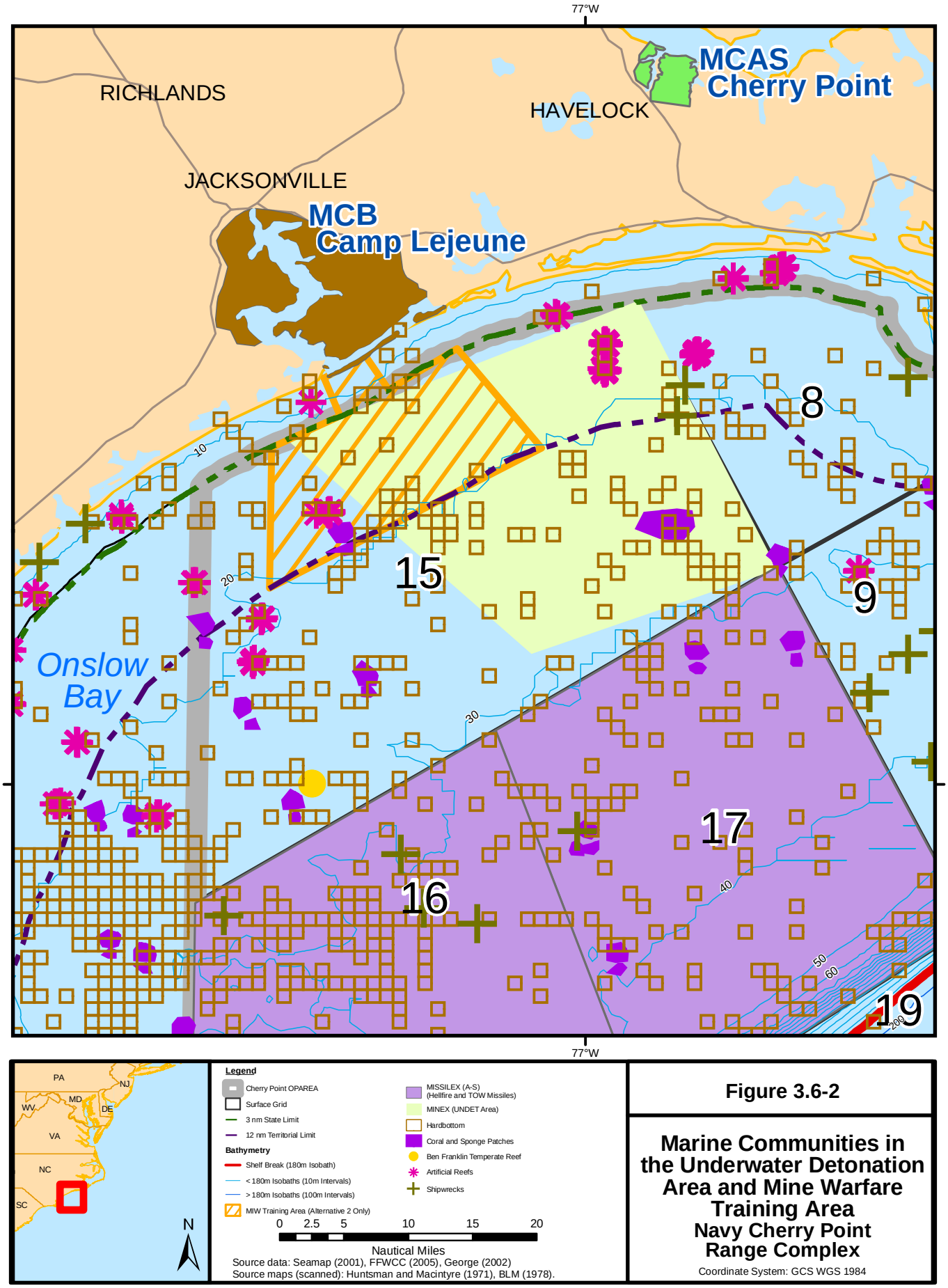
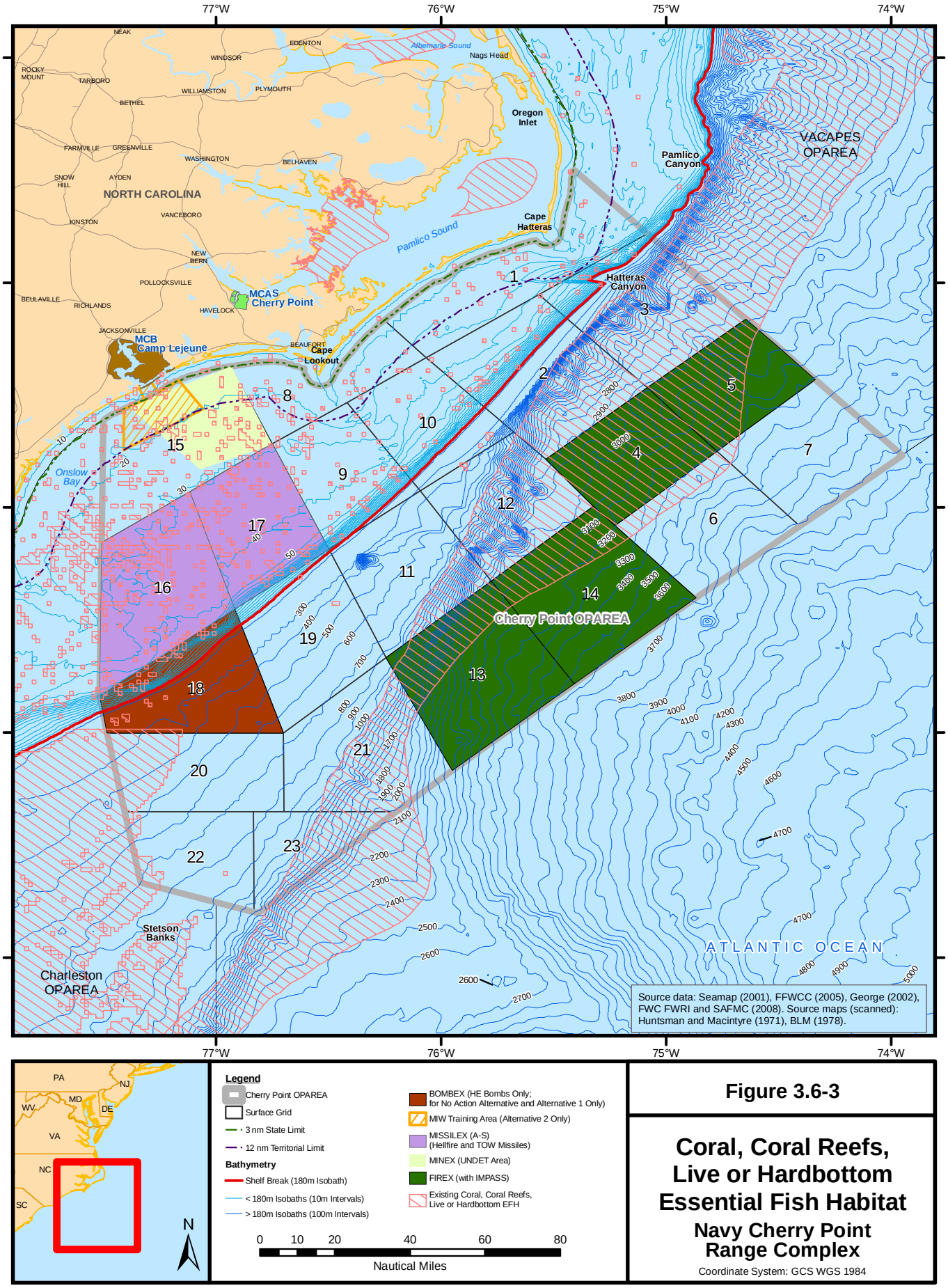


Figure 3.6-2

Marine Communities in the Underwater Detonation Area and Mine Warfare Training Area
Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984



Legend

- Cherry Point OPAREA
- Surface Grid
- 3 nm State Limit
- 12 nm Territorial Limit

Bathymetry

- Shelf Break (180m Isobath)
- < 180m Isobaths (10m Intervals)
- > 180m Isobaths (100m Intervals)

- BOMBEX (HE Bombs Only; for No Action Alternative and Alternative 1 Only)
- MIW Training Area (Alternative 2 Only)
- MISSILEX (A-S) (Hellfire and TOW Missiles)
- MINEX (UNDET Area)
- FIREX (with IMPASS)
- Existing Coral, Coral Reefs, Live or Hardbottom EFH

0 10 20 40 60 80
Nautical Miles

Figure 3.6-3

Coral, Coral Reefs, Live or Hardbottom Essential Fish Habitat

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

Sponges found throughout the Study Area are in the Phylum Porifera. They are multicellular filter feeders (although some are carnivorous) that rely on water currents for food by ingesting microscopic organisms (*i.e.*, bacteria) through dermal pores (UCMP, 2006). They live at all depths, temperatures, and latitudes, and can be vaselike, tubular, spherical, or fingerlike in shape (Kaplan, 1982).

North Carolina's continental shelf has isolated coral and sponge patches that exist south of Cape Hatteras (Menzies, 1966; Huntsman and Macintyre, 1971; BLM, 1976). Onslow Bay has isolated coral patches, sea fans, algae, and sponges associated with hard bottom (Huntsman and Macintyre, 1971). In particular, the Ben Franklin Temperate Reef is located within Onslow Bay, at 33° 59' 63"N, 77° 21 18'W and 20 m depth (George, 2002) (Figures 3.6-1 and 3.6-2). Ben Franklin Temperate Reef is well known for its abundance of compact ivory tree coral (*Oculina arbuscula*), macroalgaes, and a reef isopod (*Eurydice bowmani*) (George, 2002). Other scleractinian corals found in Onslow Bay are *Solenastrea hyades*, *Siderastrea siderea,* ivory tree coral (*Oculina varicosa*)*, Astrangia astreiformis, Phyllangia Americana,* and *Ballanophyllia floridana* (Huntsman and Macintyre, 1971). In recent years *O. varicosa* has declined in this area because it has been out-competed by seaweed forcing it into deeper, less illuminated water (NCDMF, 2005a). In addition to hard corals, soft corals such as *Titanedeum frauenfeldii* and *Telesto fructiculosa* and four species of sponges (*Homaxinella waltsonsmithi*, *Spheciospongia vesparium*, *Cliona caribbaea*, and *Halichondria bowerbanki*) are abundant on the reefs throughout the shelf (NCDMF, 2005a). Parker *et al*. (1983) suggested that rock-coral-sponge (live/hard bottom) habitats account for about 14 percent or 2,040 km^2 of the substrate between the 27 and 101 m isobaths from Cape Hatteras to Cape Fear. In addition, offshore reefs (80 to 110 m) south of Cape Lookout are known to support more tropical species of hard and soft corals, sponges, and hydroids because of its proximity to the warm Gulf Stream current (Menzies, 1966).

Two deep sea coral banks (*Lophelia pertusa*) exist within the slope area of the Study Area: the Cape Lookout *Lophelia* Banks and Cape Fear *Lophelia* Banks (Figure 3.6-1). These *Lophelia* banks are very similar. They occur off the coast of Cape Fear, North Carolina along a ridge system (0.4 km) (500 m isobath) and can grow as tall as 53 m (Ross, 2004). The Cape Fear *Lophelia* Banks exist off Cape Lookout (500 m isobath). They appear to have abundant *L. pertusa,* but size and area data are lacking. The Cape Fear *Lophelia* Banks grow on top of a ridge system composed of dead coral rubble and trapped sediments. The *Lophelia* banks extend vertically 80 m over a distance of 1 km. Besides *Madrepora oculata,* no other coral species are found associated with *L. pertusa* in this area (Ross, 2004). There are high abundances of brittle stars (*Ophiacantha bidentata*), crabs (Galatheid), and basket stars (*Novodinia antillensis*) scavenging the banks for food, which suggests a biologically rich environment. These banks are proposed deepwater coral Habitat Areas of Particular Concern (Figure 3.6-4, also see Section 3.9 Fish and Essential Fish Habitat).

Two deepwater marine protected areas are also located in the OPAREA (Figure 3.6-4, also see Section 3.9 – Fish and Essential Fish Habitat). These areas are intended to protect a portion of the long-lived, deepwater snapper grouper species and their habitat from directed fishing pressure (NMFS, 2008). Juvenile and adults of most snapper grouper species are demersal and associate with live/hard bottom that has moderate to high relief (*e.g.*, coral reef systems, artificial reef structures, rocky hard bottom substrates, and limestone outcroppings) (SAFMC and NMFS, 2006). Therefore, the marine protected areas represent areas of important live/hard bottom habitat.

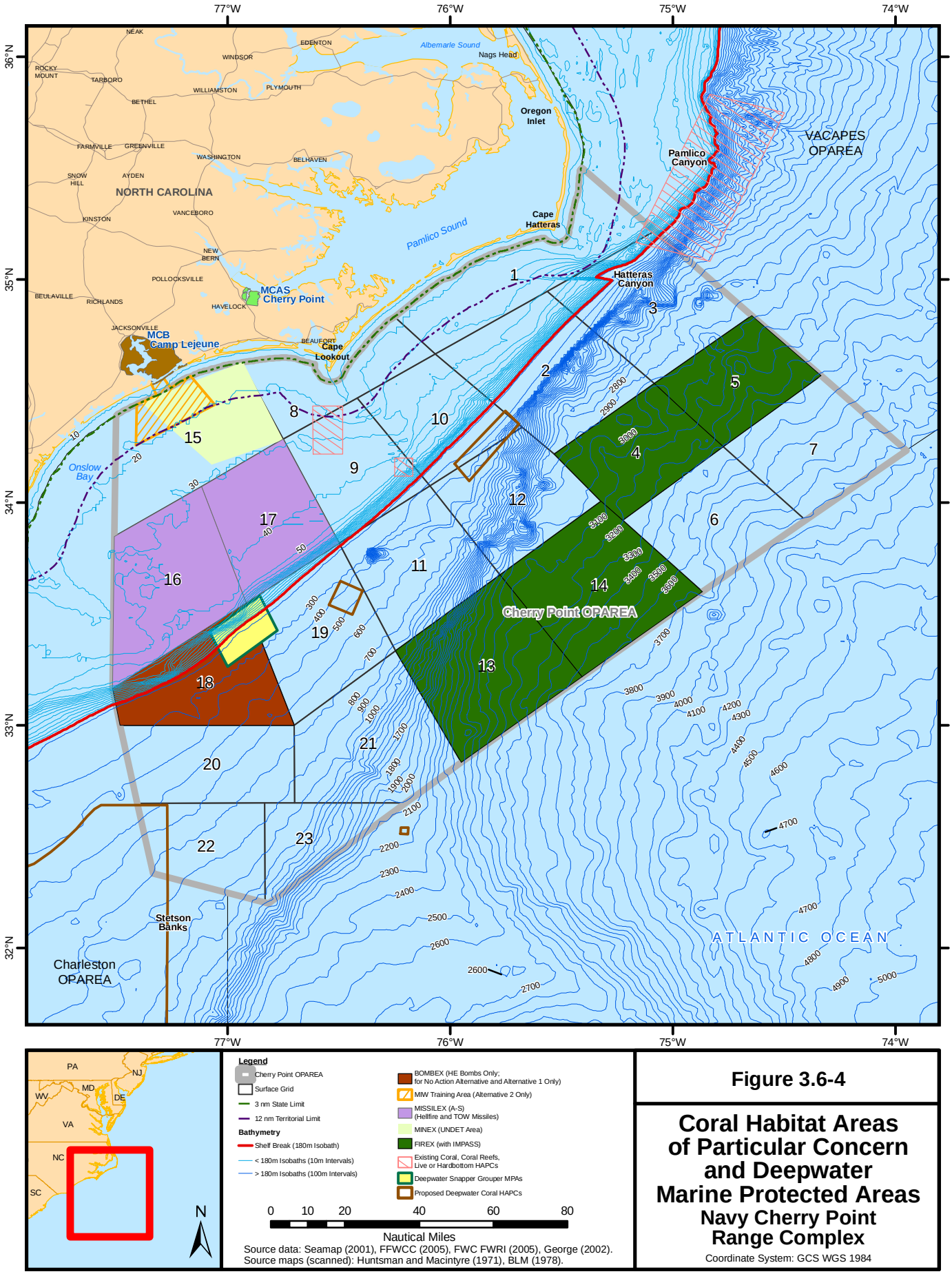


Figure 3.6-4

Coral Habitat Areas of Particular Concern and Deepwater Marine Protected Areas

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

In addition to the *Lophelia* banks, Hatteras Canyon and Pamlico Canyon are located in the Study Area between Cape Hatteras and Cape Lookout. These canyons support various benthic fauna such as soft corals (*Kophobelemnoon stelliferum* and *Distichoptilum gracile*), anemones (*Actinauge verrilli*), and sponges (*Hyalonema boreale*) (Rowe, 1971; Hecker, 1994).

3.6.2.3 Artificial Habitats

In addition to the natural hard bottom habitats in the Study Area, artificial habitats provide suitable hard substrate for epibenthic marine organisms (organisms that live on the top of the sea floor) such as algae, sponges, anemones, barnacles, and tunicates to attach, develop, and grow on (Bohnsack, *et al.*, 1991). Artificial reefs may have been created accidentally (shipwrecks) or deliberately (National Artificial Reef Plan, Liberty Ship Act, and various state artificial reef programs). The National Fishing Enhancement Act of 1984 defined an artificial reef as a human-made structure created in the navigable waters of the United States or in waters adjacent to the outer continental shelf (Seaman, 2000). Artificial reefs consist of such materials as rock or concrete rubble, decommissioned military vehicles, culverts, and even retired offshore oil/gas production platforms. The deliberate purpose underlying construction of artificial reefs is to create and enhance marine benthic habitat as well as help improve recreational fishing. An additional effect of artificial reef construction has been broadening the distribution of some species into previously unoccupied habitat (Seaman, 2000).

Whether purposefully or accidentally created, artificial reefs are so successful at enhancing habitat and improving fishing they are called fish havens on some nautical charts. In addition to recreational fishing, artificial reefs and shipwrecks also support the recreational diving and commercial fishing industries. Commercial use may involve setting pots or gillnets adjacent to reefs or trawling along the outer margins of a reef (Polovina, 1991).

Artificial reefs located offshore of North Carolina in the Study Area and vicinity (Figures 3.6-2 and 3.6-5) are composed of 30 reef complexes that contain over 100 reef sites made up of various material. The different types of material used as artificial reef structure are subway cars, hundreds of pieces of concrete pipe, hundreds of reefballs (igloo shaped structures made of concrete), and dozens of barges and ships (NCDMF, 2005a). The addition of artificial reefs off the coast of North Carolina contributed significantly to the hard bottom topography, creating more habitat for benthic fauna and fish (*i.e.*, hard and soft corals, sponges, arthropods, mollusks, and gastropods), which live in and among the artificial reefs (NCDMF, 2005a). Artificial reefs in the Study Area are also popular recreational dive sites. Some common fish found offshore on artificial reefs in the Study Area are amberjack, bank sea bass (*Centropristis ocyurus*), black sea bass, bluefish (*Pomatomus saltatrix*), red snapper (*Lutjanus campechanus*), and gag (*Mycteroperca microlepis*) (NCCF, 2006).

Numerous shipwrecks exist on the shoals (Diamond, Lookout, and Frying Pan) and capes (Hatteras, Lookout, and Fear) found throughout the Study Area and vicinity. The various shipwrecks in the Study Area and vicinity have created artificial hard bottom that has become colonized by sessile organisms (hard and soft corals, sponges, bryozoans, macroalgaes) and wreck fish (black sea bass, gag, and snapper [*Lutjanus* sp.]), essentially creating artificial reefs (NCDMF, 2005b). Natural disturbances from the convergence of strong currents, high winds and seas from hurricanes, and vessel traffic and war (Civil War and World War II) are all causes of numerous shipwrecks in the Study Area and vicinity (Newton *et al.*, 1971). Over 50 shipwreck sites are located in the OPAREA (Figure 3.6-54) (Veridian Corporation, 2001). Some of the shipwrecks date to colonial times, including the first recorded shipwreck along the coast of North Carolina (Beaufort Inlet, Cape Lookout) in the past four centuries, *The Queen Anne's Revenge*.

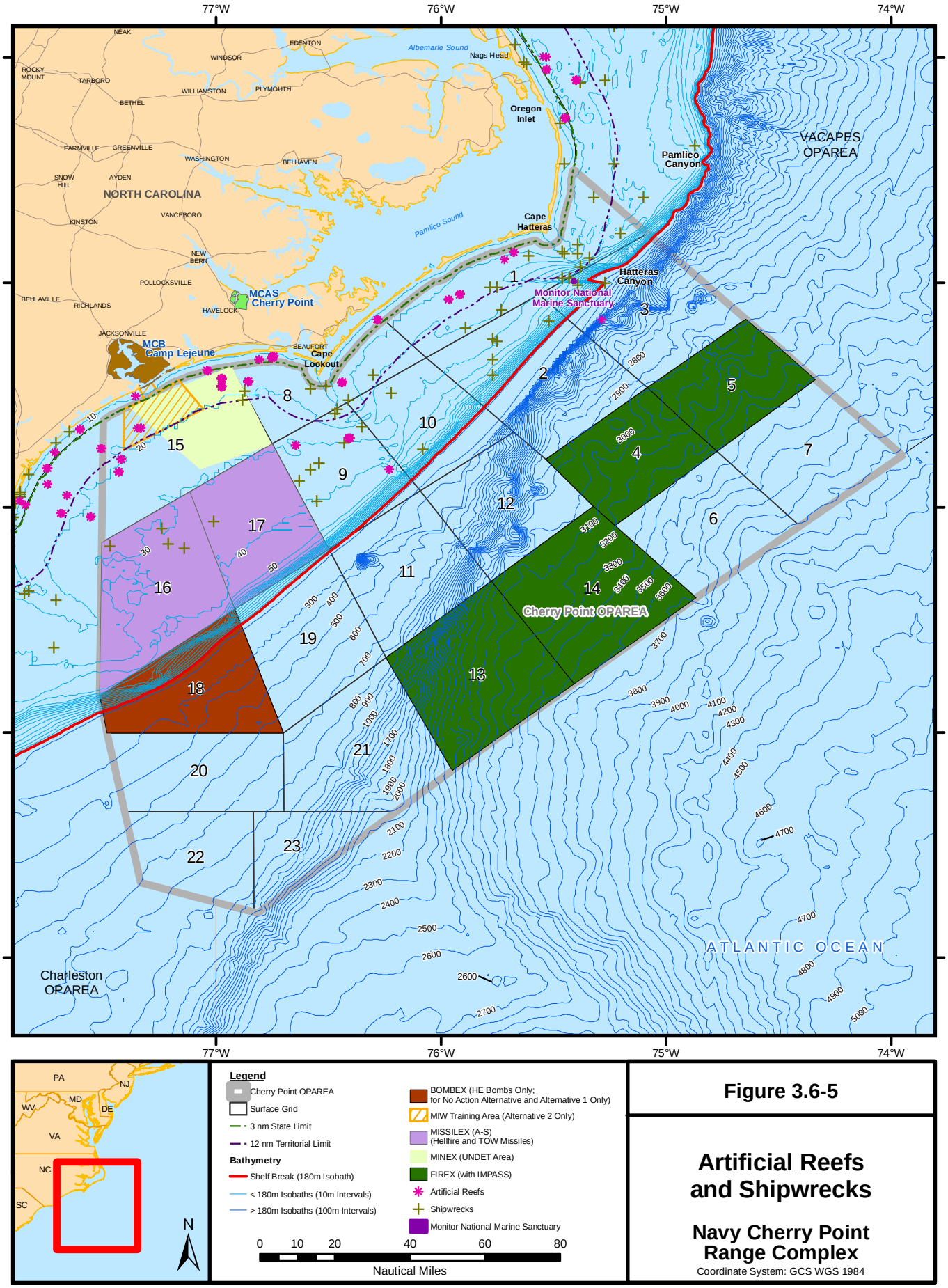


Figure 3.6-5

Artificial Reefs and Shipwrecks

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

The highest concentrations of shipwrecks within the Study Area are in the vicinity of Cape Hatteras, where the convergence of cold northern currents and the northbound Gulf Stream forms Diamond Shoals (Newton *et al*., 1971). Diamond Shoals extends 17 nm seaward creating hazardous sea conditions for vessel traffic due to their shallow depth. The Civil War Union battleship, the *USS Monitor*, lies near the Diamond Shoals in 70 meters of water, southeast off Cape Hatteras. The *USS Monitor* was designated the first National Marine Sanctuary in 1975 (NOAA, 2004). Other shipwrecks located near Diamond Shoals are the *SS Liberator* and *Dixie Arrow.*

3.6.2.4 National Marine Sanctuaries

The National Oceanic and Atmospheric Administration designates and manages national marine sanctuaries under the National Marine Sanctuary Program. These areas of the marine environment possess special national significance because of their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities. The primary objective of the National Marine Sanctuary Program is to manage marine resources.

The *Monitor* National Marine Sanctuary, which is located in the Navy Cherry Point Study Area, was established in 1975 to preserve the historical and cultural artifacts of the *USS Monitor*. This steam-powered ironclad ship was equipped with a rotating gun turret and is one of the most famous ships that have ever been built for naval warfare. The vessel is famous for its design and its part in the 1862 Battle of Hampton Roads against the Confederate ironclad *CSS Virginia*. The battle resulted in minor damage to either vessel and resulted in a draw. Later, in the same year of the battle, the *USS Monitor* sank in a storm off Cape Hatteras while in transit from Rhode Island to North Carolina for repairs (NOAA, 2008).

The *Monitor* National Marine Sanctuary is located in the Cherry Point OPAREA along the eastern edge of Area 3 about 70 meters below the surface and approximately 14 nm off Cape Hatteras in North Carolina (Figure 3.6-5). The sanctuary consists of a vertical water column 1 mile in diameter extending from the surface to the seabed. The small size of the sanctuary limits the number of marine organisms that permanently inhabit the area. However, many species pass through the area, and a small artificial reef community has developed around the wreck site (NOAA, 2008).

A permit is required to gain access to the shipwreck. Permits are typically limited to scientific research visits. Regulations prohibit anchoring, stopping, and drifting within the sanctuary, disturbing the seabed by conducting underwater detonation, drilling, laying cable, and trawling (NOAA, 2008).

3.6.3 Environmental Consequences

3.6.3.1 No Action Alternative

Vessel Movements

Many of the ongoing and proposed operations within the Navy Cherry Point Study Area involve maneuvers by various types of surface ships, boats, submarines, and amphibious vehicles (collectively referred to as vessels) (see Tables 2.2-4 and 2.2-5). The number of Navy and Marine Corps vessels operating in the Study Area varies based on training schedules and typically ranges from 0 to about 10 vessels at any given time. However, the number of vessels is much higher for short periods of time during Amphibious Assault and Amphibious Raid exercises (refer to Table 2.2-4 and Appendix D for specifics). Currently there are about 67 surface ships and submarines homeported in Norfolk. Ship sizes range from 415 feet for a frigate to 1,092 feet for a nuclear aircraft carrier (CVN). Ship speeds during training and operations generally range from 10 to 14 knots. Operations involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to 14 days. Although major exercises can last as long as 31 days, the portions of those exercises occurring in the Navy Cherry Point Study Area would likely not exceed 14 days. These operations are widely dispersed throughout the OPAREA, which is a vast area encompassing 18,617 nm^2 (an area approximately the

size of West Virginia). Consequently, the density of ships within the Study Area at any given time is extremely low (*i.e.*, less than 0.0005 ships/nm^2). The Navy and Marine Corps would log about 900 total steaming days within the Study Area during a typical year under the No Action Alternative.

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 vessel movements would be low relative to total plankton biomass. Mitigation measures include avoidance of large *Sargassum* mats by vessels (Chapter 5).

With the exception of amphibious operations, vessel movements would have no direct effect on benthic communities or artificial habitats because most vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats. As discussed in Chapter 1, this EIS/OEIS analyzes sea-based portions of amphibious operations up the mean high tide line. Land-based portions of amphibious operations are analyzed in a separate Marine Corps Environmental Assessment (DoN, 2009). Amphibious vehicles would make contact with the sea floor in the surf zone during Amphibious Assault and Amphibious Raid operations. Soft bottom habitat would be disturbed during these operations, resulting in suspension of sandy substrates and short-term and localized increases in turbidity. Benthic habitat within the surf zone is very dynamic because it is subject to constant wave action and cycles of erosion and deposition. As a result, disturbed areas would be reworked by waves and tides shortly after the disturbance. Amphibious vehicle movements would have no effect on artificial habitats because these habitats are not present in the amphibious landing area (Figure 3.6-2).

Benthic organisms, such as mole crabs (*Emerita talpodia*), clams (*Donax variabilis*), and polychaete worms, within the disturbed area could be displaced, injured, or killed during amphibious operations. However, population-level effects are not anticipated based on the relatively small area of disturbance and low number of organisms affected. Amphibious operations are limited to an area consisting of approximately 7,380 linear fe*et al*ong Onslow Beach. Benthic organisms inhabiting these areas are adapted to a highly variable environment and are expected to rapidly recolonize disturbed areas by immigration and larval recruitment. Studies indicate that benthic communities of high-energy sandy beaches recover relatively quickly (typically within 2 to 7 months) following beach nourishment (U.S. Army Corps of Engineers, 2001). Schoeman *et al*. (2000) found that the macrobenthic community required between 7 and 16 days to recover following excavation and removal of sand from a 200 m^2 (2,153 ft^2) quadrant from the mid-intertidal zone of a sandy beach. The effects of amphibious vehicle operations on benthic communities would be short-term and localized.

Vessel movements in territorial waters would have no significant impact on marine communities under the No Action Alternative. Similarly, 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 affects 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 the No Action Alternative. In addition, aircraft overflights over 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, Mine Warfare Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems that are towed through the water by helicopters flying approximately 75 to 100 feet above the water at low airspeeds. Under the No Action Alternative, 220 towed device sorties would be conducted per year. Most of these sorties would occur in the Underwater Detonation Area in Onslow Bay, with fewer occurring farther offshore in CVOA North (see Figure 2.2-1).

The use of towed Mine Warfare devices would result in short-term and localized disturbances to the water column. Benthic habitats would not be affected because the devices are not towed on the bottom. *Sargassum* mats likely occur in CVOA North based on proximity to the Gulf Stream. While towed Mine Warfare devices could result in short-term and localized disturbances to *Sargassum* habitats, 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. Therefore, any disturbance to *Sargassum* would be limited to very small patches not visible to the air 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, the use of towed Mine Warfare devices in territorial waters under the No Action Alternative would have no significant impact on marine communities. In accordance with Executive Order 12114, the use of towed devices in non-territorial waters would not result in significant harm to marine communities.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

The No Action Alternative does not include establishment of Mine Warfare Training Areas where temporary mine shapes would be deployed.

Non-explosive Practice Munitions

Current Navy and Marine Corps operations in the Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. NEPM may be used throughout the OPAREA (Tables 2.2-5 and 2.2-6). The No Action Alternative does include NEPM use in state waters (0 to 3 nm). NEPM and associated shrapnel have the potential to directly strike marine life and marine habitats as they travel through the water column and come into 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 Study Area. While a broad area of soft and hard bottom benthic habitat could be exposed to direct NEPM strikes, the training exercises are intermittent and widely dispersed, which decreases the likelihood that a given area would be subjected to repeated exposure. Most NEPM use occurs in areas greater than 12 nm offshore in waters greater than 65 feet 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. The probability of

NEPM striking an artificial reef or shipwreck is extremely low based on the widely dispersed nature of these resources and the training exercises.

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. 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, missiles, 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 654 non-explosive practice bombs would be dropped per year under the No Action Alternative in the 18,617-nm^2 OPAREA. Assuming an even distribution, the relative concentration of non-explosive practice bombs would be 3.5 per 100 nm^2/year. Actual concentrations would vary based on specific training scenarios, but would nonetheless be extremely low. Non-explosive practice missiles use (five per year for No Action Alternative) would be widely dispersed in Areas 9, 10, 11, and 12. A total of 1,259 non-explosive naval gun shells (5 in and 76 mm) would be fired per year under the No Action Alternative in the OPAREA.

The maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be approximately 4,488 ft^2 (0.00012 nm^2) per year or 44,880 ft^2 (0.0012 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, Missiles, and Naval Gun Shells Used in the Navy Cherry Point OPAREA

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
AIM-7	500	144	8	8
Hellfire	100	64	7	3.1
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, Missiles, and Naval Gun Shells in the NAVY Cherry Point OPAREA

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 - OPAREA						
BDU-45	165	1,670	182	1,842	194	1,963
MK-76	489	678	538	746	565	783
MK-83(I)	0	0	0	0	52	1,203
Subtotal =	**654**	**2,348**	**720**	**2,588**	**811**	**3,950**

Table 3.6-3 Estimates of Marine Benthic Habitat That Would be Affected by Non-Explosive Practice Bombs, Missiles, and Naval Gun Shells in the NAVY Cherry Point OPAREA (Contiued)

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 Missiles – Areas 9, 10, 11, and 12						
AIM-7	4	64	8	128	8	128
Hellfire	1	6	2	12	2	12
Subtotal =	**5**	**70**	**10**	**140**	**10**	**140**
Non-Explosive Practice Naval Gun Shells - OPAREA						
5 in	1,088	1,964	1,140	2,058	1,140	2,058
76 mm	171	106	190	118	190	118
Subtotal =	**1,259**	**2,071**	**1,330**	**2,176**	**1,330**	**2,176**
Total =		**4,488**		**4,904**		**6,226**

[1]Assumed that the area of marine benthic habitat affected per year = footprint x 2 x #/yr.

As shown in Figures 3.6-1 through 3.6-5, live hard bottom and artificial habitats are found in portions of the OPAREA. The probability of non-explosive practice bombs, missiles, and naval gun shells striking artificial habitats would be low because these resources occupy a relatively small area and most artificial reefs are located less than 12 nm offshore.

Based on the distribution of hard bottom (Figure 3.6-1), it is possible that a small percentage of non-explosive practice bombs, missiles, and naval gun shells would strike in these areas. The potential for strikes to adversely affect benthic communities in these areas would depend on the substrate and community types found at the point of physical impact. 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, missiles, and naval gun shells that would strike soft bottom habitats versus more sensitive areas such as live hard bottom. Nonetheless, the total area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be small (about 4,488 ft^2 per year) and only a percentage of the total area affected (far less than 4,488 ft^2 per year) would be sensitive benthic habitat such as live hard bottom.

Non-explosive practice bomb, missile, and naval gun shell strikes could result in long-term, minor effects to hard bottom communities, but the effects would be localized and no long-term changes to community structure or function would be expected. NEMP 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

Explosions that occur in the Study Area are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch HE rounds), as well as underwater detonations associated with Mine Neutralization training (MINEX). Underwater detonations and HE ordnance use are limited to a few specific training areas within the OPAREA (see Table 2.2-7 for a summary of underwater detonations and HE ordnance use by training area).

Explosions associated with BOMBEX, air-to-surface MISSILEX, and FIREX with IMPASS occur at or near the water's surface over relatively deep waters. BOMBEX occurs in Area 18 (Figure 2.2-2) where depths range from about 165 to 2,000 feet. Air-to-surface MISSILEX occurs in Areas 16 and 17 where depths range from about 100 to 165 feet and in Area 18 (Figure 2.2-2). FIREX with IMPASS occurs in Areas 4, 5, 13, and 14 (Figure 2.2-3) where depths are over 2,900 feet. Explosions associated with BOMBEX, air-to-surface MISSILEX, and FIREX with IMPASS are expected to have minimal effects on benthic communities and artificial habitats based on water depth. Of the ordnance types used during these exercises, the MK-84 HE bomb has the highest net explosive weight (NEW) (944.7 lbs). Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by a MK-84 HE bomb explosion would be about 11.9 m. The gas bubble would not extend to the bottom based on the minimum water depth (20 m) and a detonation depth of 1 m below the surface. Likewise, the gas bubbles produced by other ordnance types used in BOMBEX, MISSILEX, and FIREX would not extend to the bottom because they have smaller NEWs. Therefore, explosions during BOMBEX, MISSILEX, and FIREX are expected to have minimal effects on benthic communities and artificial habitats. These explosions would result in short-term and localized disturbances to the water column. Plankton in the immediate vicinity of 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 mitigation measures include avoidance of *Sargassum* mats.

Underwater detonations would be associated with Mine Neutralization training exercises, where explosive ordnance disposal detachments place explosive charges next to or on practice mines shapes. Under the No Action Alternative 20 charges with 20-lb NEW would be detonated per year in the Underwater Detonation Area (Figure 2.2-1), where water depths range from about 35 to 100 feet. Some charges would be detonated directly on the bottom and the others would be detonated in the water column.

The Navy does not set explosive charges within 1,000 ft of known live/hard bottom, artificial reefs, or shipwrecks (see Chapter 5 for detailed description of mitigation measures). Therefore, only unconsolidated, soft bottom 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 charge detonated on the bottom can create depressions in the substrate up to 4 to 5 feet in diameter and 1 foot deep (DoN, 2000b). Assuming a worst-case scenario where all underwater detonations occurred on the bottom, about 250 to 390 square feet of benthic habitat would be affected per year. Crater effects are usually temporary in sand and mud bottoms. Short-term increases in turbidity and resuspension of bottom sediments would be expected. There have been no studies of sediment deposition rates in the area of the proposed action, but the Minerals Management Service (2002) indicates that sandy sediments are quickly redeposited within 1,312 feet of oil well blowouts, and finer sediments are widely dispersed and redeposited over a period of 30 days or longer within a few thousand meters. Repopulation of displaced sediments should be relatively rapid compared to hard bottom areas (NRC, 2002).

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

Various types of military materials are expended during Navy and Marine Corps training exercises. The types and quantities of military expended materials 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 OPAREA would be exposed to military expended materials because the materials are widely dispersed and most 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 such as non-explosive practice bombs that are made of concrete and metal, would be colonized by benthic organisms that prefer hard substrate. This colonization could result in very 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 materials in territorial waters would have no significant impact on marine communities under the No Action Alternative. Furthermore, military expended materials in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

National Marine Sanctuaries

The *Monitor* National Marine Sanctuary encompasses a 1-mile diameter area along the western edge of Area 3 in the OPAREA. Potential stressors associated with operations that may occur in Area 3 include vessel movements, aircraft overflights, NEPM, and military expended materials. Based on the analyses presented above, these stressors are not expected to destroy, cause the loss of, or injure any sanctuary resource under the No Action Alternative. Underwater detonations do not occur in Area 3 and the only HE ordnance use in Area 3 is associated with air-to-air MISSILEX. Explosions associated with air-to-air MISSILEX occur in the air and would have no effect on sanctuary resources.

3.6.3.2 Alternative 1

Vessel Movements

The vessel movements would increase by about six percent per year in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased potential for phytoplankton, zooplankton, and ichthyoplankton in the upper portions of the water column to be displaced, injured, or killed by vessel and propeller movements compared to baseline conditions. However, no measurable effects on plankton populations would occur because the number of organisms exposed to vessel movements would continue to be low relative to total plankton biomass. Mitigation measures would continue to include avoidance of large *Sargassum* mats by vessels. Amphibious operations would not increase under Alternative 1. Therefore, impacts associated with amphibious vessel movements would be the same as those described for the No Action Alternative. These impacts include short-term and localized disturbances to sandy bottom substrate, as well as associated displacement, injury, and mortality to a limited number of benthic organisms. Vessel movements in territorial waters would have no significant impact on marine communities under Alternative 1. Similarly, vessel movements in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Aircraft Overflights

Alternative 1 would include a 10 percent increase in fixed-wing aircraft sorties per year and a 7 percent increase in helicopter sorties per year in the Study Area (Table 2.2-5). The potential affects 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.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would decrease by 13 percent per year under Alternative 1. Similar to the No Action Alternative, use of towed devices under Alternative 1 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. Air crews would avoid and limit disturbance to *Sargassum* habitats. 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, the use of towed Mine Warfare devices in territorial waters under Alternative 1 would have no significant impact on marine communities. In accordance with Executive Order 12114, the use of towed devices in non-territorial waters would not result in significant harm to marine communities.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

Alternative 1 does not include establishment of Mine Warfare Training Areas where temporary mine shapes would be deployed.

Non-explosive Practice Munitions

The amount of NEPM used in the Study Area would increase under Alternative 1 (Tables 2.2-5 and 2.2-6). The number of non-explosive practice bombs dropped in the OPAREA would increase from 654 to 720 per year, non-explosive practice missiles would increase from 5 to 10 per year, and non-explosive practice naval gun shells would increase from 1,259 to 1,330 (Table 3.6-3). These changes 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, 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.

The probability of non-explosive practice bombs, missiles, and naval gun shells striking hard bottom or artificial habitats would increase slightly under Alternative 1. However, the total area of benthic habitat affected would continue to be small. As shown in Table 3.6-3, the maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would increase from 4,488 ft^2 (0.00012 nm^2) per year to 4,904 ft^2 (0.00013 nm^2) per year or 49,040 ft^2 (0.0013 nm^2) over a ten-year period. Only a percentage of the total area affected (far less than 4,904 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bomb, missile, and naval gun shell strikes under Alternative 1 could result in long-term, minor effects to hard bottom communities, 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

The number and location of explosions that would occur under Alternative 1 would be the same as the No Action Alternative, with the exception of increases in air-to-surface MISSILEX (Tables 2.2-5 and 2.2-7). Eight additional explosions associated with air-to-surface MISSILEX would occur per year under Alternative 1. As discussed for the No Action Alternative, the air-to-surface MISSILEX explosions would occur in Areas 16, 17, and 18, and marine community impacts would be limited to

localized mortality to plankton. As discussed for the No Action Alternative, explosions at or near the surface are expected to have minimal effects on benthic communities and artificial habitats because the explosions' gas bubbles would not reach the bottom, In addition, impacts to hard bottom habitats, artificial reefs, and shipwrecks would be avoided through mitigation measures. Explosions in territorial waters would have no significant impact on marine communities under Alternative 1. Furthermore, explosions 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 (Table 2.2-5). 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 expended 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 materials in territorial waters would have no significant impact on marine communities under Alternative 1. Furthermore, military expended materials in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

National Marine Sanctuaries

Potential stressors associated with operations that may occur in Area 3, where the *Monitor* National Marine Sanctuary is located, include vessel movements, aircraft overflights, NEPM, and military expended materials. Based on the analyses presented above, these stressors are not expected to destroy, cause the loss of, or injure any sanctuary resource under Alternative 1. Underwater detonations do not occur in Area 3 and the only HE ordnance use in Area 3 is associated with air-to-air MISSILEX. Explosions associated with air-to-air MISSILEX occur in the air and would have no effect on sanctuary resources.

3.6.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements that would occur under Alternative 2 would be the same as Alternative 1 (Table 2.2-5). Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Vessel movements in territorial waters would have no significant impact on marine communities under Alternative 2. Similarly, vessel movements in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Aircraft Overflights

Alternative 2 would include a 12 percent increase in fixed-wing aircraft sorties per year and a 75 percent increase in helicopter sorties per year in the Study Area (Table 2.2-5). The potential affects 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 2. In addition, aircraft overflights over non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase from 220 to 576 per year (162%) under Alternative 2 (Table 2.2-5). Most of these sorties would occur in the proposed Mine Warfare Training Area, which would be established in Onslow Bay under Alternative 2 (Figure 2.2-1). Some towed devices sorties would continue to take place farther offshore in the CVOA North. Similar to the No Action Alternative, use of towed devices under Alternative 2 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. Air crews would avoid and limit disturbance to *Sargassum* habitats. Plankton in the upper portions of the water column could be displaced, injured, or killed by towed devices and the number of organisms affected would increase compared to the No Action Alternative. Despite this increase, measurable effects on plankton populations are not expected because the number of organisms exposed would be low relative to total plankton biomass. In accordance with NEPA, the use of towed Mine Warfare devices in territorial waters under Alternative 2 would have no significant impact on marine communities. In accordance with Executive Order 12114, the use of towed devices in non-territorial waters would not result in significant harm to marine communities.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

As discussed in Chapter 2, a littoral Mine Warfare Training Area would be designated in Onslow Bay under Alternative 2 (Figure 2.2-1). This section addresses potential effects on marine communities associated with establishing and maintaining this training area (*i.e.*, temporary mine shape deployment/recovery). The effects of conducting training exercises in this area are the same as those analyzed under aircraft overflights and towed mine warfare devices.

The process of deploying and recovering mine shape assemblies would result in localized disturbances to benthic habitat. As discussed in Chapter 2, the mine shape assembly would include a concrete anchor, mooring line (steel cable or chain), and the mine shape. Up to 315 mine shapes would be temporarily placed in the training area. The entire assembly (mine shape, mooring line, and anchor) would be deployed concurrently from a boat and recovered following the exercise (typically within 7 to 30 days). Approximately 6.25 ft^2 of benthic habitat would be disturbed when a concrete anchor makes contact with the sea floor. The same area would be disturbed when a concrete anchor is recovered. The total area affected per year would be less than 2,000 ft^2 based on 315 deployments/recoveries per year (Table 2.2-5). Benthic organisms could be crushed, injured, or killed by the impact of the concrete anchor.

The effects of mine shape deployment on benthic communities would depend on the community type at the specific deployment locations. Soft bottom habitats, live/hard bottom habitats (including coral and sponge patches), artificial reefs, and shipwrecks exist in the proposed training area (Figure 3.6-2). Mine shapes would not be deployed in locations with known artificial reefs or shipwrecks because these features could interfere with subsequent training operations. Soft bottom and live/hard bottom habitats, including coral and sponge patches, could be impacted by the concrete anchors. However, major reef systems such as the Ben Franklin Temperate Reef and *Lophelia* Banks are located outside of the Mine Warfare Training Area and would not be impacted. The recolonization process would occur faster in areas of soft bottom substrate than it would in hard bottom substrate (NRC, 2002). Recovery times would be longest for corals because these species have low growth rates. No population- or community-level effects are expected based on the small area that would be affected (less than 2,000 ft^2 per year).

Establishment of Mine Warfare Training Areas in territorial waters under Alternative 2 would have no significant impact on marine communities. Mine Warfare Training Areas would not be established in non-territorial waters and would have no effect on marine communities in non-territorial waters.

Non-explosive Practice Munitions

The amount of NEPM used in the Study Area under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Tables 2.2-5 and 2.2-6). The number of non-explosive practice bombs dropped in the OPAREA would increase from 654 to 811 per year (Table 3.6-3). These changes would result in increased potential for NEPM to strike benthic communities and artificial habitats compared to baseline conditions. The potential effects would be similar to those described for the No Action Alternative and Alternative 1, but the area affected by non-explosive practice bombs, missiles, and naval gun shells would increase compared to the No Action Alternative.

The probability of non-explosive practice bombs, missiles, and naval gun shells striking hard bottom or artificial habitats would increase slightly under Alternative 2. However, the total area of benthic habitat affected would continue to be small. As shown in Table 3.6-3, the maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would increase from 4,488 ft^2 (0.00012 nm^2) per year to 6,266 ft^2 (0.00017 nm^2) per year or 62,660 ft^2 (0.0017 nm^2) over a ten-year period. Only a percentage of the total area affected (far less than 6,266 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bomb, missile, and naval gun shell strikes under Alternative 2 could result in long-term, minor effects to benthic habitat, 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

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs, which would not be used in the Study Area under Alternative 2 (Tables 2.2-5 and 2.2-7). As such, water column disturbances and plankton mortality associated with BOMBEX explosions would not occur. Otherwise, impacts would be the same as those described for Alternative 1. Explosions in territorial waters would have no significant impact on marine communities under Alternative 2. Furthermore, explosions in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Military Expended Materials

The amount of military expended materials entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Tables 2.2-5 and 2.2-6). 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 expended 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 materials in territorial waters would have no significant impact on marine communities under Alternative 2. Furthermore, military expended materials in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

National Marine Sanctuaries

Potential stressors associated with operations that may occur in Area 3, where the *Monitor* National Marine Sanctuary is located, include vessel movements, aircraft overflights, NEPM, and military expended materials. Based on the analyses presented above, these stressors are not expected to destroy,

cause the loss of, or injure any sanctuary resource under Alternative 2. Underwater detonations do not occur in Area 3 and the only HE ordnance use in Area 3 is associated with air-to-air MISSILEX. Explosions associated with air-to-air MISSILEX occur in the air and would have no effect on sanctuary resources.

3.6.4 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 communities.

3.6.5 Summary of Environmental Effects

3.6.5.1 National Environmental Policy Act and Executive Order 12114

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. Furthermore, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to marine communities in non-territorial waters. The No Action Alternative, Alternative 1, and Alternative 2 are not expected to destroy, cause the loss of, or injure any resource in the *Monitor* National Marine Sanctuary.

Table 3.6-4 Summary of Environmental Effects of the Alternatives on Marine Communities in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). No long-term population or community-level effects.	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). No long-term population or community-level effects.
Aircraft Overflights	Potential exposure to aircraft noise. No long-term population or community-level effects.	Potential exposure to aircraft noise. No long-term population or community-level effects.
Towed Mine Warfare Devices	Short-term and localized disturbance to water column. No long-term population or community-level effects.	Short-term and localized disturbance to water column. No long-term population or community-level effects.
Temporary Mineshape Deployment/Recovery	Not applicable. Mine Warfare training areas would not be established under the No Action Alternative.	Not applicable. Mine Warfare training areas would not be established under the No Action Alternative.
Non-explosive Practice Munitions	Minor and localized disturbance to benthic communities. No long-term population or community-level effects.	Minor and localized disturbance to benthic communities. No long-term population or community-level effects.
Underwater Detonations and High Explosive Ordnance	Short-term and localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. No long-term population or community-level effects.	Short-term and localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. No long-term population or community-level effects.
Military Expended Materials	Long-term, minor, and localized accumulation of expended materials in benthic communities. No long-term changes in community structure or function.	Long-term, minor, and localized accumulation of expended materials in benthic communities. No long-term changes in community structure or function.
Impact Conclusion	No significant impact to marine communities.	No significant harm to marine communities.

Table 3.6-4 Summary of Environmental Effects of the Alternatives on Marine Communities in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 1		
Vessel Movements	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). Slight increase compared to No Action. No long-term population or community-level effects.	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). Slight increase compared to No Action. No long-term population or community-level effects.
Aircraft Overflights	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.
Towed Mine Warfare Devices	Short-term and localized disturbance to water column. Slight decrease compared to No Action. No long-term population or community-level effects.	Short-term and localized disturbance to water column. Slight decrease compared to No Action. No long-term population or community-level effects.
Temporary Mineshape Deployment/Recovery	No effect.	No effect.
Non-explosive Practice Munitions	Minor and localized disturbance to soft bottom benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.	Minor and localized disturbance to soft bottom benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.
Underwater Detonations and High Explosive Ordnance	Short-term and localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. No long-term population or community-level effects.	Short-term and localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. No long-term population or community-level effects.
Military Expended Materials	Long-term, minor, and localized accumulation of expended materials in benthic communities. No long-term changes in community structure or function.	Long-term, minor, and localized accumulation of expended materials in benthic communities. No long-term changes in community structure or function.
Impact Conclusion	No significant impact to marine communities.	No significant harm to marine communities.
Alternative 2		
Vessel Movements	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). Slight increase compared to No Action. No long-term population or community-level effects.	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). Slight increase compared to No Action. No long-term population or community-level effects.
Vessel Movements	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). Slight increase compared to No Action. No long-term population or community-level effects.	Short-term and localized disturbances to water column and benthic (amphibious vessels only) habitats. Localized mortality to plankton and benthic organisms (amphibious vessels only). Slight increase compared to No Action. No long-term population or community-level effects.
Aircraft Overflights	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.
Towed Mine Warfare Devices	Short-term and localized disturbance to water column. Slight increase compared to No Action. No long-term population or community-level effects.	Short-term and localized disturbance to water column. Slight increase compared to No Action. No long-term population or community-level effects.

Table 3.6-4 Summary of Environmental Effects of the Alternatives on Marine Communities in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 2 (Cont)		
Temporary Mineshape Deployment/Recovery	Short-term and localized disturbance of benthic habitat. Creation of small areas of hard bottom habitat. No long-term population or community-level effects.	No effect.
Non-explosive Practice Munitions	Minor and localized disturbance to benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.	Minor and localized disturbance to benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.
Underwater Detonations and High Explosive Ordnance	Short-term and localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. Decrease in HE BOMBEX compared to No Action. No long-term population or community-level effects.	Short-term and localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. Decrease in HE BOMBEX compared to No Action. No long-term population or community-level effects.
Military Expended Materials	Long-term, minor, and localized accumulation of expended materials in soft bottom benthic communities. Slight increase compared to No Action. No long-term changes in community structure or function.	Long-term, minor, and localized accumulation of expended materials in soft bottom benthic communities. Slight increase compared to No Action. No long-term changes in community structure or function.
Impact Conclusion	No significant impact to marine communities.	No significant harm to marine communities.

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 USC 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 of Fiscal Year 2004 (Public Law 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) [16 USC 1374 (c)(3)]. The Fiscal Year 2004 National Defense Authorization Act adopted the definition of "military readiness activity" as set forth in the Fiscal Year 2003 National Defense Authorization Act (Public Law 107-314). Military training activities within the Navy Cherry Point Study Area constitute military readiness activities as that term is defined in Public Law 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 USC 1362 (18)(B)(i)(ii)].

Section 101(a)(5) of the MMPA directs the Secretary of the Department of Commerce 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 and will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses.

Several species of marine mammals may occur in the Navy Cherry Point Study Area. 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 Endangered Species Act (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 in danger of extinction throughout all or a significant portion of its range, while a "threatened" species is a species likely to become endangered within the foreseeable future throughout all or in a

significant portion of its range. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (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 the West Indian manatee), while the NMFS has primary responsibility for marine species (including listed whales) and anadromous fish species (species that migrate from saltwater to freshwater to spawn). The ESA allows 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. Under Section 9 of the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. 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 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).

Seven marine mammal species that are listed as endangered under the ESA could potentially occur in the Navy Cherry Point Study Area. 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 has completed the ESA Section 7 informal consultation process with USFWS for the West Indian manatee. The Navy has initiated the ESA Section 7 formal consultation process with NMFS to determine if the action would adversely affect ESA-listed whales or jeopardize the continued existence of a listed species. Critical habitat for listed species has not been designated under the ESA in the Navy Cherry Point Study Area. Copies of correspondence with NMFS and USFWS are provided in Appendices A and C of this EIS/OEIS.

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 EIS/OEIS includes several warfare areas (*e.g.,* Mine Warfare, Anti-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.,* vessel movements, 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 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 alternatives 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 EIS/OEIS.
- Identify resources that may occur in the action 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 Study Area for marine mammals is described in Section 1.5 and is shown in Figure 1.5-1. The 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 and 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, theses, dissertations, endangered species recovery plans, species management plans, stock assessment reports, Environmental Impact Statements, 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 (geographic coordinates) on the occurrence of marine resources within the Study Area.

Information was collected from the following sources to summarize the occurrence patterns of and to evaluate the impacts to protected species in the Study Area and vicinity:

- Academic and educational/research institutions: College of William and Mary, Duke University, Los Angeles County Museum, New England Aquarium, Old Dominion University, Rutgers University, Texas A&M University, University of Rhode Island, and Virginia Institute of Marine Science;
- On-line databases: Ingenta, Web of Science; Aquatic Sciences and Fisheries Abstracts, Science Direct, Synergy, BIOSIS previews;
- The Internet, including various databases and related websites: National Oceanic and Atmospheric Administration (NOAA)-Coastal Services Center, NMFS, Ocean Biogeographic Information System, U.S. Geological Survey, Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, New England Fishery Management Council, Atlantic States Marine Fisheries Commission, Gulf of Mexico Fishery Management Council, WhaleNet, Blackwell-Science, FishBase, Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute, Food and Agriculture Organization, Federal Register, Marine Turtle Newsletter, Proceedings of the Annual Sea Turtle Symposium, Caribbean Conservation Corporation, National Marine Mammal Laboratory Library, and Seaturtle.org;
- Federal and state agencies: the Navy, South Atlantic Fishery Management Council, Gulf of Mexico Fishery Management Council, Atlantic States Marine Fisheries Commission, Mid-Atlantic Fishery Management Council, New England Fishery Management Council, NMFS Highly Migratory Species Division, NMFS Southeast Fisheries Science Center, NMFS Southwest Fisheries Science Center, NMFS Southeast Regional Office, NMFS Northeast Fisheries Science Center, NMFS Northeast Regional Office, NMFS Office of Habitat Protection, NMFS Office of Protected Resources, NOAA: Marine Managed Areas Inventory, USFWS Ecological Services Field Offices, U.S. Environmental Protection Agency, U.S. Geological Survey: Sirenia Project, Bureau of Land Management, Minerals Management Service, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, and Georgia Department of Natural Resources; and
- Marine resource experts and specialists.

Marine Resource Assessments

The information contained in this Chapter 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 final version MRA for the Cherry Point OPAREA was completed in 2008 (DoN, 2008).

The MRA data were used to provide a regional context for each species. The MRA represents a compilation and synthesis of available scientific literature (for example [e.g.], 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.

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

DEIS/OEIS are derived from the *Navy OPAREA Density Estimates (NODE) for the Southeast OPAREAS* report (DoN, 2007).

Density estimates for cetaceans were derived in one of three ways, in order of preference: 1) through spatial models using line-transect survey data provided by the NMFS (as discussed below); 2) using abundance estimates from Mullin and Fulling (2003); or 3) based on the cetacean abundance estimates found in the National Ocean and Atmospheric Administration (NOAA) stock assessment reports (SAR; (Waring *et al.*, 2007). 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 concentration was formulated using generalized additive models (GAM). 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-Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (NMFS-SEFSC) between 1998 and 2005. Species-specific density estimates derived through spatial modeling were compared with abundance estimates found in the most current NOAA SAR 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 method involved in calculating the density estimates provided in this EIS/OEIS, please refer to the NODE report for the Southeast (DoN, 2007a). The report is available at:

http://www.Navycherrypointrangecomplexeis.com

The following shows how density estimates were modeled or derived for species analyzed in this EIS/OEIS:**Model-Derived Density Estimates**

- Fin whale (*Balaenoptera physalus*)
- Sperm whale (*Physeter macrocephalus*)
- Beaked whales (*Family Ziphiidae*)
- Bottlenose dolphin (*Tursiops truncatus*)
- Atlantic spotted dolphin (*Stenella frontalis*)
- Striped dolphin (*Stenella coeruleoalba*)
- Common dolphin (*Delphinus delphis*)
- Risso's dolphin (*Grampus griseus*)
- Pilot whales (*Globicephala spp.)*

SAR or Literature-Derived Density Estimates

- North Atlantic right whale (*Eubalaena glacialis*)[1]
- Humpback whale (*Megaptera novaeangliae*)[1]
- Minke whale (*Balaenoptera acutorostrata*)[2]
- *Kogia* spp.[2]
- Rough-toothed dolphin (*Steno bredanensis*)[2]
- Pantropical spotted dolphin (*Stenella attenuata*)[2]
- Clymene dolphin (*Stenella clymene*)[2]

[1] Abundance estimates were geographically and seasonally partitioned

[2] Abundance estimates were uniformly distributed geographically and seasonally Source: (DoN, 2007)

Table 3.7-1 shows the density estimates by species for training areas where explosive ordnance use may occur in the Navy Cherry Point Range Complex.

Table 3.7-1 Seasonal Density Estimates for Marine Mammals in the Cherry Point 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				
4 & 5	0.00000	0.00000	0.00000	0.00000
13 & 14	0.00000	0.00000	0.00000	0.00000
16 & 17	0.00000	0.00000	0.00000	0.00000
UNDET	0.00000	0.00000	0.00000	0.00000
Humpback Whale				
4 & 5	0.00058	0.00116	0.00000	0.00116
13 & 14	0.00058	0.00116	0.00000	0.00116
16 & 17	0.00058	0.00116	0.00000	0.00116
UNDET	0.00058	0.00116	0.00000	0.00116
North Atlantic Right Whale				
4 & 5	0.00000	0.00000	0.00000	0.00000
13 & 14	0.00000	0.00000	0.00000	0.00000
16 & 17	0.00027	0.00015	0.00000	0.00006
UNDET	0.00040	0.00023	0.00000	0.00011
Sei Whale	Insufficient data to estimate density.			
Sperm Whale				
4 & 5	0.00051	0.00051	0.00134	0.00051
13 & 14	0.00015	0.00015	0.00025	0.00015
16 & 17	<0.00001	<0.00001	<0.00001	<0.00001
UNDET	<0.00001	<0.00001	0.00000	<0.00001
West Indian Manatee	Insufficient data to estimate density.			
Non-Threatened or Endangered Marine Mammal Species				
Atlantic Spotted Dolphin				
4 & 5	0.00888	0.00888	0.00888	0.00888
13 & 14	0.00460	0.00460	0.00460	0.00460
16 & 17	0.14257	0.14257	0.14257	0.14257
UNDET	0.08807	0.08807	0.08807	0.08807
Beaked Whales				
4 & 5	0.00014	0.00014	0.00071	0.00014
13 & 14	0.00021	0.00021	0.00043	0.00021
16 & 17	< 0.00001	< 0.00001	< 0.00001	< 0.00001
UNDET	0.00000	0.00000	0.00000	0.00000

Table 3.7-1 Seasonal Density Estimates for Marine Mammals in the Cherry Point Range Complex Training Areas Where Explosive Ordnance May Occur (Continued)

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Bottlenose Dolphin				
4 & 5	0.00017	0.00017	0.00004	0.00017
13 & 14	0.00642	0.00642	0.00882	0.00642
16 & 17	0.02342	0.02342	0.03410	0.02342
UNDET	0.01717	0.01717	0.04277	0.01717
Bryde's Whale	Insufficient data to estimate density.			
Clymene Dolphin				
4 & 5	0.01063	0.01063	0.01063	0.01063
13 & 14	0.01063	0.01063	0.01063	0.01063
16 & 17	0.01063	0.01063	0.01063	0.01063
UNDET	0.01063	0.01063	0.01063	0.01063
Common Dolphin				
4 & 5	0.00000	0.00000	0.00000	0.00000
13 & 14	0.00000	0.00000	0.00000	0.00000
16 & 17	<0.00001	<0.00001	<0.00001	<0.00001
UNDET	<0.00001	<0.00001	<0.00001	<0.00001
False Killer whale	Insufficient data to estimate density.			
Fraser's Dolphin	Insufficient data to estimate density.			
Harbor Porpoise	Insufficient data to estimate density.			
Killer Whale	Insufficient data to estimate density.			
Melon-headed Whale	Insufficient data to estimate density.			
Minke Whale				
4 & 5	0.00004	0.00004	0.00004	0.00004
13 & 14	0.00004	0.00004	0.00004	0.00004
16 & 17	0.00004	0.00004	0.00004	0.00004
UNDET	0.00004	0.00004	0.00004	0.00004
Pantropical Spotted Dolphin				
4 & 5	0.02225	0.02225	0.02225	0.02225
13 & 14	0.02225	0.02225	0.02225	0.02225
16 & 17	0.02225	0.02225	0.02225	0.02225
UNDET	0.02225	0.02225	0.02225	0.02225
Pilot Whales				
4 & 5	0.00048	0.00048	0.00077	0.00048
13 & 14	0.01425	0.01425	0.00673	0.01425
16 & 17	0.00019	0.00019	0.00015	0.00019
UNDET	0.00001	0.00001	<0.00001	0.00001
Pygmy and Dwarf Sperm Whales				
4 & 5	0.00101	0.00101	0.00101	0.00101
13 & 14	0.00101	0.00101	0.00101	0.00101
16 & 17	0.00101	0.00101	0.00101	0.00101

Table 3.7-1 Seasonal Density Estimates for Marine Mammals in the Cherry Point Range Complex Training Areas Where Explosive Ordnance May Occur (Continued)

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
UNDET	0.00101	0.00101	0.00101	0.00101
Pygmy Killer Whale	Insufficient data to estimate density.			
Risso's Dolphin				
4 & 5	<0.00001	<0.00001	<0.00001	<0.00001
13 & 14	0.00005	0.00005	0.00005	0.00005
16 & 17	0.02148	0.02148	0.02148	0.02148
UNDET	<0.00001	<0.00001	<0.00001	<0.00001
Rough-toothed Dolphin				
4 & 5	0.00048	0.00048	0.00048	0.00048
13 & 14	0.00048	0.00048	0.00048	0.00048
16 & 17	0.00048	0.00048	0.00048	0.00048
UNDET	0.00048	0.00048	0.00048	0.00048
Spinner Dolphin	Insufficient data to estimate density.			
Striped Dolphin				
4 & 5	<0.00001	<0.00001	<0.00001	<0.00001
13 & 14	<0.00001	<0.00001	<0.00001	<0.00001
16 & 17	<0.00001	<0.00001	<0.00001	<0.00001
UNDET	<0.00001	<0.00001	<0.00001	<0.00001
Harbor Seal	Insufficient data to estimate density.			

Density estimates could not be calculated for all species due to the limited available data. Occurrence of these species in the Cherry Point Range Complex is considered uncommon.

Species for Which Density Estimates Are Not Available

- Blue whale (*Balaenoptera musculus*)
- Sei whale (*Balaenoptera borealis*)
- Bryde's whale (*Balaenoptera brydei/edeni*)
- Killer whale (*Orcinus orca*)
- Pygmy killer whale (*Feresa attenuata*)
- False killer whale (*Pseudorca crassidens*)
- Melon-headed Whale (*Peponocephala electra*)
- Spinner dolphin (*Stenella longirostris*)
- Fraser's dolphin *(Lagenodelphis hosei*)
- Harbor porpoise (*Phocoena phocoena*)
- West Indian Manatee (*Trichechus manatus*)

Species for which density estimates were not available are expected so infrequently that exposures are not predicted.

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 EIS/OEIS. As shown in Table 3.7-2, potential stressors to marine mammals include vessel movements (disturbance or collisions), aircraft overflights (disturbance), towed Mine Warfare (MIW) devices (strikes), temporary mine shape deployment/recovery (habitat alteration), weapons firing/non-explosive practice munitions (NEPM) (disturbance and strikes), underwater detonations and high explosive (HE) ordnance (explosions), and military expended materials (ordnance related-materials, targets, chaff, self-protection flares, marine markers, and TOW missile guide wires). The potential effects of these stressors on marine mammals are analyzed in detail in Section 3.7.3.

As discussed in the EIS, 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 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 occurrences in the Navy Cherry Point Study Area. These include 33 cetacean species, four pinniped species, and one sirenian species (DoN, 2008). Although it is possible that 38 species of marine mammals could occur in the Study Area, only 34 of those species are expected to occur regularly in the OPAREA. The remaining species are considered extralimital in the Study Area; indicating there are one or more records of an animal's presence in the Study Area, but it is considered beyond the normal range of the species. Extralimital species will not be analyzed further in this study. Some cetacean species are resident year-round [e.g., bottlenose dolphins (*Tursiops truncatus*) and beaked whales], while others [e.g., North Atlantic right whales (*Eubalaena glacialis*) and humpback whales (*Megaptera novaeangliae*)] occur seasonally as they migrate through the area. Most of the resource information presented for the Study Area is compiled in the Marine Resources Assessment (MRA) Update for the Cherry Point Operating Area (DoN, 2008).

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 undoubtedly 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 at low latitudes (Corkeron and Connor, 1999; Stern, 2002). However, not all baleen whales migrate. Some individual fin, Bryde's, minke, and blue whales may stay in a specific area year-round.

Table 3.7-2 Summary of Potential Stressors to Marine Mammals[21]

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)									
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓	✓			
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓	✓	✓	✓	✓
Surface Warfare (SUW)									
Bombing Exercise (Air-to-Surface)	W-122 (Area 18)			✓			✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Areas 16 and 17)			✓			✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17)			✓			✓		✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓	✓				✓		✓
GUNEX (Surface-to-Surface) USMC Small Arms Training	Cherry Point OPAREA	✓	✓				✓		✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO) - Ship	Cherry Point OPAREA	✓	✓						
MSO to include VBSS/MIO - Helo	Cherry Point OPAREA	✓	✓	✓					
Air Warfare (AW)									
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)			✓					
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)			✓			✓		✓

[21] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations see Table 2.2-4 and Appendix D.

Table 3.7-2 Summary of Potential Stressors to Marine Mammals (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Air Warfare (AW) Continued									
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)			✓			✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓					✓
Air Intercept Control	W-122	✓	✓	✓					
Electronic Warfare (EC)									
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122	✓	✓	✓					
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15 & 16)			✓					✓
Chaff Exercise- ship	Cherry Point OPAREA	✓	✓						✓
Flare Exercise- aircraft	W-122 (Areas 1, 8, 15 & 16)			✓					✓
Strike Warfare (STW)									
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, & 21)			✓				✓	✓
Amphibious Warfare (AMW)									
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)	✓	✓				✓		
FIREX - Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Areas 4/5 & 13/14)	✓	✓				✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓					
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓					

Table 3.7-3 Marine Mammal Species Found in the Cherry Point 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 boreali	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 sperm whales)		
Kogia breviceps	Pygmy sperm whale	
Kogia sima	Dwarf sperm whale	
Family Ziphiidae (beaked whales)		
Ziphius cavirostris	Cuvier's beaked whale	
Mesoplodon mirus	True'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	
Delphinus delphis	Common dolphin	
Lagenodelphis hosei	Fraser's dolphin	
Grampus griseus	Risso's dolphin	
Family Delphinidae (dolphins) (…*continued*)		
Peponocephala electra	Melon-headed whale	
Feresa attenuata	Pygmy killer whale	
Pseudorca crassidens	False killer whale	
Orcinus orca	Killer whale	
Globicephala melas	Long-finned pilot whale	
Globicephala macrorhynchus	Short-finned pilot whale	
Family Phocoenidae (porpoises)		
Phocoena phocoena	Harbor porpoise	
Order Carnivora Suborder Pinnipedia (seals, sea lions, walruses) Family Phocidae (true seals)		
Phoca vitulina concolor	Harbor seal	
Order Sirenia Family Trichechidae (manatees)		
Trichechus manatus	West Indian manatee	ENDANGERED

Source: (DoN, 2008)

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 chlorophyll *a* concentrations, and features such as bottom depth (Fiedler, 2002). Oceanographic features, such as eddies associated with the Gulf Stream, are important factors determining cetacean distribution since their prey are attracted to the increased primary productivity associated with some of these features (Biggs *et al.*, 2000; Wormuth *et al.*, 2000; Davis *et al.*, 2002). The warm Gulf Stream moves rapidly through the Florida Straits and extends northeast along the continental shelf. This current is the single most-influential oceanographic feature of the region and influences water temperature, salinity, and nutrient availability. These factors, in turn, are important in regulating primary productivity associated with phytoplankton growth in the region and the subsequent secondary productivity of zooplankton and other animal life that provide prey for marine mammals.

There is also an association between cetaceans and cold-core and warm-core rings (Griffin, 1999; Biggs *et al.*, 2000; Waring *et al.*, 2001). Both ring types are eddies that detach from the Gulf Stream; it is possible to find either near the Cherry Point OPAREA, increasing the likelihood of higher cetacean presence for the duration of these mesoscale hydrographic features. It is possible that the upwelling associated with cold-core rings permits greater feeding efficiency by cetaceans by concentrating prey species due to higher local productivity.

Along the Virginia and North Carolina shoreline, upwelling and downwelling events are not limited to Gulf Stream or deep-sea canyon geography. Wind patterns and outflow from the Chesapeake Bay cause upwelling and downwelling features along the continental shelf on a regular basis (Cudaback and Largier, 2001), potentially increasing regional productivity and thereby enhancing local cetacean abundance.

Disturbances, such as hurricanes, atmospheric frontal systems, and shifts in current patterns can also increase the before-mentioned oceanographic conditions to enhance local productivity. For example, increased sediment and nutrient loads are present in freshwater systems following heavy and prolonged rainfall, similarly enhancing primary productivity along the continental shelf near the system's effluence.

Waters off North Carolina have the greatest cetacean diversity along the eastern seaboard (Webster *et al.*, 1995). Cape Hatteras is generally considered to be a boundary between temperate and tropical species in the western North Atlantic and an area of overlap for many marine species (Ekman, 1953; Briggs, 1974; Garrison *et al.*, 2003b). Many marine mammals along North Carolina waters are year-round residents, but others migrate into inshore waters during summer/fall and winter/spring months (Webster *et al.*, 1995).

3.7.2.2 Endangered Species Act-Listed Marine Mammals

As identified in Table 3.7-3, seven marine mammal species listed as endangered under the ESA may occur in the Study Area. These mammals include five baleen whale species (blue, fin, humpback, North Atlantic right, and sei), one toothed whale species (sperm whale), and one sirenian species (West Indian manatee). Status, habitat, and distribution of each species are provided below.

Blue Whale

Blue whales are the largest living animals. Adult blue whales in the northern hemisphere reach 22.9 to 28 m in length (Jefferson *et al.*, 1993). Blue whales feed primarily on euphausiids (krill) (Nemoto and Kawamura, 1977; Kenney *et al.*, 1985). Like other rorquals, blue whales feed by "gulping" (Pivorunas, 1979).

Status and Management - The endangered blue whale was severely depleted by commercial whaling in the twentieth century (NMFS, 1998b). It is likely that 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.*, 1990; Ramp *et al.*, 1996). There are no current estimates of abundance for the North Atlantic blue whale (Waring *et al.*, 2008). However, the 308 photo-identified individuals from the Gulf of St. Lawrence area 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 the 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 extended south to Florida and the Gulf of Mexico, however the southern limit of this species' range 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). However, in the Gulf of St. Lawrence, blue whales show strong preferences for the nearshore regions where strong tidal and current mixing leads to high productivity and rich prey resources (Sears *et al.*, 1990). Important foraging areas for this species include the edges of continental shelves and upwelling regions (Reilly and Thayer, 1990; Schoenherr, 1991). Based on acoustic and tagging data from the North Pacific, relatively cold, productive waters and fronts attract feeding blue whales (Moore *et al.*, 2002). Clark and Gagnon (2004) determined that vocalizing blue whales show strong preferences, even during summer months, for shelf breaks, seamounts, or other areas where food resources are known to occur.

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.*, 1993). Stranding and sighting data suggest blue whale occurrence in the Atlantic extended south to Florida and the Gulf of Mexico, however the southern limit of this species' range is unknown (Yochem and Leatherwood, 1985). Blue whales now rarely occur in the U.S. Atlantic 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). Blue whales off the Atlantic coast of North America are most frequently sighted in the waters of eastern Canada. The majority of known records of blue whales in the western North Altantic come from the Gulf of St. Lawrence (Lesage and Hammill, 2003). 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). Researchers using the Navy integrated undersea surveillance system resources 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).

Calving occurs primarily during the winter (Yochem and Leatherwood, 1985; Jefferson *et al.*, 2008). Breeding grounds are thought to be located in tropical/subtropical waters; however, exact locations are unknown (Jefferson *et al*., 2008).

Cherry Point OPAREA Blue Whale Occurrence - The majority of western North Atlantic blue whale observations during the spring, summer, and fall take place around Newfoundland, the Gulf of St.

Lawrence, and Nova Scotia (CETAP, 1982; Wenzel *et al.*, 1988; Sears *et al*., 1990). The southern extent of its feeding range may be somewhere near 40° N latitude and records suggest occurrence of this species south to Florida and in the Gulf of Mexico. The information above suggests the blue whale is less likely to be present during summer months, but may occur any time of the year.

Cherry Point OPAREA Blue Whale Density - There were not sufficient data available to estimate a density for the Study Area, nor is there an abundance estimate in the NOAA SAR (DoN, 2007). Lack of sighting data for density estimates is not indicative of the absence of blue whales.

Fin Whale

The fin whale is the second-largest whale species, with adults reaching 24 m in length (Jefferson *et al.*, 1993). 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, 2006a).

Status and Management - The NOAA SAR estimates that there are 2,269 individual fin whales in the U.S. Atlantic waters (Waring *et al.*, 2008); this is probably an underestimate, however, as survey coverage of known and potential fin whale habitat was incomplete. The fin whale is listed as endangered and is under jurisdiction of the NMFS. The draft recovery plan for the fin whale was released in June 2006 (NMFS, 2006a). NMFS recently initiated a 5-year review for the fin whale under the ESA (NMFS, 2007b).

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). Waring *et al.* (1992) reported sighting fin whales along the edge of a warm core eddy and a remnant near Wilmington Canyon, along the northern wall of the Gulf Stream. 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.*, 1990b; Kenney *et al.*, 1997; Notarbartolo-di-Sciara *et al*., 2003). Clark and Gagnon (2004) determined that vocalizing fin whales show strong preferences, even during summer months, 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 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).

Distribution - Fin whales are broadly distributed throughout the world's oceans, usually in temperate, polar, and tropical latitudes (Jefferson *et al.*, 2008). 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, 2006a). 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).

Relatively consistent sighting locations for fin whales off the Atlantic coast of North America include the banks on the Nova Scotian Shelf, Georges Bank, Jeffreys Ledge, Cashes Ledge, Stellwagen Bank, Grand Manan Bank, Newfoundland Grand Banks, the Great South Channel, the Gulf of St. Lawrence, off Long

Island and Block Island, Rhode Island, and along the shelf break of the northeastern U.S. (CETAP, 1982; Hain *et al.*, 1992; Waring *et al*., 2008). Hain *et al*. (1992) reported that the single most important habitat in their study was a region of the western Gulf of Maine, to Jeffreys Ledge, Cape Ann, Stellwagen Bank, and to the Great South Channel, in approximately 50 m of water. This was an area of high prey (sand lance) density during the 1970s and early 1980s (Kenney and Winn, 1986). Secondary areas of important fin whale habitat included the mid- to outer shelf from the northeast area of Georges Bank through the mid-Atlantic Bight.

Based on passive acoustic detection using Navy Sound Surveillance System (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 conduct seasonal migrations. 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 location of breeding grounds is unknown.

Cherry Point OPAREA Fin Whale Occurrence - Fin whales are more commonly encountered north of Cape Hatteras (CETAP, 1982; Hain *et al*., 1992; Waring *et al.*, 2008). Fin whales are the most commonly sighted large whale during the winter in the U.S. Atlantic continental shelf waters. As much as a quarter of the spring/summer peak population stay in continental shelf waters year-round (CETAP, 1982). During the spring, summer, and fall, fin whales occur along the Atlantic coasts of the U.S. and Canada, with smaller numbers of animals remaining through the winter. Sightings are almost exclusively limited to continental shelf waters inshore of the 1829-m (6000-ft) isbath, from the Gulf of Maine south to Cape Hatteras (CETAP, 1982; Agler *et al.*, 1993). The greatest abundance and widest occupation of fin whales in the northeast U.S. has been shown to occur in the spring (Hain *et al*., 1985).

Cherry Point OPAREA Fin Whale Density - The density estimates for training areas where explosions and/or ordnance use may occur in the Cherry Point OPAREA are provided in Table 3.7-1. Methods and results are detailed in NODE Report (DoN, 2007). The Navy does not consider estimates of zero density to mean that this species does not occur in the area only that they generally occur in low numbers or infrequently based on the best available data. It may be reasonable to assume that a number of the sightings recorded as unidentified rorquals might be of fin whales.

Humpback Whale

Adult humpback whales are 11 to 16 m in length. 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*., 1993; Clapham and Mead, 1999). Humpback whales feed on a wide variety of invertebrates and small schooling fishes including euphausiids (krill), herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham and Mead, 1999).

Status and Management - An estimated 11,570 humpback whales occur in the entire North Atlantic (Stevick *et al.*, 2003). Humpback whales in the western North Atlantic are thought to belong to five different stocks based on feeding locations (Katona and Beard, 1990; Waring *et al*., 2008): 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 (Waring *et al*., 2008) based on a 2006 aerial survey. The humpback whale is listed as endangered under the ESA and management of the species is

under the jurisdiction of the 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.*, 1990a; Hamazaki, 2002). The habitat requirements of wintering humpbacks appear to be determined by the conditions necessary for calving. Optimal calving conditions are warm water (24° to 28° C) and relatively shallow, low-relief ocean bottom in protected areas (*i.e.*, 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, most 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.*, 2003).

There has been an increasing occurrence of humpbacks, which appear to be primarily juveniles, during the winter along the U.S. Atlantic coast from Florida north to Virginia (Clapham *et al*., 1993; Swingle *et al.*, 1993; Wiley *et al.*, 1995; Laerm *et al*., 1997). It was recently proposed that the mid-Atlantic region primarily represents a supplemental winter feeding ground, which is also an area of mixing of humpback whales from different feeding stocks (Barco *et al*., 2002).

Cherry Point OPAREA Humpback Whale Occurrence - Humpback whales may occur on the continental shelf and in deep waters of the Cherry Point OPAREA in fall, winter, and spring during migrations between calving grounds in the Caribbean and feeding grounds off the northeastern U.S. The greater number of humpback whales observed in this region in the winter may represent whales that have chosen to stay in higher latitudes rather than migrating south to the breeding grounds (Barco *et al.*, 2002). The concentration of whales here also supports the notion of the mid-Atlantic region as a supplemental winter feeding ground for humpbacks (Barco *et al.*, 2002). During the summer, humpback whales are generally found farther north at the feeding grounds.

Cherry Point OPAREA Humpback Whale Density - The density estimates for training areas where explosions and/or ordnance use may occur in the Cherry Point OPAREA are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007). Density estimates for the OPAREA reflect the migration patterns of the humpback whale with higher density predicted during spring and fall

migration, lower densities during the winter when animals should be largely in calving grounds farther south, and zero density during the summer season when humpbacks should be on feeding grounds to the north.

North Atlantic Right Whale

Adults are robust and may reach 18 m in length (Jefferson *et al.*, 1993). North Atlantic right whales feed on zooplankton, particularly large calanoid copepods such as *Calanus* (Kenney *et al.*, 1985; Beardsley *et al.*, 1996; Baumgartner *et al.*, 2007).

Status and Management - The North Atlantic right whale is one of the world's most endangered large whale species (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 SAR states that in a review of the photo-id recapture database for June 2006, 313 individually recognized whales were known to be alive during 2001 (Waring *et al*., 2008). This is considered the minimum population size. The North Atlantic right whale is under the jurisdiction of the NMFS. The recovery plan for the North Atlantic right whale was published in 2005 (NMFS, 2005b).

This species showed a decline in survival during the 1990's (Best *et al.*, 2001; Waring *et al*., 2008). In recent years, there has been in increase in the number of catalogued individuals (Waring *et al*., 2008); however, Kraus *et al.* (2005) noted that the recent increases in birth rate were insufficient to counter the observed spike in human-caused mortality that has recently occurred.

One calving and two feeding areas in U.S. waters are designated as critical habitat for the North Atlantic right whale (NMFS, 1994; NMFS, 2005b).

In an effort to reduce ship collisions with critically endangered North Atlantic right whales, the Early Warning System (EWS) was started 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 to the feeding areas off New England (NMFS-NEFSC, 2008).

In 1999, a Mandatory Ship Reporting System was implemented by the U.S. Coast Guard (USCG) (USCG, 1999; USCG, 2001). This reporting system requires vessels larger than 300 gross registered tons (Navy ships are exempt) to report their location when entering 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 in order 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 geographical boundaries include the waters of Cape Cod Bay, Massachusetts Bay, and the Great South Channel east and southeast of Massachusetts.

In October 2008, NMFS published the final rule to implement speed restrictions to reduce the threat of ship collisions with NARW. The final rule includes a speed restriction of 10 knots or less during certain times of the year along the U.S. east coast and modification of key shipping routes into Boston. These restrictions only apply to vessels greater than 20 m in length and are not mandatory for any Federal agency (NOAA, 2008). However, the Navy is consulting with NMFS regarding potential impacts from vessel collisions.

Habitat - North Atlantic right whales on the winter calving grounds are most often found in very shallow, nearshore waters in cooler sea surface temperatures 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 sea surface temperature distribution (Garrison *et al.*, 2005; Glass *et al.*, 2005). Warm Gulf Stream waters appear to represent a thermal limit (both southward and eastward) for right whales (Keller *et al.*, 2006).

The 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).

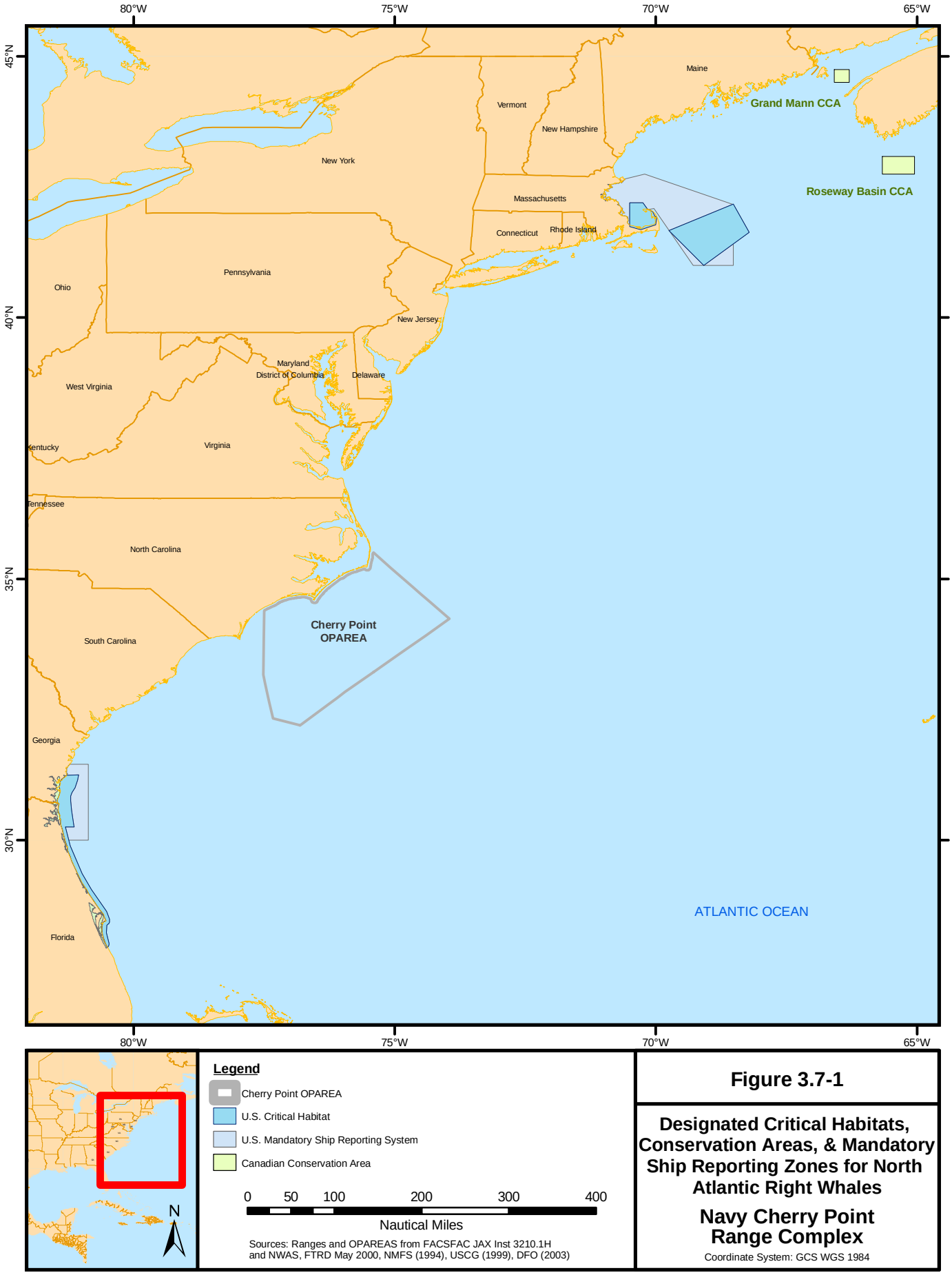
Acoustics and Hearing - Most of the sounds produced by right whales range in frequency from 0.02 to 15 kHz (dominant frequency range from 0.02 to less than 2 kHz; durations typically range from 0.01 to multiple seconds) with some sounds having multiple harmonics (Parks and Tyack, 2005). Recent morphometric analyses of northern right whale inner ears estimates 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°N to 20°N, prior to serious declines in abundance due to intensive whaling (NMFS, 2006b; Reeves *et al.*, 2007). North Atlantic right whales are found primarily in continental shelf waters between Florida and Nova Scotia. 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; NMFS, 2005b). 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, 2005b; Figure 3.7-1). 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), although, according to NMFS, some calving also takes place off southern North Carolina. The feeding grounds of Cape Cod Bay, which have individuals in February through April (Winn *et al.*, 1986; Hamilton and Mayo, 1990), and the Great South Channel east of Cape Cod, with 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 (Figure 3.7-1).

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 (there may be a regular offshore component).

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).

Cherry Point OPAREA North Atlantic Right Whale Occurrence - North Atlantic right whales may occur inshore of the shelf break throughout this area. As noted by Gaskin (1982), North Atlantic right whales might be seen anywhere off the Atlantic U.S. throughout the year. The coastal waters of the Carolinas are part of a migratory corridor for the right whale (Winn *et al.*, 1986; Knowlton *et al*., 2002). North Atlantic right whale sightings in very deep offshore waters of the western North Atlantic are infrequent (Knowlton *et al*., 2002). However, there is limited evidence suggesting that a regular offshore



Sources: Ranges and OPAREAS from FACSFAC JAX Inst 3210.1H and NWAS, FTRD May 2000, NMFS (1994), USCG (1999), DFO (2003)

Figure 3.7-1

Designated Critical Habitats, Conservation Areas, & Mandatory Ship Reporting Zones for North Atlantic Right Whales

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

component exists to their distributional and migratory cycle. This evidence includes a rare occurrence at Bermuda; off-shelf excursions by satellite-tracked individuals (Mate *et al*., 1997); disappearance of right whales from most coastal habitats in winter; genetic and sighting data, indicating there are additional summer grounds; and right whale individuals sighted past the continental shelf break off Florida. There have also been opportunistic sightings of North Atlantic right whales in deep waters of the Cherry Point OPAREA (DoN, 2007). 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). Sightings observed during spring and fall months are likely of right whales transiting the area on their migrations to and from breeding grounds farther south or feeding grounds farther north. North Atlantic right whales should occur farther north on their feeding grounds during summer and are not likely to occur in the Cherry Point OPAREA. ***Cherry Point OPAREA North Atlantic Right Whale Density*** **-** The density estimates for training areas where explosions and/or ordnance use may occur in the Cherry Point OPAREA are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007). The low density estimates, which likely reflect the low number of animals, do not signify there will be no animals in those areas. Although rare, North Atlantic right whales may occur in any warning area at any given time. Similarly, the summer estimates reflect right whale migration patterns since animals are likely to be on northern feeding grounds in this season; however, North Atlantic right whales may occur any where in the U.S. Atlantic throughout the year (Gaskin, 1982).

Sei Whale

Adult sei whales are up to 18 m in length and are mostly dark gray in color with lighter bellies, often with mottling on the back (Jefferson *et al.*, 1993). In the North Atlantic Ocean, the major prey species are copepods and krill (Kenney *et al*., 1985).

Status and Management - 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 Nova Scotia Stock occurs in U.S. Atlantic waters (Waring *et al*., 2008). The best abundance estimate for sei whales in the western North Atlantic is 207; however this is considered conservative due to uncertainties in population movements and structure (Waring *et al.*, 2008). The sei whale is under the jurisdiction of the 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; however, the species is listed as endangered under the ESA.

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 deep water, 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. 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).

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, sei whales occur primarily from Georges Bank north to Davis Strait (northeast Canada, between Greenland and Baffin Island) (Perry *et al.*, 1999). Sei whales are not known to be common in most 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). The distribution of the Nova Scotia stock might extend along the U.S. coast at least to North Carolina (NMFS, 1998a). 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).

Cherry Point OPAREA Sei Whale Occurrence - Winter range of most rorquals (blue, fin, sei, and minke whales) is hypothesized to be in offshore waters (Kellogg, 1928; Gaskin, 1982). Acoustic data support the hypothesis of an offshore wintering habitat (Clark, 1995). Based on their preference for deep, oceanic waters, rare occurrences of the sei whale may occur in deep waters of the Cherry Point OPAREA during fall, winter, and spring. Sei whale occurrence is probably the same during these seasons due to individual whales migrating earlier or later in the year (and appearing in a different season). Sei whales are not likely to occur in the Cherry Point OPAREA during summer, since they should be on feeding grounds around the eastern Scotian Shelf or Grand Banks.

Cherry Point OPAREA Sei Whale Density - There was not sufficient data available to estimate a density for the Study Area, nor was there an abundance estimate in the NOAA stock assessment report at the time density calculations were completed (DoN, 2007). Lack of sighting data for density estimates is not indicative of the absence of sei whales as they are difficult to distinguish from other rorquals at sea.

Sperm Whale

Sperm whales are the largest of the toothed whale species. Adult females can reach 12 m in length, while adult males measure as much as 18 m in length (Jefferson *et al.*, 1993). Sperm whales prey on large mesopelagic squids and other cephalopods, as well as demersal fishes and benthic invertebrates (Fiscus and Rice, 1974; Rice, 1989; Clarke, 1996).

Status and Management - Sperm whales are classified as endangered under the ESA (NMFS 2006c), although they are globally not in any immediate danger of extinction. The current combined best estimate of sperm whale abundance from Florida to the Bay of Fundy in the western North Atlantic Ocean is 4,804 individuals (Waring *et al*., 2008). Stock structure for sperm whales in the North Atlantic is unknown (Dufault *et al.*, 1999). The sperm whale is under the jurisdiction of the NMFS. The draft recovery plan for the sperm whale was released in June 2006 for public comment (NMFS, 2006c). In January 2007, NMFS initiated a 5-yr review for the sperm whale under the ESA (NMFS, 2007a).

Habitat - Sperm whale distribution can be variable but is generally associated with waters over the continental shelf edge, continental slope, and offshore waters (CETAP, 1982; Hain *et al*., 1985; Smith *et al.*, 1996; Waring *et al*., 2001; Davis *et al.*, 2002). Rice (1989) noted a strong offshore preference by sperm whales.

In some areas, sperm whale densities have been correlated with high secondary productivity and steep underwater topography (Jaquet and Whitehead, 1996). Data from the Gulf of Mexico suggest that sperm

whales adjust their movements to stay in or near cold-core rings (Davis *et al*., 2000b; Davis *et al.*, 2002), which demonstrate that sperm whales can shift their movements in response to prey density.

Off the eastern U.S., sperm whales are found in regions of pronounced horizontal temperature gradients, such as along the edges of the Gulf Stream and within warm-core rings (Waring *et al.*, 1993; Jaquet and Whitehead, 1996; Griffin, 1999). Fritts *et al.* (1983) reported sighting sperm whales associated with the Gulf Stream. Waring *et al.* (2003) conducted a deepwater survey south of Georges Bank in 2002 and examined fine-scale habitat use by sperm whales. Sperm whales were located in waters characterized by sea-surface temperatures of 23.2º to 24.9º C and bottom depths of 325 to 2,300 m (Waring *et al*., 2003).

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 70ºN and 70º S (Rice, 1998). Females are normally restricted to areas with SSTs greater than approximately 15°C, whereas males, and especially the largest males, can be found in waters as far poleward as the pack ice with temperatures close to 0° (Rice, 1989). The thermal limits on female distribution correspond approximately to the 40° parallels (50° in the North Pacific) (Whitehead, 2003).

Sperm whales are the most-frequently sighted whale seaward of the continental shelf off the eastern U.S. (CETAP, 1982; Kenney and Winn, 1987; Waring *et al.*, 1993). In Atlantic EEZ waters, sperm whales appear to have a distinctly seasonal distribution (CETAP, 1982; Scott and Sadove, 1997). Although concentrations shift depending on the season, sperm whales generally occur in Atlantic EEZ waters year-round.

Mating may occur December through August, with the peak breeding season falling in the spring (NMFS, 2006c); however location of specific breeding grounds is unknown.

Cherry Point OPAREA Sperm Whale Occurrence - Worldwide, sperm whales exhibit a strong affinity for deep waters beyond the continental shelf break (Rice, 1989). Sighting data from the Navy Cherry Point Study Area and vicinity are consistent with this known habitat preference (DoN, 2008). Few sightings occur south of Cape Hatteras, but this is likely a result of a lower amount of survey effort. Strandings are scattered from North Carolina to Florida (Leatherwood *et al.*, 1976; Schmidly, 1981). Sperm whales probably occur seaward of the shelf break throughout the Cherry Point OPAREA in all seasons.

Cherry Point OPAREA Sperm Whale Density - The density estimates for training areas where explosions and/or ordnance use may occur in the Cherry Point OPAREA are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007). Density is not expected to be uniform across the warning area. Sperm whales will likely be concentrated in waters near and seaward of the shelf break based on habitat preferences. The higher density estimated for summer likely reflects greater survey effort in offshore areas during the summer as compared to other seasons. Occurrence is anticipated to be the same across all seasons.

West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is a rotund, slow-moving animal, which reaches a maximum length of 3.9 m (Jefferson *et al*., 1993). They have unusually low metabolic rates and high thermal conductance that lead to energetic stress in winter (Bossart *et al.*, 2002). Manatees are herbivores that feed 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 - Manatees are classified as endangered under the ESA, and managed under the jurisdiction of USFWS. In the most recent revision of the manatee recovery plan, it was concluded that, based upon movement patterns, manatees around Florida should be divided into four relatively discrete management units (MUs) or subpopulations, each representing a significant portion of the species' range (USFWS, 2001). Manatees found along the Atlantic U.S. coast make up two subpopulations: the Atlantic Region and the Upper St. Johns River Region (USFWS, 2001). Manatees from the western coast of Florida make up the other two subpopulations: the Northwest Region and the Southwest Region (USFWS, 2001).

Manatee numbers are assessed by aerial surveys during the winter months when manatees are concentrated in warm-water refuges. Aerial surveys conducted in February 2007 produced a preliminary abundance estimate of 2,812 individuals (FMRI, 2007). Along Florida's Gulf Coast, observers counted 1,400 manatees, while observers on the Atlantic coast counted 1,412.

Habitat - Sightings of manatees are restricted to warm freshwater, estuarine, and extremely nearshore coastal waters. Manatees occur in very shallow waters of 2 to 4 m in depth (7 to 13 ft) generally close to shore (approximately less than 1 km) (Beck *et al.*, 2004). Shallow seagrass beds close to deep channels are preferred feeding areas in coastal and riverine habitats (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 with access to natural and artificial freshwater sources are typical West Indian manatee habitat (USFWS, 2001). 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). Effluents from sewage treatment plants are important sources of freshwater for West Indian manatees in the Caribbean Sea (Rathbun *et al*., 1985). Manatees are also observed drinking fresh water that flows out of the mouths of rivers (Lefebvre *et al*., 2001) and out of offered hoses at harbors (Fertl *et al.*, 2005).

Distribution - Manatees occur 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). Manatees occur along both the Atlantic and Gulf coasts of Florida. 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, 1951b, 1951a; Beck, 2006b). During winter months, the 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) as far north as the Florida/Georgia border along the U.S. east coast. As water temperatures rise in spring, West Indian manatees disperse from winter aggregation areas. Manatees are frequently reported in coastal rivers of Georgia and South Carolina during warmer months (Lefebvre *et al*., 2001).

Historically, manatees were likely restricted to southernmost Florida during winter and expanded their distribution northward during summer; however, industrial development has made warm-water refuges available (e.g., power plant effluent plumes), and the introduction of several exotic aquatic plant species

has expanded the available food supply. These factors have enabled an expansion of West Indian manatee winter range (USFWS, 2001; Laist and Reynolds, 2005).

Several patterns of seasonal movement are known along the Atlantic coast ranging from year-round residence to long-distance migration (Deutsch *et al*., 2003). Individuals may be highly consistent in seasonal movement patterns and show strong fidelity to warm and winter ranges, both within and across years (Deutsch *et al*., 2003).

Perhaps the most famous long distance movements of any West Indian manatee were exhibited by the animal known as "Chessie," who gained fame in the summer of 1995 by swimming to Rhode Island, returning to Florida for the winter, and traveling north again to Virginia where he was seen in 1996. In early September 2001, "Chessie" was once again sighted in Virginia. More recently, in August 2006, a West Indian manatee was sighted in waters off Rhode Island, Delaware, New Jersey, Massachusetts, and in the Hudson River (Anonymous, 2006; Beck, 2006a; Kenney, 2007).

Cherry Point OPAREA Manatee Occurrence - West Indian manatees have been sighted in estuarine and coastal waters of North Carolina during all seasons, with summer and fall having the most reports (Schwartz, 1995). It is possible that West Indian manatees may be expanding their range into North Carolina waters (Schwartz, 1995; Lefebvre *et al*., 2001; Deutsch *et al*., 2003). Based on their known habitat preferences, manatees may occur throughout the freshwater, estuarine, and nearshore coastal waters near the Cherry Point OPAREA year-round. Although manatees may occur close to shore along the North Carolina coast, they are rare in the offshore waters of the Cherry Point OPAREA.

Cherry Point OPAREA Manatee Density— Sufficient data do not exist to calculate density estimates.

3.7.2.3 Non-Endangered Species Act-Listed Marine Mammals

Twenty-seven non-threatened/non-endangered marine mammal species may be affected by the proposed activities in the Study Area. These include two baleen whale species, 24 toothed whale species, and one pinniped species.

Atlantic Spotted Dolphin

Atlantic spotted dolphin adults are up to 2.3 m long and can weigh as much as 143 kilograms (kg) (Jefferson *et al.*, 1993). Atlantic spotted dolphins are born spotless and develop spots as they age (Perrin *et al*., 1994c; Herzing, 1997). There is marked regional variation in adult body size (Perrin *et al.*, 1987). There are two forms: a robust, heavily spotted form that inhabits the continental shelf, usually found within 250 to 350 km of the coast and a smaller, less-spotted form that inhabits offshore waters (Perrin *et al.*, 1994c). Atlantic spotted dolphins feed on small cephalopods, fishes, and benthic invertebrates (Perrin *et al*., 1994c).

Status and Management— The best estimate of Atlantic spotted dolphin abundance in the U.S. Atlantic Exclusive Economic Zone (EEZ) is 50,978 individuals (Waring et al., 2008). Recent genetic evidence suggests that there are at least two populations in the western North Atlantic (Adams and Rosel, 2006), as well as possible continental shelf and offshore segregations. Atlantic populations are divided along a latitudinal boundary corresponding roughly to Cape Hatteras (Adams and Rosel, 2006). 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 typically occurs over the continental shelf inshore of or near the 185-m isobath, 8 to 20 km from shore (Perrin *et al.*, 1994c; Davis *et al*., 1998; Perrin, 2002b). There are also frequent sightings beyond the continental shelf break in the Caribbean Sea, Gulf of Mexico, and off the U.S. Atlantic Coast (Mills and Rademacher, 1996; Roden and Mullin, 2000; Fulling *et al*., 2003; Mullin

and Fulling, 2003; Mullin *et al*., 2004). Atlantic spotted dolphins are found commonly in inshore waters south of Chesapeake Bay as well as over continental shelf break and slope waters north of this region (Payne *et al.*, 1984; (Mullin and Fulling, 2003). Sightings have also been made along the northern wall of the Gulf Stream and its associated warm-core ring features (Waring *et al*., 1992).

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 warm-temperate and tropical Atlantic waters from approximately 45ºN to 35ºS; in the western North Atlantic, this translates to waters from New England to Venezuela, including the Gulf of Mexico and the Caribbean Sea (Perrin *et al*., 1987).

Peak calving periods in the Bahamas are early spring and late fall (Herzing, 1997); however in the western Atlantic breeding times and locations are largely unknown.

Cherry Point OPAREA Atlantic Spotted Dolphin Occurrence—Atlantic spotted dolphins may occur in both continental shelf and offshore waters of the OPAREA year-round. Sightings are scattered throughout the Navy Cherry Point OPAREA and range from shallow, coastal waters to deep waters over the abyssal plain (DoN, 2008). The Gulf Stream and its associated warm-core ring features likely influence occurrence of Atlantic spotted dolphins in this region.

Cherry Point study Area Atlantic Spotted Dolphin Density-Table 3.7-1 provides densities for the Atlantic spotted dolphin in the Navy Cherry Point OPAREA. Methods and results are detailed in the NODE Reports (DoN, 2007).

Beaked Whales

Based upon available data, the following five beaked whale species may be affected by the proposed activities in the Navy Cherry Point Study Area: Cuvier's beaked whales and four members of the genus *Mesoplodon* (True's, Gervais', Blainville's, and Sowerby's beaked whales). Northern bottlenose whales are extralimital to the Navy Cherry Point Study Area and are not likely to be affected by the proposed activities.

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* species have maximum reported adult lengths of 6.2 m (Mead, 1989). Stomach content analyses of captured and stranded individuals suggest beaked whales are deep divers that feed by suction on mesopelagic fishes, squids, 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 fishes, while stomach contents of *Mesoplodon* species frequently do (MacLeod *et al.*, 2003).

Status and Management— The best estimate of *Mesoplodon* spp. and Cuvier's beaked whale abundance combined in the western North Atlantic is 3,513 individuals (Waring *et al*., 2008). A recent study of global phylogeographic structure of Cuvier's beaked whales suggested that some regions show a high level of differentiation (Dalebout *et al.*, 2005); however, Dalebout *et al.*, (2005) could not discern finer-scale population differences within the North Atlantic. Beaked whales are under the jurisdiction of NMFS.

Habitat— World-wide, beaked whales normally inhabit continental slope and deep oceanic waters (>200 m) (Waring *et al*., 2001; Cañadas *et al*., 2002; Pitman, 2002; MacLeod *et al*., 2004; Ferguson *et al.*, 2006; MacLeod and Mitchell, 2006). Beaked whales are only occasionally reported in waters over the continental shelf (Pitman, 2002). Distribution of *Mesoplodon* spp. in the North Atlantic may relate to water temperature (MacLeod, 2000). The Blainville's and Gervais' beaked whales occur in warmer southern waters, in contrast to Sowerby's and True's beaked whales that are more northern (MacLeod, 2000). Beaked whale abundance off the eastern U.S. may be highest in association with the Gulf Stream and the warm-core rings it develops (Waring *et al*., 1992). In summer, the continental shelf break off the northeastern U.S. is primary habitat (Waring *et al.*, 2001).

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.*, 2005b; 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).

Northern bottlenose whale sounds recorded by Hooker and Whitehead (2002) were predominantly clicks, with two major types of click series. Loud clicks were produced by whales socializing at the surface and were rapid with short and variable interclick intervals. The frequency spectra was often multimodal, and peak frequencies ranged between 2 and 22 kHz (mean of 11 kHz). Clicks received at low amplitude (produced by distant whales, presumably foraging at depth) were generally a unimodal frequency spectra with a mean peak frequency of 24 kHz and a 3 dB bandwidth of 4 kHz. Winn *et al.* (1970) recorded sounds from northern bottlenose whales that were not only comprised of clicks but also whistles that they attributed to northern bottlenose whales. Hooker and Whitehead (2002) noted that it was more likely that long-finned pilot whales (*Globicephala melas*) had produced the whistles, although they also noted that more recordings from this species while no other animals are around are needed to confirm whether or not the species actually produces whistles or not.

Recent studies incorporating Digital Acoustic Recording tags (DTAGs- capable of recording audio, pitch, roll, heading, and depth) 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.*, 2005b; 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).

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 (Heyning, 1989; MacLeod *et al.*, 2006). This species occupies almost all temperate, subtropical, and tropical waters, as well as subpolar and even polar waters in some areas (MacLeod *et al*., 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). The Sowerby's beaked whale is endemic to the North Atlantic; this is considered to be more of a temperate species (MacLeod *et al*., 2006). In the western North Atlantic, confirmed strandings of True's beaked whales are recorded from Nova Scotia to Florida and also in Bermuda (MacLeod *et al*., 2006). There is also a sighting made southeast of Hatteras Inlet, North Carolina (Tove, 1995).

The continental shelf margins from Cape Hatteras to southern Nova Scotia were recently identified as known "key areas" for beaked whales in a global review by MacLeod and Mitchell (2006).

Beaked whale life histories are poorly known, reproductive biology is generally undescribed, and the locations of specific breeding grounds are unknown.

Cherry Point Study Area Beaked Whale Occurrence—Cuvier's, True's, Gervais', Sowerby's and Blainville's beaked whales may occur seaward of the continental shelf break throughout the Navy Cherry Point Study Area year-round. Beaked whale sightings in the western North Atlantic Ocean appear to be concentrated in waters between the 200 m isobath and those just beyond the 2,000 m isobath (DoN, 2008; DoN, 2007). In the Study Area, beaked whales are likely to occur mostly in slope and deeper waters with predicted occurrence concentrated in the southeastern corner of the OPAREA in winter, south of Cape Lookout in spring, and south of Cape Hatteras in summer (DoN 2008).

Cherry Point Study Area Beaked Whale Density-Table 3.7-1 displays the densities for beaked whales in the Navy Cherry Point OPAREA. Occurrence of beaked whales is anticipated to be the same throughout all seasons. The increased density estimate for summer may reflect the higher survey effort during that season. Methods and results are detailed in the NODE Reports (DoN, 2007).

Bottlenose Dolphin

Bottlenose dolphins are large and robust with striking regional variations in body size; adult body lengths range from 1.9 to 3.8 m (Jefferson *et al*., 1993). Bottlenose dolphins are opportunistic feeders that utilize

numerous feeding strategies to prey upon a variety of fish, cephalopod, and shrimp (Shane, 1990; Wells and Scott, 1999).

Status and Management— Two forms of bottlenose dolphins are recognized in the western North Atlantic Ocean: nearshore (coastal) and offshore (Waring *et al*., 2008). The best estimate for the western North Atlantic coastal stock of bottlenose dolphins in summer (May through October) is 28,331 and 32,533 in winter (Waring *et al.*, 2008). Currently, a single western North Atlantic offshore stock is recognized seaward of 34 km from the U.S. coastline (Waring *et al*., 2008). The best population estimate for this stock is 81,588 individuals (Waring *et al*., 2008).

Habitat— Bottlenose dolphins live in coastal areas of all continents, around many oceanic islands and atolls, and over shallow offshore banks and shoals. Read *et al.* (2003) found the dolphins occurring in North Carolina bays, sounds, and estuaries to contribute substantially to the coastal bottlenose dolphin population in the area. Bays, sounds, and estuaries are high-use habitats for bottlenose dolphins due to their importance as nursery and feeding areas (Read *et al*., 2003).

Coastal bottlenose dolphins show a temperature-limited distribution, occurring in significantly warmer waters than the offshore stock, and having a distinct northern boundary (Kenney, 1990). A study of the Chesapeake Bay/Virginia coast area showed a much greater probability of sightings with SSTs of 16° to 28°C (Armstrong *et al*., 2005). SST may significantly influence seasonal movements of migrating coastal dolphins along the western Atlantic coast (Barco *et al.*, 1999); these seasonal movements are likely also influenced by movements of prey resources.

The nearshore waters of the Outer Banks serve as winter habitat for coastal bottlenose dolphins (Read *et al.*, 2003). Cape Hatteras represents important habitat for bottlenose dolphins, particularly in winter, as evidenced from concentrations of bottlenose dolphins during recent aerial surveys (Torres *et al*., 2005).

In the western North Atlantic, the greatest concentrations of the offshore stock are along the continental shelf break (Kenney, 1990). Evidence suggests that there is a distinct spatial separation of the coastal and offshore stocks during the summer; however the morphotypes overlap in the winter (Garrison *et al*., 2003a; Torres *et al*., 2003). During CETAP surveys, offshore bottlenose dolphins generally were distributed between the 200- and 2,000-m isobaths in waters with a mean bottom depth of 846 m from Cape Hatteras to the eastern end of Georges Bank. Geography and temperature also influence the distribution of offshore bottlenose dolphins (Kenney, 1990).

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 μPa2 s is a reasonable threshold for the onset of TTS in bottlenose dolphins exposed to mid-frequency tones.

Distribution— In the western North Atlantic, 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). Bottlenose dolphins occur seasonally in waters over the outer continental shelf and inner slope, as far north as Georges Bank (CETAP, 1982; Kenney, 1990).

In North Carolina, there is significant overlap between distributions of coastal and offshore dolphins during the summer. North of Cape Lookout, there is a separation of the two stocks by bottom depth; the coastal form occurs in nearshore waters (<20 m deep) while the offshore form is in deeper waters (>40 m deep) (Garrison and Hoggard, 2003); however, south of Cape Lookout to northern Florida, there is significant spatial overlap between the two stocks. In this region, coastal dolphins may be found in waters as deep as 31 m and 75 km from shore while offshore dolphins may occur in waters as shallow as 13 m (Garrison *et al*., 2003a). Additional aerial surveys and genetic sampling are required to better understand the distribution of the stocks throughout the year.

Populations exhibit seasonal migrations regulated by temperature and prey availability (Torres *et al*., 2005), traveling as far north as New Jersey in summer and as far south as central Florida in winter (Urian *et al*., 1999).

Coastal bottlenose dolphins along the western Atlantic coast may exhibit either resident or migratory patterns (Waring *et al*., 2008). Photo-identification studies support evidence of year-round resident bottlenose dolphin populations in Beaufort and Wilmington, North Carolina (Koster *et al.*, 2000; Waring *et al*., 2008); these are the northernmost documented sites of year-round residency for bottlenose dolphins in the western North Atlantic (Koster *et al*., 2000). Migratory dolphins may enter these areas seasonally as well, as evidenced by a bottlenose dolphin tagged in 2001 in Virginia Beach who overwintered in waters between Cape Hatteras and Cape Lookout (NMFS-SEFSC, 2001).

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.

Cherry Point Study Area Bottlenose Dolphin Occurrence—Bottlenose dolphins are abundant in continental shelf and inner slope waters throughout the western North Atlantic (CETAP 1982; Kenney, 1990; Waring *et al.*, 2008). The greatest concentrations of offshore animals are along the continental shelf break and between the 200 and 2,000 m isobaths (Kenney, 1990; Waring *et al.*, 2008). However, tagging data suggest that the range of offshore bottlenose dolphins may actually extend into deeper waters (Wells *et al.*, 1999), possibly even over the Hatteras Abyssal Plain just southeast of the Navy Cherry Point OPAREA. Bottlenose dolphins also occur in nearshore waters of North Carolina year-round and in Virginia waters seasonally from late April to November (Blaylock, 1988; Barco *et al*., 1999; NMFS-SEFSC, 2001). The OPAREA waters around Cape Hatteras and the Outer Banks have higher predicted concentrations of bottlenose dolphins, particularly in the winter and summer; however occurrence is also predicted throughout shelf and slope waters (DoN, 2008). Therefore, bottlenose dolphins may occur throughout the Navy Cherry Point Study Area year-round.

Cherry Point study Area Bottlenose Dolphin Density-Table 3.7-1 provides the density estimates for bottlenose dolphins in the Navy Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Lower density estimates offshore are not necessarily indicative of fewer animals, but may reflect lower survey efforts in deep water areas.

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 can be easily 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— No abundance information is currently available for Bryde's whales in the western North Atlantic, as defined by NMFS (Waring *et al*., 2008). Bryde's whales are under the jurisdiction of NMFS.

Habitat— Bryde's whales are found both offshore and near the coasts in many regions. The Bryde's whale appears 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 subtropical and tropical waters and generally do not range north of 40° in the northern hemisphere or south of 40° in the southern hemisphere (Jefferson *et al*., 1993).

The Bryde's whale does not have a well-defined breeding season in most areas and locations of specific breeding areas are unknown.

Cherry Point Study Area Bryde's Whale Occurrence—There is a general lack of knowledge of this species, particularly in the North Atlantic, although records support a tropical occurrence for the species here (Mead, 1977). One Bryde's whale stranding is recorded from the winter of 1927 well within Chesapeake Bay (Mead, 1977). A few unidentified Bryde's/sei whale records are also documented near the shelf break off the coast of Virginia (DoN, 1995). This species has been known to strand further south on the coasts of Georgia and eastern Florida (Schmidly, 1981). Bryde's whales may occur throughout the Study Area year-round based on occurrences both in coastal and offshore waters in other locales.

Cherry Point Study Area Bryde's Whale Density- There were not sufficient data available to estimate a density for the Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007). Lack of sighting data for density estimates is not indicative of the absence of Bryde's whales as they are difficult to distinguish from other rorquals at sea.

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 can reach at least 2 m in length and weights of at least 85 kg (Jefferson *et al*., 1993). 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 population in the western North Atlantic is currently considered a separate stock for management purposes although there is not enough information to distinguish this stock from the Gulf of Mexico stock(s) (Waring *et al*., 2008). The best estimate of abundance for the western North Atlantic stock of Clymene dolphins is 6,086 individuals (Waring *et al.*, 2008). The Clymene dolphin is under NMFS jurisdiction.

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). Biogeographically, 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 were identified primarily in offshore waters east of Cape Hatteras over the continental slope and are likely to be strongly influenced by oceanographic features of the Gulf Stream (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.*, 1994a). 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— 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 is unknown.

Cherry Point Study Area Clymene Dolphin Occurrence—Sightings are recorded in offshore waters in or near the Navy Cherry Point OPAREA (DoN, 2008). The oceanographic features of the Gulf Stream likely influence the distribution of Clymene dolphins in this area. Based on confirmed sightings and the

preference of this species for deep waters, Clymene dolphins may occur in waters seaward of the shelf break throughout the Navy Cherry Point Study Area.

Cherry Point Study Area Clymene Dolphin Density-Table 3.7-1 provides density estimates for Clymene dolphins in the Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Density is not expected to be uniform across the warning areas. Clymene dolphins will likely be concentrated in deeper waters seaward of the shelf break and/or near the Gulf Stream based on habitat preferences.

Common Dolphin

Only the short-beaked common dolphin is expected to occur in the Navy Cherry Point Study Area. The short-beaked common dolphin is a moderately-robust dolphin, with a moderate-length beak, and a tall, slightly falcate dorsal fin. Length ranges up to about 2.3 m (females) and 2.6 m (males); however, there is substantial geographic variation (Jefferson *et al.*, 1993). Common dolphins feed on a wide variety of epipelagic and mesopelagic schooling fishes and squids, such as the long-finned squid, Atlantic mackerel, herring, whiting, pilchard, and anchovy (Waring *et al.*, 1990; Overholtz and Waring, 1991).

Status and Management— The best estimate of abundance for the western North Atlantic *Delphinus* spp. stock is 120,743 individuals (Waring *et al.*, 2008). There is no information available for western North Atlantic common dolphin stock structure (Waring *et al*., 2008). The common dolphin is under the jurisdiction of NMFS.

Habitat— Common dolphins occupy a variety of habitats, including shallow continental shelf waters, waters along the continental shelf break, and continental slope and oceanic areas. Along the U.S. Atlantic coast, common dolphins typically occur in temperate waters on the continental shelf between the 100 and 200-m isobaths, in association with the Gulf Stream, along the edge of the continental shelf (CETAP, 1982; Selzer and Payne, 1988; Waring and Palka, 2002).

Acoustics and Hearing— Recorded *Delphinus* spp. vocalizations include whistles, chirps, barks, and clicks (Ketten, 1998). Clicks range from 0.2 to 150 kHz with dominant frequencies between 23 and 67 kHz and estimated source levels of 170 dB re 1 μPa. Chirps and barks typically have a frequency range from less than 0.5 to 14 kHz, and whistles range in frequency from 2 to 18 kHz (Fish and Turl, 1976; Thomson and Richardson, 1995; Ketten, 1998; Oswald *et al.*, 2003). Maximum source levels are approximately 180 dB 1 μPa-m (Fish and Turl, 1976). This species' hearing range extends from 10 to 150 kHz; sensitivity is greatest from 60 to 70 kHz (Popov and Klishin, 1998).

Distribution— Common dolphins occur from southern Norway to West Africa in the eastern Atlantic and from Newfoundland to Florida in the western Atlantic (Perrin, 2002a), although this species more commonly occurs in temperate, cooler waters in the northwestern Atlantic (Waring and Palka, 2002). This species is abundant within a broad band paralleling the continental slope from 35ºN to the northeast peak of Georges Bank (Selzer and Payne, 1988). Short-beaked common dolphin sightings are known to occur primarily along the continental shelf break south of 40ºN in spring and north of this latitude in fall. During fall, this species shifts with a higher abundance over the southern portion of George's Bank and the shelf north of Block canyon (CETAP, 1982) but less common south of Cape Hatteras (Waring *et al.*, 2008).

Calving peaks differ between stocks, and have been reported in spring and autumn as well as in spring and summer (Jefferson *et al.*, 1993); however locations of breeding areas are unknown.

Cherry Point Study Area Common Dolphin Occurrence—Common dolphins primarily occur in a broad band along the shelf break from Cape Hatteras to Nova Scotia year-round (CETAP, 1982). This species is

less common south of Cape Hatteras (Waring *et al*., 2008). Common dolphins are only expected to occur in the extreme northern portion of the Navy Cherry Point Study Area to just south of Cape Hatteras and bounded to the east by the warmer waters of the Gulf Stream.

Cherry Point Study Area Common Dolphin Density-Table 3.7-1 provides the density estimates for common dolphins in the Cherry Point Study Area. Density is not anticipated to be uniform across the areas. Methods and results are detailed in the NODE Reports (DoN, 2007). This species is likely to be concentrated in the northern portion of the Study Area based on knowledge of occurrence patterns (DoN, 2008; Waring *et al*., 2008).

False Killer Whale

The false killer whale has a long slender body, a rounded overhanging forehead, and little or no beak (Jefferson *et al*., 1993). Individuals reach maximum lengths of 6.1 m (Jefferson *et al*., 1993). The flippers have a characteristic hump on the S-shaped leading edge—this is perhaps the best characteristic for distinguishing this species from the other "blackfish" (an informal grouping that is often taken to include pygmy killer, melon-headed, and pilot whales; (Jefferson *et al*., 1993). Deepwater cephalopods and fishes are their primary prey (Odell and McClune, 1999), but large pelagic species, such as dorado, have been taken. False killer whales are known to attack marine mammals such as other delphinids, (Perryman and Foster, 1980; Stacey and Baird, 1991), sperm whales (Palacios and Mate, 1996), and baleen whales (Hoyt, 1983).

Status and Management— There are no abundance estimates available for this species in the western North Atlantic (Waring *et al*., 2008). The false killer whale 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 peak-to-peak (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.*, 2004b). 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°S and 50°N 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.

Cherry Point Study Area False Killer Whale Occurrence—False killer whales occur in offshore, warm waters worldwide (Baird, 2002). The warm waters of the Gulf Stream likely influence occurrence in the Navy Cherry Point Study Area. A small number of sightings and strandings are recorded near the Study

Area; the sightings reflect the preference of this species for offshore waters (DoN, 2008). False killer whales may occur seaward of the shelf break throughout the Study Area year-round.

Cherry Point Study Area False Killer Whale Density- There was not sufficient data available to estimate a density for the Study Area. Nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007).

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.*, 1993). They feed on mesopelagic fish, squid, and shrimp (Jefferson and Leatherwood, 1994; Perrin *et al.*, 1994a).

Status and Management— No abundance estimate of Fraser's dolphins in the western North Atlantic is available (Waring *et al*., 2008). Fraser's dolphins are under the jurisdiction of NMFS.

Habitat— The Fraser's dolphin is an oceanic species, except in places where deepwater approaches a coastline (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 hearing data available for this species.

Distribution— Fraser's dolphins are found in subtropical and tropical waters around the world, typically between 30ºN and 30ºS (Jefferson *et al*., 1993). 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.

Cherry Point Study Area Fraser's Dolphin Occurrence—One confirmed sighting was recorded in deep waters (>3,000 m in depth) offshore of Cape Hatteras (NMFS-SEFSC, 1999). Fraser's dolphins may occur seaward of the shelf break throughout the OPAREA year-round. The most likely area of occurrence in the Study Area is in waters seaward of the continental shelf, and distribution is assumed to be similar year-round.

Cherry Point Study Area Fraser's Dolphin Density- There was not sufficient data available to estimate a density for the Study Area. Nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007).

Harbor Porpoise

Harbor porpoises are the smallest cetaceans in the North Atlantic with a maximum length of 2.0 m (Jefferson *et al*., 1993). They feed on a variety of small, schooling clupeoid (herring-like) and gadid (cod-like) fishes usually less than 30 cm in length (Read, 1999).

Status and Management— There are four proposed harbor porpoise populations in the western North Atlantic: Gulf of Maine and Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland stocks (Gaskin, 1982) with additional studies supporting this hypothesis (Wang *et al*., 1996; Rosel *et al.*, 1999). Abundance estimates given in the SAR are based on the four population structure. The best estimate of abundance for the Gulf of Maine and Bay of Fundy stock is 89,054 individuals (Waring *et al*., 2008). The harbor porpoise is under the jurisdiction of NMFS.

Habitat— Harbor porpoises appear restricted to relatively cool waters where prey aggregations are concentrated (Watts and Gaskin,1985). Harbor porpoises are seldom found in waters warmer than 17ºC (Read, 1999) and closely mirror the movements of their primary prey, Atlantic herring (Gaskin, 1992).

Harbor porpoises are generally scarce in areas without significant coastal fronts or topographically-generated upwellings (Gaskin, 1992; Skov *et al*., 2003). Harbor porpoises occur most frequently in shallow and shelf waters (Read, 1999; Jefferson *et al*., 2008); however, pelagic drift net bycatches and movements of a satellite-tracked individual, which swam offshore into water over 1,800 m deep, indicate a potential offshore distribution (Read *et al*., 1996; Westgate *et al*., 1998).

Acoustics and Hearing - Harbor porpoise vocalizations include clicks and pulses (Ketten, 1998), as well as whistle-like signals (Verboom and Kastelein, 1995). The dominant frequency range is 110 to 150 kHz, with source levels between 135 and 205 dB re 1 µPa-m (Ketten, 1998) (Villadsgaard, 2007). Echolocation signals include one or two low-frequency components in the 1.4 to 2.5 kHz range (Verboom and Kastelein, 1995).

A behavioral audiogram of a harbor porpoise indicated the range of best sensitivity is 8 to 32 kHz at levels between 45 and 50 dB re 1 µPa-m (Andersen, 1970); however, auditory-evoked potential studies showed a much higher frequency of approximately 125 to 130 kHz (Bibikov, 1992). The auditory-evoked potential method suggests that the harbor porpoise actually has two frequency ranges of best sensitivity. More recent psycho-acoustic studies found the range of best hearing to be 16 to 140 kHz, with a reduced sensitivity around 64 kHz (Kastelein *et al.*, 2002a). Maximum sensitivity occurs between 100 and 140 kHz (Kastelein *et al.*, 2002a).

Distribution— Harbor porpoises occur in subpolar to cool-temperate waters in the North Atlantic and Pacific (Read, 1999). Off the northeastern U.S., harbor porpoise distribution is strongly concentrated in the Gulf of Maine/Georges Bank region, with more scattered occurrences to the mid-Atlantic (CETAP, 1982; Northridge, 1996). Stranding data indicate that the southern limit is northern Florida (Polacheck *et al*., 1995; Read, 1999).

From January through March, harbor porpoises can be found in moderate densities in waters off New Jersey to North Carolina (Waring *et al.*, 2008). Densities of this species are lower in waters off New York to New Brunswick, Canada during this same time (Waring *et al*., 2008). A satellite tagged harbor porpoise was rehabilitated and released off the coast of Maine and followed the continental slope south to near Cape Hatteras between January and March of 2004 (WhaleNet, 2004). During this time of year, significant numbers of porpoises occur along the mid-Atlantic shore from New Jersey to North Carolina, where they are subject to incidental mortality in a variety of coastal gillnet fisheries (Cox *et al.*, 1998; Waring *et al*., 2008). Harbor porpoises are not tied to shallow, nearshore waters during winter, as evidenced by a harbor porpoise caught in a pelagic drift net off North Carolina (Read *et al*., 1996).

In the Gulf of Maine, calves are born in late spring (Read, 1990; Read and Hohn, 1995). Generally, most calves are born April through August (Jefferson *et al*., 2008). The location of breeding areas is unknown.

Cherry Point Study Area Harbor Porpoise Occurrence—The harbor porpoise primarily occurs on the continental shelf in cool temperate to subpolar waters (Read, 1999) that are at higher latitudes than the Navy Cherry Point Study Area. Occurrences of harbor porpoises in the mid-Atlantic are scattered (CETAP, 1982; Northridge, 1996). Intermediate densities of harbor porpoises are found in waters off North Carolina during winter (January through March) (Waring *et al*., 2008). Based on distribution records and known habitat preferences, harbor porpoises are expected to occur throughout the Study Area during most of the year (DoN, 2008). During summer, harbor porpoises are concentrated in the northern Gulf of Maine and lower Bay of Fundy region and are not expected to occur as far south as the Study Area.

Cherry Point Study Area Harbor Porpoise Density- There was not sufficient data available to estimate a density for the Study Area. Nor is there an abundance estimate in the NOAA stock assessment report used to estimate density in the NODE report (DoN, 2007).

Killer Whale

Killer whales are probably the most instantly recognizable of all the 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). This is the largest member of the dolphin family. Females may reach 7.7 m in length and males 9.0 m (Dahlheim and Heyning, 1999). Killer whales feed on fish, cephalopods, seabirds, sea turtles, and other marine mammals (Katona *et al*., 1988; Jefferson *et al*., 1991; Jefferson *et al*., 2008).

Status and Management— There are no estimates of abundance for killer whales in the western North Atlantic (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); however, at this time, further information is not available, particularly for the western North Atlantic. The killer whale is under the jurisdiction of NMFS.

Habitat— Killer whales have the most ubiquitous distribution of any species of marine mammal, and 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 further offshore (Katona *et al*., 1988; Mitchell and Reeves, 1988). Killer whales in the Hatteras-Fundy region probably respond to the migration and seasonal distribution patterns of prey species, such as bluefin tuna, herring, and squids (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 whales populations (Yurk *et al.*, 2002) and are 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 polar pack ice zones of both hemispheres. In the western North Atlantic, killer whales are known from the polar pack ice, off of Baffin Island, and in Labrador Sound southward to Florida, the Bahamas, and the Gulf of Mexico (Dahlheim and Heyning, 1999), where they have been sighted year-round (Jefferson and Schiro, 1997; O'Sullivan and Mullin, 1997; Würsig *et al*., 2000). A year-round killer whale population in the western North Atlantic may exist south of around 35°N (Katona *et al.*, 1988).

In the Atlantic, calving takes place in late fall to mid-winter (Jefferson *et al*., 2008); however location of killer whale breeding in the North Atlantic is unknown.

Cherry Point Study Area Killer Whale Occurrence—Several killer whale sightings are recorded in both shallow and deep waters of the Study Area and vicinity (DoN, 2008). Strandings are also reported along the Outer Banks (DoN, 2008). There is photo-identification evidence that a small population moves through parts of the Hatteras-Fundy region on a seasonal basis (Katona *et al.*, 1988). Killer whales may occur seaward of the shoreline year-round based on sighting data and the diverse habitat preferences of this species.

Cherry Point Study Area Killer Whale Density- There was not sufficient data available to estimate a density for the Study Area. Nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007).

Melon-headed Whale

Melon-headed whales at sea closely resemble pygmy killer whales; both species have blunt heads with little or no beak. 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 reach a maximum length of 2.75 m (Jefferson *et al.*, 1993). Melon-headed whales prey on squids, pelagic fishes, 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— There are no abundance estimates for melon-headed whales in the western North Atlantic (Waring *et al*., 2008). The melon-headed whale is under the jurisdiction of NMFS.

Habitat— Melon-headed whales are most often found in offshore waters. Sightings off Cape Hatteras, North Carolina are reported in waters greater than 2,500 m (NMFS-SEFSC 1999; 2002), and most in the Gulf of Mexico have been well beyond the edge of the continental shelf break (Mullin *et al*., 1994; Davis and Fargion, 1996b; Davis *et al*., 2000b) 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 subtropical and tropical waters. There are very few records for melon-headed whales in the North Atlantic (Jefferson and Barros, 1997). Maryland is

thought to represent the extreme of the northern distribution for this species in the northwest Atlantic (Perryman *et al*., 1994; Jefferson and Barros, 1997).

Seasonality and location of melon-headed whale breeding are unknown.

Cherry Point Study Area Melon-headed Whale Occurrence—The melon-headed whale is an oceanic species which may occur seaward of the shelf break year-round throughout the Study Area. One sighting of melon-headed whales is recorded in offshore waters north of the Navy Cherry Point OPAREA (DoN, 2008). Based on warm water preferences, melon-headed whale occurrence in the Study Area during winter is likely influenced by the Gulf Stream.

Cherry Point Study Area Melon-headed Whale Density- There was not sufficient data available to estimate a density for the Study Area. Nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007).

Minke Whale

Minke whales are small rorquals; adults reach 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 in the North Atlantic Ocean: Canadian East Coast, West Greenland, Central North Atlantic, and Northeastern North Atlantic (Donovan, 1991). Minke whales off the eastern U.S. are considered to be part of the Canadian East Coast stock which inhabits the area from the western half of the Davis Strait to 45º W and south to the Gulf of Mexico (Waring *et al*., 2008). The best estimate of abundance for the Canadian East Coast stock is 3,312 individuals (Waring *et al.*, 2008). The minke whale is under the jurisdiction of NMFS.

Habitat— Off eastern North America, minke whales generally remain in waters over the continental shelf, including inshore bays and estuaries (Mitchell and Kozicki, 1975; Mignucci-Giannoni, 1989; Murphy, 1995); however, based on whaling catches and global surveys, there is an offshore component to minke whale distribution (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); they are less common in the tropics than in cooler waters. This species is more abundant in New England waters than in the mid-Atlantic (Hamazaki, 2002; Waring *et al*., 2008). The southernmost sighting in recent NMFS shipboard surveys was of one individual offshore of the mouth of Chesapeake Bay, in waters with a bottom depth of 3,475 m (Mullin and Fulling, 2003). Minke whales off the U.S. Atlantic coast apparently migrate offshore and southward in winter (Mitchell, 1991). Minke whales are known to occur during the winter months (November through March) in the western North Atlantic from Bermuda to the West Indies (Winn and Perkins, 1976; Mitchell, 1991; Mellinger *et al*., 2000).

Mating is thought to occur in October to March but has never been observed (Stewart and Leatherwood, 1985); however location of specific breeding grounds is unknown though it is though to be in areas of low latitude (Jefferson *et al*., 2008).

Cherry Point Study Area Minke Whale Occurrence—There are no records of minke whales in the Navy Cherry Point Study Area; however, the presence of this species here is recognized based on sparse sighting and stranding records near the Navy Cherry Point Study Area (DoN, 2008). Minke whales may occur in shelf and deep waters north of Cape Hatteras during winter. South of Cape Hatteras, occurrence is expected just inshore of the shelf break and seaward of the shelf break in the Study Area. The change in occurrence patterns just south of Cape Hatteras takes into consideration the steep bathymetric gradient. Minke whales may occur in shelf and offshore waters of the Study Area during spring and fall. During summer, minke whales may occur in shelf and offshore waters of the Study Area but are more likely to occur at higher latitudes on their feeding grounds.

Cherry Point Study Area Minke Whale Density- Table 3.7-1 provides density estimates for minke whales in the Navy Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Density numbers are too low to indicate any seasonal differences in minke whale numbers; however it is assumed that, as with other rorquals, minke whales engage in seasonal migrations and actual occurrences would reflect this.

Pantropical Spotted Dolphin

The pantropical spotted dolphin is a rather slender dolphin. Adults may reach 2.6 m in length (Jefferson *et al*., 1993). Pantropical spotted dolphins are born spotless and develop spots as they age although the degree of spotting varies geographically (Perrin and Hohn, 1994). North and offshore of Cape Hatteras, adults may bear only a few small, dark, ventral spots whereas individuals over the continental shelf become so heavily spotted that they appear nearly white (Perrin and Hohn, 1994). Pantropical spotted dolphins prey on epipelagic fishes, squids, and crustaceans (Perrin and Hohn, 1994; Robertson and Chivers, 1997; Wang *et al.*, 2003).

Status and Management— The best estimate of abundance of the western North Atlantic stock of pantropical spotted dolphins is 4,439 individuals (Waring *et al*., 2008). There is no information on stock differentiation for pantropical spotted dolphins in the U.S. Atlantic (Waring *et al.*, 2008). The pantropical spotted dolphin is under the jurisdiction of NMFS.

Habitat— Pantropical spotted dolphins tend to associate with bathymetric relief and oceanographic interfaces. Pantropical spotted dolphins may rarely be sighted in shallower waters (e.g., Peddemors, 1999; Gannier, 2002; Mignucci-Giannoni *et al*., 2003; Waring *et al.,* 2008). Along the northeastern U.S., Waring*, et al.,* (1992) found that *Stenella* spp. were distributed along the Gulf Stream's northern wall. *Stenella* sightings also occurred within the Gulf Stream, which is consistent with the oceanic distribution of this genus and its preference for warm water (Waring *et al*., 1992; Mullin and Fulling, 2003).

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— Pantropical spotted dolphins occur in subtropical and tropical waters worldwide (Perrin and Hohn, 1994).

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.

Cherry Point Study Area Pantropical Spotted Dolphin Occurrence—Pantropical spotted dolphins have been sighted along the Florida shelf and slope waters and offshore in Gulf Stream waters southeast of Cape Hatteras (Waring *et al*., 2008). In the Atlantic, this species is considered broadly sympatric with Atlantic spotted dolphins (Perrin and Hohn, 1994). The offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea. Based on sighting data and known habitat preferences, pantropical spotted dolphins may occur seaward of the shelf break throughout the Study Area year-round.

Cherry Point Study Area Pantropical Spotted Dolphin Density-Table 3.7-1 provides density estimates for pantropical spotted dolphins in the Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Density will likely not be uniform across the Study Area. Based on habitat preferences, pantropical dolphins are anticipated to be found seaward of the shelf break. Given estimates may reflect lower survey efforts in offshore waters or the difficulty in distinguishing pantropical spotted dolphins from the offshore form of the Atlantic spotted dolphin.

Pilot Whales

Pilot whales are among the largest dolphins, with long-finned pilot whales potentially reaching 5.7 m (females) and 6.7 m (males) in length. Short-finned pilot whales may reach 5.5 m (females) and 6.1 m (males) in length (Jefferson *et al*., 1993). The flippers of long-finned pilot whales are extremely long, sickle shaped, and slender, with pointed tips, and an angled leading edge that forms an "elbow". Long-finned pilot whale flippers range from 18 to 27 % of length. Short-finned pilot whales have flippers that are somewhat shorter than long-finned pilot whale at 16 to 22 % of the total body length (Jefferson *et al*., 1993). Both pilot whale species feed primarily on squids but also take fishes (Bernard and Reilly, 1999).

Status and Management— The best estimate of pilot whale abundance (combined short-finned and long-finned) in the western North Atlantic is 31,139 individuals (Waring *et al*., 2008). Pilot whales are under the jurisdiction of NMFS.

Habitat— Pilot whales occur along the continental shelf break, in continental slope waters, and in areas of high-topographic relief (Olson and Reilly, 2002). While typically distributed along the continental shelf break, they are also commonly sighted on the continental shelf and inshore of the 100-m isobath (CETAP, 1982; Payne and Heinemann, 1993). Sightings of pilot whales also frequently occur seaward of the 2,000-m isobath north of Cape Hatteras (CETAP, 1982; Payne and Heinemann, 1993).

Waring *et al.* (1992) sighted pilot whales principally along the northern wall of the Gulf Stream and along the shelf break at thermal fronts. A few of these sightings were also made in the mid-portion of the Gulf Stream near Cape Hatteras (Abend and Smith, 1999).

Pilot whales occur close to shore at oceanic islands where the shelf is narrow and deeper waters are nearby (Mignucci-Giannoni, 1998; Gannier, 2000; Anderson, 2005). Long-finned pilot whale sightings extend south to near Cape Hatteras through the VACAPES OPAREA (Abend and Smith, 1999) along the continental slope.

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 peak-to-peak (Fish and Turl, 1976;

Ketten, 1998). There are no hearing data available for either pilot whale species. However, the most sensitive hearing range for odontocetes generally includes high frequencies (Ketten, 1997).

Distribution— Long-finned pilot whales are distributed in subpolar to temperate North Atlantic waters offshore and in some coastal waters. The short-finned pilot whale usually does not range north of 50°N or south of 40°S (Jefferson *et al*., 1993); short-finned pilot whales have stranded as far north as Rhode Island. Strandings of long-finned pilot whales have been recorded as far south as South Carolina (Waring *et al*., 2008). Short-finned pilot whales are common south of Cape Hatteras (Caldwell and Golley, 1965; Irvine *et al*., 1979). Long-finned pilot whales appear to concentrate during winter along the continental shelf break primarily between Cape Hatteras and Georges Bank (Waring *et al*., 1990). The apparent ranges of the two pilot whale species overlap in shelf/shelf-edge and slope waters of the northeastern U.S. between 35°N and 38° to 39°N (New Jersey to Cape Hatteras, North Carolina) (Payne and Heinemann, 1993); however, incidents of strandings of short-finned pilot whales as far north as Block Island, Rhode Island, and Nova Scotia indicate that area of overlap may be larger than previously thought (Waring *et al*., 2008).

Pilot whales concentrate along the continental shelf break from during late winter and early spring north of Cape Hatteras (CETAP, 1982; Payne and Heinemann, 1993). This corresponds to a general movement northward and onto the continental shelf from continental slope waters (Payne and Heinemann, 1993). Short-finned pilot whales seem to move from offshore to continental shelf break waters and then northward to approximately 39ºN, east of Delaware Bay during summer (Payne and Heinemann, 1993). Sightings coalesce into a patchy continuum and, by December, most short-finned pilot whales occur in the mid-Atlantic slope waters east of Cape Hatteras (Payne and Heinemann, 1993). Although pilot whales appear to be seasonally migratory, sightings indicate common year-round occurrence in some continental shelf areas, such as the southern margin of Georges Bank (CETAP, 1982; Abend and Smith, 1999).

The calving peak for long-finned pilot whales is from July to September in the northern hemisphere (Bernard and Reilly, 1999). 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.

Cherry Point Study Area Pilot Whale Occurrence—The Navy Cherry Point Study Area is located in a region of range overlap between both pilot whale species (Payne and Heinemann, 1993). As a deep-water species, pilot whales may occur seaward of the shelf break throughout the Study Area year-round. They may also occur between the shore and shelf break which is supported by opportunistic sightings and bycatch records inshore of the shelf break in the Navy Cherry Point Study Area (DoN, 2008). Concentrated areas of occurrence are likely influenced by high levels of productivity generated by warm-core rings from the Gulf Stream as well as the steep sloping bottom topography of the area (DoN, 2008).

Cherry Point Study Area Pilot Whale Density-Table 3.7-1 provides density estimates for pilot whales in the Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Density is not anticipated to be uniform throughout the warning areas. Although pilot whales do occur over continental shelf waters in the OPAREA (DoN, 2008), these species are more likely to be concentrated seaward of the shelf break.

Pygmy and Dwarf Sperm Whales

Dwarf and pygmy sperm whales are difficult for the inexperienced observer to distinguish from one another at sea, and sightings of either species are often categorized as *Kogia* spp. The difficulty in identifying pygmy and dwarf sperm whales is exacerbated by their avoidance reaction towards ships and change in behavior towards approaching survey aircraft (Würsig *et al*., 1998). Pygmy sperm whales have

a shark-like head with a narrow jaw, flippers set high on the sides near the head, and a small falcate dorsal fin set well behind the midpoint of the back (Jefferson et al. 2008). The dwarf sperm whale is similar in appearance, but has a larger dorsal fin set nearer to the middle of the back and a more pointed snout (Jefferson et al. 2008). Pygmy and dwarf sperm whales reach body lengths of around 3.8 m and 2.7 m, respectively (Jefferson et al. 2008). *Kogia* spp. 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— There is currently no information to differentiate Atlantic stock(s) (Waring *et al*., 2008). The best estimate of abundance for both species combined in the western North Atlantic is 395 individuals (Waring *et al.*, 2008). Species-level abundance estimates cannot be calculated due to uncertainty of species identification at sea (Waring *et al*., 2008). Pygmy and dwarf sperm whales are under the jurisdiction of NMFS.

Habitat— *Kogia* spp. occurs in waters along the continental shelf break and over the continental slope (e.g., Baumgartner *et al.*, 2001; McAlpine, 2002). Data from the Gulf of Mexico suggest that *Kogia* spp. may associate with frontal regions along the continental shelf break and upper continental slope, where their primary prey of squid may concentrate due to higher epipelagic zooplankton biomass (Baumgartner *et al*., 2001).

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. No information on sound production or hearing is available for the dwarf sperm whale.

Distribution— Both *Kogia* species apparently 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 (Piers, 1923; Baird *et al*., 1996; McAlpine *et al*., 1997; Measures *et al.*, 2004) and as far south as Colombia and around to Brazil (in the southern Atlantic) (de Carvalho, 1967; Geise and Borobia, 1987; Muñoz-Hincapié *et al.*, 1998). Pygmy sperm whales are also found in the Gulf of Mexico (Gunter *et al*., 1955; Hysmith *et al*., 1976; 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 (Potter, 1979; Morgan *et al.*, 2002), and New Jersey (Waring *et al*. 2008). Records of strandings and incidental captures indicate the dwarf sperm whale may range as far south as the Northern Antilles in the northern Atlantic; 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 (Jefferson and Schiro, 1997; Davis *et al.*, 2002).

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 are unknown.

Cherry Point Study Area Kogia Occurrence—*Kogia* generally occur along the continental shelf break and over the continental slope (e.g., Baumgartner *et al*., 2001; McAlpine, 2002). Few sightings are recorded in the Study Area which is likely due to incomplete survey coverage throughout most of the deep waters of this region (especially during winter and fall) as well as their avoidance reactions towards ships (DoN, 2008). However, strandings are recorded in the Navy Cherry Point Study Area during all

seasons and support the likelihood of *Kogia* occurrence in the region year-round (DoN, 2008). During 15-16 January 2005, a noteworthy unusual mortality event took place involving two dwarf sperm whales stranding near Hatteras, North Carolina (Hohn *et al.*, 2006). A decomposed dwarf sperm whale was found south of the Outer Banks at around the same time as the other strandings and may have been involved in the same stranding event (MMC, 2006). *Kogia* may occur seaward of the shelf break throughout the Study Area year-round.

Cherry Point Study Area Kogia Density - The density estimates for training areas where explosions and/or ordnance use may occur in the Navy Cherry Point OPAREA are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007). Density is not expected to be uniform across the warning area. *Kogia* spp. will likely be concentrated in waters near and seaward of the shelf break based on habitat preferences. Density estimates may reflect the lower amount of survey effort in offshore waters as well as their documented avoidance reactions to ships.

Pygmy Killer Whale

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 reach lengths of up to 2.6 m (Jefferson *et al*., 1993). Pygmy killer whales eat predominantly fishes and squids, and sometimes take large fish. They are known to occasionally attack other dolphins (Perryman and Foster, 1980; Ross and Leatherwood, 1994).

Status and Management— There are no estimate of abundances for pygmy killer whales in the western North Atlantic (Waring *et al*., 2008). Pygmy killer whales are under the jurisdiction of NMFS.

Habitat— Pygmy killer whales generally occupy offshore habitats. In the northern Gulf of Mexico, this species is found primarily in deeper waters off the continental shelf (Davis and Fargion, 1996a; Davis *et al*., 2000a) out to waters over the abyssal plain (Jefferson, 2008). Pygmy killer whales were sighted in waters deeper than 1,500 m off Cape Hatteras (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.*, 2004b). Recorded clicks from pygmy killer whales have centroid frequencies between 70 and 85 kHz. These clicks are bimodal with 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.*, 2004b). These clicks possess characteristics of echolocation clicks (Madsen *et al.*, 2004b). There are no empirical hearing data available for this species.

Distribution— Pygmy killer whales have a worldwide distribution in tropical and subtropical waters, generally not ranging north of 40ºN or south of 35ºS (Jefferson *et al*., 1993). There are few records of this species in the western North Atlantic (e.g., Caldwell and Caldwell, 1971; Ross and Leatherwood, 1994). Most records from outside the tropics are associated with unseasonable intrusions of warm water into higher latitudes (Ross and Leatherwood, 1994).

Seasonality and location of pygmy killer whale breeding are unknown.

Cherry Point Study Area Pygmy Killer Whale Occurrence—Few strandings and an offshore sighting are recorded near the Navy Cherry Point Study Area (DoN, 2008). The pygmy killer whale is an oceanic species which may occur seaward of the shelf break year-round throughout the Study Area. Based on warm water preferences, pygmy killer whale occurrence in the Study Area during winter is likely influenced by the Gulf Stream.

Cherry Point Study Area Pygmy Killer Whale Density- There was not sufficient data available to estimate a density for the Study Area. Nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007).

Risso's Dolphin

Risso's dolphins are moderately large, robust animals reaching at least 3.8 m in length (Jefferson *et al*., 1993). Cephalopods are their primary prey (Clarke, 1996).

Status and Management— The best estimate of Risso's dolphin abundance in the western North Atlantic is 20,479 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). Baumgartner (1997) hypothesized that the fidelity of Risso's dolphins to the steeper portions of the upper continental slope in the Gulf of Mexico is most likely the result of cephalopod prey distribution in the same area.

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.*, 2004a). 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 (Jefferson et al. 2008) southward to the Gulf of Mexico (Baumgartner, 1997; Jefferson and Schiro, 1997), throughout the Caribbean, and around the equator (van Bree, 1975; Ward *et al.*, 2001).

Risso's dolphins are distributed along the continental shelf break and slope waters from Cape Hatteras north to Georges Bank in spring, summer, and fall (CETAP, 1982; Payne *et al*., 1984). In the winter the range shifts to mid-Atlantic Bight and offshore waters (Payne *et al.,* 1984). Risso's dolphins may also occur in the waters from the mid-shelf to over the slope from Georges Bank south to, and including, the mid-Atlantic Bight, primarily in the summer and fall (Payne *et al.,* 1984). Only rare occurrences are noted in the Gulf of Maine (Payne *et al*., 1984).

In the North Atlantic, there appears to be a summer calving peak (Jefferson *et al.*, 1993); however locations of breeding areas are unknown.

Cherry Point Study Area Risso's Dolphin Occurrence—As mentioned above, Risso's dolphins are most commonly found in areas with steep bottom topography and are often sighted along the northern wall of the Gulf Stream which is a region of enhanced productivity. Records of this species in the Study Area

generally follow this pattern of distribution with patches of sightings recorded along the path of the Gulf Stream and over steep portions of the continental slope (DoN, 2008). Risso's dolphins may occur just inshore of the shelf break and seaward of the shelf break throughout the Study Area year-round based on sighting data and the preference of this species for deep waters.

Cherry Point Study Area Risso's Dolphin Density-Table 3.7-1 provides density estimates for Risso's dolphins in the Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Based on species habitat preferences, density is not anticipated to be uniform across the warning areas. Risso's dolphins will likely be concentrated just inshore of the shelf break and seaward.

Rough-toothed Dolphin

The rough-toothed dolphin is relatively robust with a cone-shaped head with no demarcation between the melon and beak (Jefferson *et al.*, 1993). Rough-toothed dolphins reach 2.8 m in length (Jefferson *et al.*, 1993). They feed 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— No abundance estimate is available for rough-toothed dolphins in the western North Atlantic (Waring *et al*., 2008). The rough-toothed dolphin is 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 shallower waters as well (e.g., Gannier and West, 2005). Tagging data for this species from the Gulf of Mexico and western North Atlantic provide important information on habitat preferences. Three dolphins with satellite-linked transmitters released in 1998 off the Gulf Coast of Florida were tracked off the Florida panhandle in average water depths of 195 m (Wells *et al*., 1999). Dolphins released in March of 2005 after a mass stranding were tagged with satellite-linked transmitters and released southeast of Fort Pierce moved within the Gulf Stream and parallel to the continental shelf off Florida, Georgia, and South Carolina, in waters with a depth of 400 to 800 m (Manire and Wells, 2005). They later moved northeast into waters with a depth greater than 4,000 m (Manire and Wells, 2005). Another tagged dolphin from released after the 2005 mass stranding moved north as far as Charleston, South Carolina, before returning to the Miami area, remaining in relatively shallow waters (Wells, 2007). During May 2005, seven more rough-toothed dolphins (stranded in the Florida Keys in March 2005 and rehabilitated) were tagged and released by the Marine Mammal Conservancy in the Florida Keys (Wells, 2007). During an initial period of apparent disorientation in the shallow waters west of Andros Island, they continued to the east, then moved north through Crooked Island Passage, and paralleled the West Indies (Wells, 2007). The last signal placed them northeast of the Lesser Antilles (Wells, 2007). During September 2005, two more individuals (from the same mass stranding) were satellite-tagged and released east of the Florida Keys and proceeded south to a deep trench close to the north coast of Cuba (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; Chou, 2005). 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, 2002). Not many records for this species exist from the western North Atlantic, but they indicate that this species occurs from Virginia south to Florida, the Gulf of Mexico, the West Indies, and along the northeastern coast of South America (Leatherwood *et al.*, 1976; Jefferson *et al*., 2008).

Seasonality and location of rough-toothed dolphin breeding is unknown.

Cherry Point Study Area Rough-toothed Dolphin Occurrence—A few strandings and one sighting have been recorded in or near the Study Area (DoN, 2008). Rough-toothed dolphins may occur seaward of the shelf break based on this species' preference for deep waters. During the winter, the rough-toothed dolphin's occurrence is expected in warmer waters so occurrence in the Study Area may follow the western edge of the standard deviation of the Gulf Stream. The rough-toothed dolphin may occur in the Study Area year-round.

Cherry Point Study Area Rough-toothed Dolphin Density-Table 3.7-1 provides density estimates for rough-toothed dolphins in the Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Based on species habitat preferences, density is not anticipated to be uniform across the warning areas. Rough-toothed dolphins will likely be concentrated seaward of the shelf break and along the Gulf stream.

Spinner Dolphin

The spinner dolphin generally has a dark eye-to-flipper stripe and dark lips and beak tip (Jefferson *et al.*, 1993). 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*., 1993). Spinner dolphins feed primarily on small mesopelagic fish, squid, and sergestid shrimp (Perrin and Gilpatrick, 1994).

Status and Management— No estimate of abundances are currently available for the western North Atlantic stock of spinner dolphins (Waring *et al*., 2008). Stock structure in the western North Atlantic is unknown (Waring *et al*., 2008). The spinner dolphin is under the jurisdiction of NMFS.

Habitat— Spinner dolphins occur in both oceanic and coastal environments. Most sightings of this species in tropical waters 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 in the Gulf of Mexico, they are distributed in waters with a depth greater than 2,000 m (CETAP, 1982; Davis *et al*., 1998). Off the eastern U.S. coast, spinner dolphins were sighted within the Gulf Stream, which is consistent with the oceanic distribution and warm-water preference of this genus (Waring *et al*., 1992).

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 subtropical and tropical waters worldwide, with different geographical forms in various ocean basins. The range of this species extends to near 40°N latitude (Jefferson *et al.*, 1993). Distribution in the western North Atlantic is thought to extend from North Carolina south to Venezuela (Schmidly, 1981), including the Gulf of Mexico (Davis *et al*., 2002).

Breeding occurs across all season 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.

Cherry Point Study Area Spinner Dolphin Occurrence—There is only one sighting record for this species in the Navy Cherry Point Study Area; several sighting and bycatch records are north of this area (DoN, 2008). Spinner dolphins prefer warm, offshore waters as evidenced by the sighting and bycatch records associated with the Gulf Stream in the winter and spring months (DoN, 2008). Spinner dolphins may occur from the vicinity of the continental shelf break to eastward of the Study Area boundary in association with the Gulf Stream's northern boundary. No seasonal differences in occurrence are anticipated.

Cherry Point Study Area Spinner Dolphin Density- There was not sufficient data available to estimate a density for the Study Area; nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007).

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 fishes (in particular, myctophids or lanternfish) and squids are the dominant prey (Perrin *et al.*, 1994b; Ringelstein *et al.*, 2006).

Status and Management— The best estimate of striped dolphin abundance in the western North Atlantic is 94,462 individuals (Waring *et al*., 2008). The striped dolphin is under the jurisdiction of NMFS.

Habitat— Striped dolphins are usually found beyond the continental shelf, typically over the continental slope out to oceanic waters and are often associated with convergence zones and waters influenced by upwelling (Au and Perryman, 1985). This species also occurs in conjunction with the shelf edge in the northeastern U.S. (between Cape Hatteras and Georges Bank; (Hain *et al*., 1985). Striped dolphins are known to associate with the Gulf Stream's northern wall and warm-core ring features (Waring *et al*., 1992).

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— Striped dolphins are distributed worldwide in cool-temperate to tropical zones. In the western North Atlantic, this species occurs from Nova Scotia southward to the Caribbean Sea, Gulf of Mexico, and Brazil (Baird *et al*., 1993; Jefferson *et al*., 2008). Off the northeastern U.S., striped dolphins are distributed along the continental shelf break from Cape Hatteras to the southern margin of Georges Bank, as well as offshore over the continental slope and continental rise in the mid-Atlantic region (CETAP, 1982).

Off Japan, where their biology has been best studied, there are two calving peaks: one in summer and one in winter (Perrin *et al*., 1994b); however, in the western Atlantic breeding times and locations are largely unknown.

Cherry Point Study Area Striped Dolphin Occurrence—As noted earlier, the striped dolphin is a deep water species that is generally distributed north of Cape Hatteras (CETAP, 1982). In the Study Area, there is one sighting near the northern perimeter of the OPAREA and several strandings along the coast (DoN 2007b). Occurrence here is likely influenced by the path of the Gulf Stream since striped dolphins are often associated with the Gulf Stream's northern wall and warm-core rings (Waring *et al.,* 1992). Striped dolphins may occur near and seaward of the shelf break throughout the Study Area year-round.

Cherry Point Study Area Striped Dolphin Density- Table 3.7-1 provides density estimates for the striped dolphin in the Cherry Point Study Area. Methods and results are detailed in the NODE Reports (DoN, 2007). Density is not expected to be uniform across the warning area. Striped dolphins will likely be concentrated in waters near and seaward of the shelf break and/or along the Gulf Stream based on habitat preferences.

Harbor Seal

The harbor seal (or common seal) is a small- to medium-sized seal. Adult males attain a maximum length of 1.9 m and weigh 70 to 150 kg; females reach 1.7 m in length and weigh between 60 and 110 kg (Jefferson *et al.*, 1993). Northeastern U.S. harbor seals eat sand lance, Atlantic herring, cod, and winter flounder (Payne and Selzer, 1989).

Status and Management— Five subspecies of *Phoca vitulina* are recognized; *Phoca vitulina concolor* is the form found in the western North Atlantic (Rice, 1998). Harbor seals are the most common and frequently reported seals in the northeastern U.S. (Katona *et al*., 1993). Currently, harbor seals along the coast of the eastern U.S. and Canadian coasts are considered a single population (Waring *et al*., 2008).

The best estimate of abundance of harbor seals in the western North Atlantic stock is 99,340 individuals (Waring *et al.*, 2008). An estimated 5,575 harbor seals over-wintered in southern New England in 1999, increasing from an estimated 2,834 individuals in 1981 (Barlas, 1999). Kraus and Early (1995) suggested that the northeastern U.S. population increase could represent increasing southward shifts in wintering distribution. The harbor seal is under NMFS jurisdiction.

Habitat— This is a coastal species, usually found near shore, and frequently occupying bays, estuaries, and inlets (Baird, 2001). Individual harbor seals have been observed miles upstream in coastal rivers (Baird, 2001).

Although primarily aquatic, harbor seals also utilize terrestrial environments where they haul out periodically. Haulout substrates vary but include intertidal and rocky outcrops, sandbars, sandy beaches, and even peat banks in salt marshes (Wilson, 1978; Schneider and Payne, 1983; Gilbert and Guldager, 1998). Along the majority of the New England coast, harbor seals haul out on rocky outcroppings and intertidal ledges (Kenney, 1994; Gilbert and Guldager, 1998; Schroeder, 2000). In the mid-Atlantic Bight, harbor seals are commonly observed hauled out on dry parts of submerged structures (Steimle and Zetlin, 2000).

Acoustics and Hearing - Harbor seal males and females produce a variety of low-frequency in-air vocalizations including snorts, grunts, and growls, while pups make individually unique calls for mother recognition (main energy at 0.35 kHz) (Thomson and Richardson, 1995). Adult males also produce several underwater sounds such as roars, bubbly growls, grunts, groans, and creaks during the breeding season. These sounds typically range from 0.025 to 4 kHz (duration range: 0.1 sec to 11 seconds) (Hanggi and Schusterman, 1994). Hanggi and Schusteman (1994) found that there is individual variation in the dominant frequency range of sounds between different males, and Van Parijs *et al.* (2003) reported oceanic, regional, population, and site-specific levels of variation (*i.e.*, could represent vocal dialects) between males.

Harbor seals hear nearly as well in air as underwater (Kastak and Schusterman, 1998). Harbor seals are capable of hearing frequencies from 1 to 180 kHz (most sensitive at frequencies between 1 kHz and 60 kHz using behavioral response testing) in water and from 0.25 to 30 kHz in air (most sensitive from 6 to 16 kHz using behavior and auditory brainstem response testing) (Richardson, 1995; Terhune and Turnbull, 1995; Wolski *et al.*, 2003). Despite the absence of an external ear, harbor seals are capable of directional hearing in-air, giving them the ability to mask out background noise (Holt and Schusterman, 2007). Underwater sound localization was demonstrated by Bodson *et al.* (2006). TTS for the harbor seal was assessed at 2.5 kHz and 3.53 kHz (exposure level was 80 and 95 dB above threshold), by Kastak *et al.* (2005). Data indicated that the range of TTS onset would be between 183-206 dB re: 1μPa2-s (Kastak *et al.*, 2005).

Distribution— Harbor seal distribution is associated with temperate waters (Jefferson *et al*., 1993) (Stanley *et al*., 1996). Harbor seals are year-round residents of eastern Canada (Boulva, 1973) and coastal Maine (Katona *et al*., 1993; Gilbert and Guldager, 1998). The greatest concentrations of harbor seals in northeastern U.S. waters are found along the coast of Maine, specifically in Machias and Penobscot bays and off Mt. Desert and Swans Islands (Katona *et al*., 1993).

Harbor seals occur south of Maine from late September through late May (Rosenfeld *et al.*, 1988; Whitman and Payne, 1990; Barlas, 1999; Schroeder, 2000). During winter, the population divides and disperses offshore into the Gulf of Maine south into southern New England and a portion remains in coastal waters of Maine and Canada. From at least October through December, harbor seal numbers decrease in Canadian waters (Terhune, 1985) but increase three to five fold south of Maine (Rosenfeld *et al*., 1988). A general southward movement along the Canadian coast and northeastern U.S. is thought to occur during this period (Rosenfeld *et al*., 1988). Tagging efforts by Gilbert and Wynne (1985) support this hypothesis. Although harbor seals of all ages and both sexes frequent winter haulout sites south of Maine, many of the over-wintering individuals are immature, suggesting that there might be seasonal segregation resulting from age-related competition for haulout sites near preferred pupping ledges and age-related differences in food requirements (Whitman and Payne, 1990; Slocum and Schoelkopf, 2001).

The timing of harbor seal pupping along the eastern North American coast varies geographically (Temte *et al*., 1991). Pupping takes place from mid May through mid June along the Maine coast (Richardson, 1976; Wilson, 1978; DeHart, 2002).

Cherry Point Study Area Harbor Seal Occurrence- Several strandings near the Navy Cherry Point OPAREA have occurred during the winter, spring, and fall. Winn *et al.* (1979) suggested that harbor seals found in this area are likely young individuals that disperse from the north during the winter months. Stranding data support a consistent seasonal occurrence of harbor seals in this region (Harry *et al*., 2005). Occurrences of juvenile and possibly adult harbor seals are increasing in frequency in the mid-Atlantic region, primarily December through April (Barco, 2008). Between 2000 and 2005, at least 71 records of harbor seal strandings were reported for North Carolina and Virginia (Harry *et al*., 2005). Most of these strandings occurred between November and April and were of young individuals. In February 2003, a harbor seal was rescued from Cape Lookout, North Carolina (WhaleNet, 2003). Sightings and strandings of harbor seals have been documented throughout the year in South Carolina (McFee, 2006). Therefore, harbor seals may occur in or near the OPAREA any time of the year.

Cherry Point Study Area Harbor Seal Density- There was not sufficient data available to estimate a density for the Study Area. Nor was there an abundance estimate in the NOAA stock assessment used to estimate density in the NODE report (DoN, 2007).

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 block. 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.

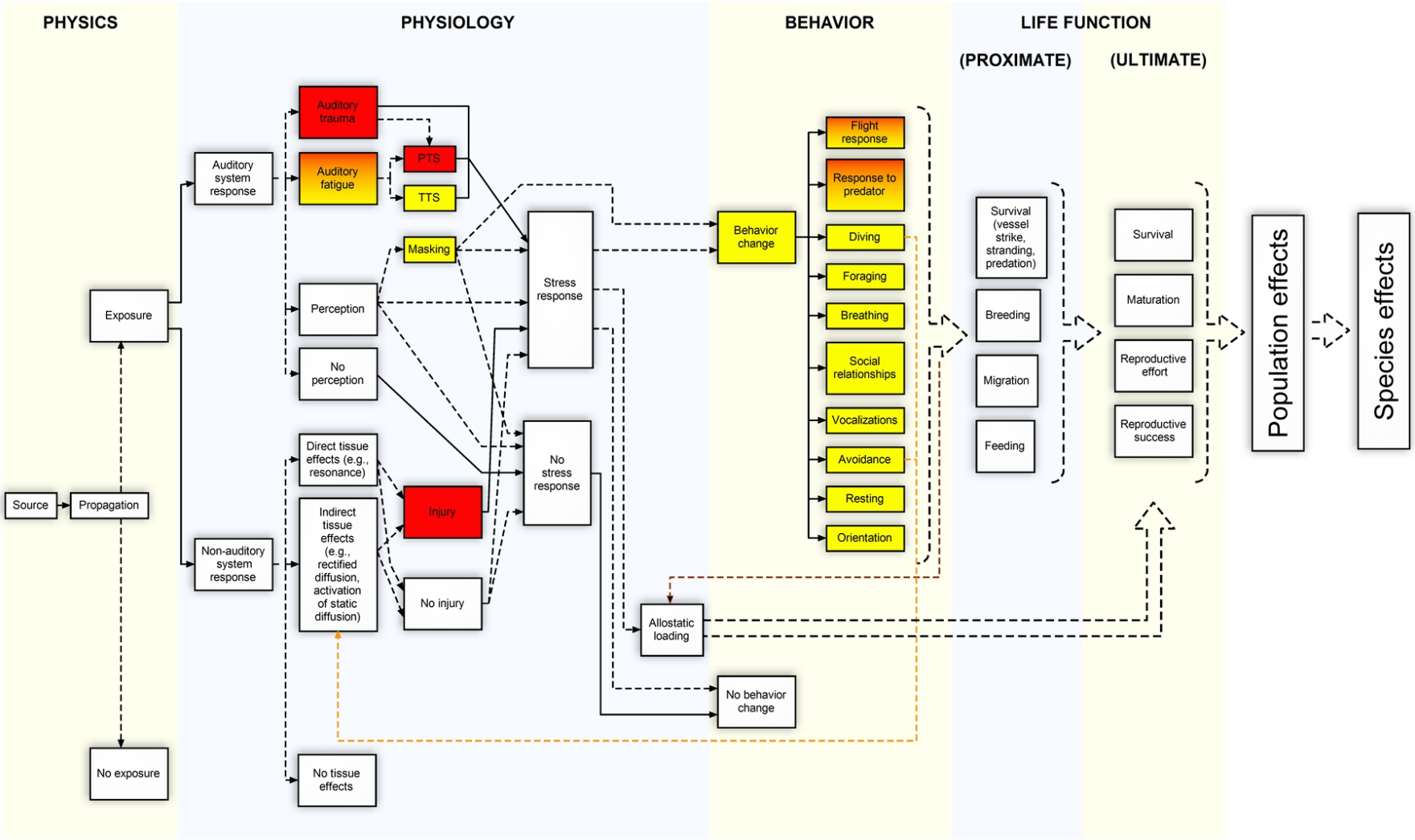


Figure 3.7-2 Conceptual Biological Framework Used to Order and Evaluate the Potential Responses of Marine Mammals to Sound.

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, and duration 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.*, 2002; 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.*, 1990b; Turnbull and Terhune, 1990; Kastelein *et al.*, 2002, 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.*, 1990a) 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 Navy Cherry Point 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 FEIS/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). A 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 a TS following a sound exposure. If the TS eventually returns to zero (the threshold returns to the preexposure 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 EIS/OEIS 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.

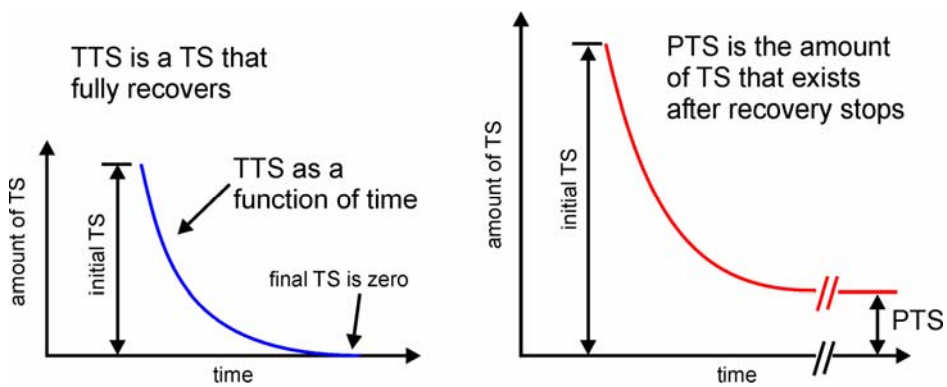


Figure 3.7-3 Two Hypothetical Threshold Shifts

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). In these studies hearing thresholds were measured in trained dolphins and belugas 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 for the species studied in this EIS/OEIS and non-impulsive, mid-frequency sounds of interest:

- 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.*, 1965; 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.* (1999a; 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 duration 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.*, 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.* for harbor seals, is 183 dB re 1 μPa^2-s.

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 a 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 a 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 EIS/OEIS 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 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 3.7-3 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 the 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.*, 1990a; 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 has 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 3.7-3 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 (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 intepretations 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.*, 2007).

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 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.

Potential Impacts from Exposure to Underwater Detonations

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; Departmen of the Navy 2001, 2007). 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 rarefraction waves. Subsequent rarefraction 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 (Department of Navy, 2001; 2007). 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), facture 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 (Department of the Navy, 2001; 2007).

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 Final Environmental Impact Statement (FEIS) ("Seawolf") and subsequently used in the USS Winston S. Churchill (DDG-81) Ship Shock FEIS ("Churchill") (DoN, 1998; DoN, 2001). NMFS adopted these criteria and thresholds in its final rule on unintentional taking of marine animals occurring incidental to the shock testing (NMFS, 2001a). 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 FIREX (with IMPASS) and BOMBEX. In addition, this section reflects a revised acoustic criterion for small underwater explosions (*i.e.*, 23 lbs per square inch [psi] for peak pressure instead of previous acoustic criteria of 12 psi for peak pressure), which is based on the final rule issued to the Air Force by NMFS (NMFS, 2005a). As was the case for Seawolf and Churchill, 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.

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 percent 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 inch pounds per square inch (in-lbs/in^2) (about 205 dB referenced to one microPascal squared second [dB re one μPa^2-sec]). 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 percent incidence of PTS at the same threshold).

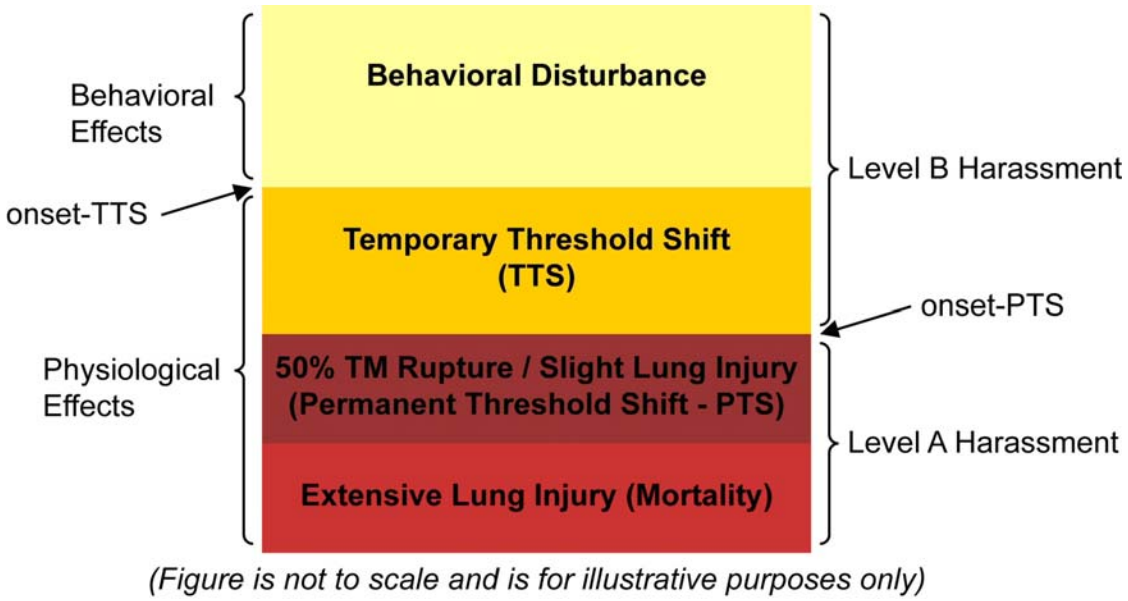


Figure 3.7-4 Physiological and Behavioral Acoustic Effects Framework for Explosives

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-millisecond (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 percent small animals. The criterion with the largest potential exposure 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 1 percent 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 occurs during FIREX (with IMPASS) and the BOMBEX events where the MK-82 and MK-83 bombs are used. Since FIREX and portions of BOMBEX require multiple explosions, the Churchill approach had to be extended to cover multiple sound events at the same training site. For FIREX, the exercise is estimated to take up to 6 hours. For BOMBEX, the bombs are dropped roughly 3 minutes apart, so the exercise is approximately 12 minutes. 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 physiological effects is TTS — a slight, recoverable loss of hearing sensitivity (DoN, 2001). For this assessment, there are dual thresholds 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 physiological (TTS) exposures.

Single Explosion –TTS-Energy Threshold

The first threshold is a 182 dB re 1 μPa^2-sec maximum energy flux density level 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 produce different results in the impact 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 exposure ranges resulting from the 10 and 100 Hz frequency range cutoffs 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-sec in any 1/3-octave band. The energy threshold usually dominates over peak pressure threshold and is used in the analysis to determine potential non-injurious physiological (TTS) 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 referenced to 1 micropascal [dB re 1 μPa]). This criterion was adopted for Precision Strike Weapons (PSW) Testing and Training by Eglin Air Force Base in the Gulf of Mexico (NMFS, 2005a). 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 exposure ranges than the 182-dB energy metric. Furthermore, it is not unusual for the TTS exposure range for the 23-psi pressure metric to actually exceed the disturbance exposure 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

For this analysis, the use of multiple explosions occurs during FIREX (with IMPASS) and the BOMBEX events where the MK-82 and MK-83 bombs are used. Because multiple explosions would occur within a discrete time period, a new acoustic criterion-behavioral disturbance 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 threshold for tones is derived from the SSC tests, and is found to be five dB below the threshold for TTS, or 177 dB re one μPa^2-sec 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 lbs NEW), as what was modeled for this analysis, the spectrum of the shot arrival is broad, and there is essentially no difference in exposure ranges for toothed whales/sea turtles or baleen whales. In shallower water, the behavioral disturbance exposure range can be about twice the exposure range for TTS. However, in deeper water, the TTS pressure criteria (23 psi (peak)) exposure range can result in a longer exposure range than the behavioral disturbance criteria exposure range. This is due to the fact that in a deep water environment, it is more likely that there is a direct path for the shockwave to propogate, which results in a larger peak pressure range. In shallow water, there is reflection, absorption, and cancellation of the shockwave propagation due to interactions with the bottom, sediment type, etc., which can limit the peak pressure range.

Summary of Thresholds and Criteria for Impulsive Sounds

Table 3.7-4 summarizes the effects, criteria, and thresholds used in the assessment for impulsive sounds. 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 FIREX (with IMPASS) event or a BOMBEX event involving MK-82 or MK-83 bombs.

Table 3.7-4 Effects, Criteria, and Thresholds for Impulsive Sounds

Effect	Criteria	Metric	Threshold	Effect
Mortality	Onset of Extensive Lung Injury	Goertner modified positive impulse	indexed to 30.5 psi-ms (assumes 100% small animal at 26.9 lbs)	Mortality
Injurious Physiological	50% Tympanic Membrane Rupture- PTS	Energy flux density	1.17 in-lb/in^2 (about 205 dB re 1 μPa^2-sec)	*MMPA* - Level A
Injurious Physiological	Onset Slight Lung Injury	Goertner modified positive impulse	indexed to 13 psi-ms (assumes 100% small animal at 26.9 lbs)	*MMPA* - Level A
Non-injurious Physiological	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	*MMPA* - Level B
Non-injurious Physiological	TTS	Peak pressure for any single exposure	23 psi	*MMPA* - Level B
Non-injurious Behavioral	Behavioral Disturbance	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 explosions only)	177 dB re 1 μPa^2-sec	*MMPA* - Level B
MMPA TTS PTS	Marine Mammal Protection Act Temporary Threshold Shift Permanent Threshold Shift			

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.

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

The exercises that use explosives include: FIREX with IMPASS, MISSILEX, BOMBEX, and MINEX. Table 3.7-5 summarize the number of events (per year) for the No Action Alternative and specific areas where each occurs for each type of explosive ordnance used. Table 3.7-6 summarizes the number of events (per year) for Alternative 1 and specific areas where each occurs for each type of explosive ordnance used. Table 3.7-7 summarizes the number of events (per year) for Alternative 2 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 (unless specified otherwise).

Table 3.7-5 Number of Explosive Events in the No Action Alternative

No Action Alternative		
Sub-Area	**Ordnance**	**Annual Totals**
	MISSILEX	**7**
Area 16, 17	Hellfire	3
	TOW	4
	FIREX with IMPASS	**2**
Area 4/5 and 13/14	5" NGF	2
	MINEX	**20**
UNDET	20 LB	20
	BOMBEX	**37**
Area 18	MK-82*	23
Area 18	MK-83*	13
Area 18	MK-84	1

** One event using the MK-82 or MK-83 bombs consists of four bombs being dropped in succession. For example, in Area 18 there are 23 events for the MK-82, which means that a total of 92 bombs will be dropped per year.*

Table 3.7-6 Number of Explosive Events in the Alternative 1

Alternative 1		
Sub-Area	**Ordnance**	**Annual Totals**
	MISSILEX	**14**
Area 16, 17	Hellfire	6
	TOW	8
	FIREX with IMPASS	**2**
Area 4/5 and 13/14	5" NGF	2
	MINEX	**20**
UNDET	20 LB	20
	BOMBEX	**37**
Area 18	MK-82*	23
Area 18	MK-83*	13
Area 18	MK-84	1

** One event using the MK-82 or MK-83 bombs consists of four bombs being dropped in succession. For example, in Area 18 there are 23 events for the MK-82, which means that a total of 92 bombs will be dropped per year.*

Table 3.7-7 Number of Explosive Events in the Alternative 2

Alternative 2		
Sub-Area	**Ordnance**	**Annual Totals**
	MISSILEX	**14**
Area 16, 17	Hellfire	6
	TOW	8
	FIREX with IMPASS	**2**
Area 4/5 and 13/14	5" NGF	2
	MINEX	**20**
UNDET	20 LB	20
	BOMBEX	**0**
Area 18	MK-82	0
Area 18	MK-83	0
Area 18	MK-84	0

The acoustic effects analysis presented in the following sections is briefly described for each major type of exercise. A more in-depth description of the modeling can be found in Appendix J.

FIREX (with IMPASS)

Modeling was completed for a 5-in. round, 8-lbs NEW charge exploding at a depth of 1 ft (0.3 m). The analysis approach begins using a high-fidelity acoustic model to estimate energy in each 5-in. explosive round. Effects areas are calculated by summing the energy from multiple explosions over a firing exercise (FIREX) mission, and determining the effects area based on the thresholds and criteria. Non-injurious exposures were determined based on the 177 dB re 1 μPa^2-sec (energy) criterion for behavioral disturbance (without TTS) due to the use of multiple explosions.

Effect areas for a full FIREX (with IMPASS) event must account for the time and space distribution of 39 explosions, as well as the movement of animals (using 3 knot average swim speed) over the several hours of the exercise. The total effect area for the 39-shot event is calculated as the sum of small effect areas for seven FIREX missions (each with four to six rounds fired) and one pre-FIREX action (with six rounds fired). Table 3.7-8 shows the Zone of Influence (ZOI) results of the model estimation.

Table 3.7-8 Estimated ZOIs (km^2) for a single FIREX (IMPASS) Event (39 live rounds)

Area	Estimated ZOI @ 23 psi (peak)*	Estimated ZOI @ 205 dB re 1 μPa^2-sec or 13 psi-ms
Cherry Point		
4 & 5	3.7387	0.18522
13 & 14	3.7387	0.18522

**In these areas, which occur in deeper water (>1000 m), the 23psi(peak pressure) criteria dominates over the 177 dB re 1 μPa^2-sec (1/3 octave bands) behavioral disturbance criterion and therefore was used in the analysis for non-injurious exposures.*

The ZOI, when multiplied by the animal densities (Table 3.7-1) and the total number of events (Tables 3.7-20 to 3.7-7), provides the exposure estimates for that animal species for the nominal exercise case of 39 5-in. explosive rounds. The potential effects would occur within a series of small effect areas associated with the pre-calibration rounds and missions spread out over a period of several hours. Additionally, target locations are changed from event to event and because of the time lag between events, 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 event. The exposure results based on the injurious criteria (13 psi-ms or 205 dB re 1 μPa^2-sec) were very low, and extrapolation showed there would be zero mortality exposures, so modeling was not completed for the 30.5 psi-ms mortality criterion.

FIREX (with IMPASS) is restricted two primary locations (4 & 5 and 13 & 14) (Figure 2.2-3). In addition to other mitigation measures (see Chapter 5), a dedicated lookout monitors the target area for marine mammals and sea turtles before the exercise, during the deployment of the IMPASS array, and during the return to firing position. Ships will not fire on the target until the area is cleared and will suspend the exercise if any marine mammals enter the buffer area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

BOMBEX

Modeling was completed for four 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 explosives are 192-lbs, 415-lbs, 945-lbs, respectively.

MK-84 bombs are dropped one at a time and, therefore, are modeled as a single detonation event. More specifically, the single explosion dual TTS criteria were used to determine the ZOI for the non-injurious exposure analysis.

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 explosions. For the MK-82 and MK-83, 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 explosions are modeled as a single point event with only the EFD summed incoherently:

$$Total\ EFD\ db = 10\log_{10}\sum_{i=1}^{n} 10^{(EFD_i/10)}$$

The multiple explosives behavioral disturbance energy criterion was used to determine the ZOI for the non-injurious exposure analysis for the MK-82 and MK-83 bombs. Table 3.7-9 shows the ZOI results of the model estimation. The ZOI, when multiplied by the animal densities (Table 3.7-1) and total

Table 3.7-9 Estimated ZOI (km^2) used in exposure calculation for BOMBEX

Area	Ordnance	Estimated ZOI @ 177 dB re 1 μPa^2-sec				Estimated ZOI @ 182 dB re 1 μPa^2-sec or 23 psi (peak)				Estimated ZOI @ 205 dB re 1 μPa^2-sec or 13 psi-ms				Mortality			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
Cherry Point																	
Area 18	MK-82	111.73	113.11	99.58	106.92	NA	NA	NA	NA	2.59	2.59	2.59	2.80	<0.01	<0.01	<0.01	<0.01
	MK-83	313.06	267.24	158.07	182.02	NA	NA	NA	NA	4.98	4.98	5.13	4.69	<0.01	<0.01	<0.01	<0.01
	MK-84	NA	NA	NA	NA	9.73	10.99	10.14	9.73	0.62	0.62	0.62	0.62	<0.01	<0.01	<0.01	<0.01

Note: ZOIs for MK-82 and MK-83 bombs are modeled as multiple detonations (4 bombs dropped at same location). ZOI for MK-84 bombs are modeled as single detonations.

Note: Events were either modeled for 177 dB re 1 μPa^2-sec (1/3 octave bands) due to multiple detonations (MK-82 and MK-83 BOMBEX) or modeled for 182 dB re 1 μPa^2-sec (1/3 octave bands) or 23 psi (peak) due to single detonations (MK-84BOMBEX). Therefore, for MK-82 and MK-83 the NA refers to the criteria that were less dominant and therefore not used in the analysis. For MK-84 the NA refers to the fact that these events are not multiple detonations and therefore not modeled at 177 dB re 1 μPa^2-sec.

number of events (Tables 3.7-5 to 3.7-7), provides the exposure estimates for that animal species for the given bomb source.

BOMBEX is restricted to one location (Area 18; Figure 2.2-3). 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 drop ordnance 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 area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

MINEX

The Comprehensive Acoustic System Simulation/Gaussian Ray Bundle (Oceanographic and Atmospheric Master Library [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 OAML standard databases. The explosive source was modeled with standard similitude formulas, as in the Churchill FEIS. Because all the sites are shallow (less than 50 m), propagation model runs were made for bathymetry in the range from 10 m to 40 m.

Estimated ZOIs varied as much within a single area as from one area to another, which had been the case for the FIREX (with 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. The single explosion non-injurious TTS-energy criterion (182 dB re 1 μPa^2-sec) was used to determine the ZOI for the exposure analysis. Table 3.7-10 shows the ZOI results of the model estimation.

The total ZOI, when multiplied by the animal densities (Table 3.7-1) and total number of events (Tables 3.7-5 through 3.7-7) provides the exposure estimates for that animal species for each specified charge. The results for the injurious exposures at the 13 psi-ms criterion were very low, and extrapolation showed there would be zero mortality exposures, so modeling was not completed for the 30.5 psi-ms mortality criteria.

Underwater detonations are restricted to one area (UNDET Area) (Figure 2.2-1). 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 ZOI and will only restart after the area has been clear for a full 30 minutes. Table 3.7-11 is a list of marine mammal dive times that are documented. Therefore, a 30 minute shutdown of naval exercises represents an adequate time period to assess marine mammal movements within the designated area and ensure the animal's safety before actions resume.

Table 3.7-10 Estimated ZOIs (km^2) used in exposure calculation for MINEX

Threshold	ZOI
	20-lb NEW
Estimated ZOI @ 13 psi-ms	0.13 km^2 ± 10%
Estimated ZOI @ 182 dB re 1 μPa^2-sec	0.8 km^2 ± 25%

Table 3.7-11 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, 1998 ; 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*., 200; 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
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

Table 3.7-11 Marine Mammal Dive Times (Continued)

Common Name	*Scientific Name*	Average Dive Duration (min)	Maximum Dive Duration (min)	Citations
Bottlenose dolphin	*Tursiops truncatus*		8	Evans, 1987; Ridgway and Harrison, 1986
Pantropical spotted dolphin	*Stenella attenuata*		4.7	Perrin *et a*l., 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 Perin 1994; Evans, 1971
Atlantic white-sided dolphin	*Lagenorhynchus acutus*		4	Mate *et al*., 1994
Risso's dolphin	*Grampus griseus*		30	Clarke, 1986
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
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

MISSILEX (Hellfire and TOW)

Modeling was completed for two explosive missiles involved in MISSILEX, each assumed detonation at 1-m depth. These missiles usually explode in the air (greater than 10 ft), so the 1-m depth detonation assumption used in this analysis is most likely an over estimate of the potential ZOI. The NEW used in simulations of the Hellfire and TOW missiles are 8 lbs and 15.33 respectively. . The single explosion dual TTS criteria (energy or peak pressure) were used to determine the ZOI for the non-injurious exposure analysis Table 3.7-12 shows the ZOI results of the model estimation.

Table 3.7-12 Estimated ZOI (km^2) used in exposure analysis for MISSILEX

Area	Ordnance	Estimated ZOI @ 182 dB re 1 μPa^2-sec or 23 psi (peak)				Estimated ZOI @ 205 dB re 1 μPa^2-sec or 13 psi-ms				Mortality			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
Cherry Point													
Area 16 17	Hellfire	0.31	0.31	0.31	0.31	0.04	0.04	0.04	0.04	<0.01	<0.01	<0.01	<0.01
Area 16 17	TOW	0.39	0.39	0.35	0.39	0.04	0.04	0.04	0.04	<0.01	<0.01	<0.01	<0.01

The total ZOI, when multiplied by the animal densities (Table 3.7-1) and total number of events (Tables 3.7-5 through 3.7-7), provides the exposure estimates for that animal species for each specified missile. MISSILEX is restricted to one location: Area 16 & 17 (Figures 2.2-3). In addition to other mitigation measures (see Chapter 5), aircraft will survey the target area for marine mammals before and during the exercise. Ships and/or aircraft will not fire on the target until the area is cleared 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.

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 Cherry Point Range Complex, as well as vessel movements into, within, and through these distinct components. Many of the operations within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels) and amphibious vehicles. Movements of Navy and Marine Corps ships, boats and amphibious vehicles have the potential to affect marine mammals by directly striking or disturbing individual animals. The probability of Navy and Marine Corps ships, boats and amphibious vehicles and marine mammal interactions occurring in the Study Area is dependant 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 mitigation measures implemented by the Navy and Marine Corps. Currently, the number of Navy and Marine Corps ships, boats and amphibious vehicles operating in the Study Area varies based on training schedules. Ship sizes range from 362 feet for a SSN to 1,092 feet for a CVN. Operations involving Navy and Marine Corps ship, boat and amphibious vehicle movements occur intermittently and are variable in duration, ranging from a few hours up to 2 weeks. These operations are widely dispersed throughout the OPAREA, which is a vast area encompassing 18,617 nm^2 (an area approximately the size of West Virginia). Consequently, the density of ships within the Study Area at any given time is extremely low. The Navy and Marine Corps logs about 900 total steaming days within the Study Area during a typical year under the No Action Alternative.

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 consol boat with twin outboard engines).

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.

Disturbance Associated with Vessel Movements

Marine mammals are frequently exposed to vessels due to research, ecotourism, commercial and private vessel traffic, 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 years (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 (blue, fin, humpback, North Atlantic right, sei, sperm whales, and manatees) that occur in the Study Area 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 is provided below.

North Atlantic Right Whales

Although very little data exist that examines the relationship between vessel presence and significant impact to the North Atlantic right whale, it is thought that any impacts from vessel disturbance would be minor and/or temporary in nature (NMFS, 2005b). North Atlantic right whales continually utilize habitats in high ship traffic areas (Nowacek *et al*., 2004a). Studies show that North Atlantic right whales have little, if any, reaction to sounds of vessels approaching or the presence of the vessels themselves (Terhune and Verboom, 1999; Nowacek *et al.*, 2004a). Although this may minimize potential disturbance from passing ships, it does increase vulnerability to potential collisions which will be discussed further in the following section. North Atlantic right whales are protected through measures such as the 500-yard no-approach limit, which affords them additional protection and further alleviates any effect vessel traffic might have on behavior or distribution (NMFS, 1997).

Fin and Humpback Whales

Fin whales have been observed altering their swimming patterns by increasing speed and heading away from the vessel, as well as changing their breathing patterns in response to a vessel approach (Jahoda *et al*., 2003). Observations have shown that when vessels remain 100 m or farther from fin and humpback whales, they were largely ignored (Watkins *et al.*, 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 *et al*., 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: 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) when vessels were between 0 and 2,000 m away (Baker *et al*., 1983).

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, individual animal tolerance levels (Watkins *et al*., 1981; Baker *et al*., 1983; Jahoda *et al*., 2003). Should the vessels approach close enough to invoke a reaction, animals may engage in avoidance behaviors 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 has left the area.

Blue and Sei Whales

There is little information on blue whale or sei whale response to vessel presence (NMFS, 1998b; NMFS, 1998a). Sei whales have been observed ignoring the presence of vessels and passing close to

the vessel (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 would be short-term in nature.

Sperm Whales

Sperm whales generally had 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 addition, in the presence of whale watching and research boats, changes in respiration (alter blow intervals) and echolocation patterns (reduced time until first click after diving) 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).

West Indian Manatees

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.*, 2007; Nowacek *et al.*, 2004b). 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.*, 2004b). 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.*, 2004b). 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.*, 2004b). 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).

Delphinids

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 just approaching a vessel (observed in white-beaked dplphins) (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.

Dwarf and Pygmy Sperm Whales and Beaked Whales

Kogia spp. and beaked whales show strong adverse reactions to vessels. They engage is quick diving behavior and avoidance maneuvers (Würsig *et al.*, 1998).

Chronic stress response to vessel movements

Marine mammals exposed to a passing Navy or Marine Corps vessel may not respond at all, or they could exhibit a short-term behavioral response, but not to the extent where natural behavioral patterns would be abandoned or significantly altered. 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. 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. 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 budget (Frid, 2003), displacement from habitat (Sutherland, 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 marine mammal species.

Vessel movements under the No Action Alternative are not expected to result in chronic stress because, as discussed above, Navy and Marine Corps vessel density in the Study Area would remain low and mitigation measures are implemented to avoid marine mammals.

Summary

Vessel traffic related to the proposed activity would interact with 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 (*i.e.*, whale watching vessels, research vessels, *etc*.). 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, 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 implications of ship sound on marine mammals is largely unknown (NMFS, 2007c).

General vessel disturbance would have no effect on the manatee based its transient occurrence in the Study Area. General disturbance associated with vessel movements may affect ESA-listed marine mammals, but is not expected to result in Level A or Level B harassment 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 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). Manatees are also particularly susceptible to vessel interactions and collisions with watercraft constitute the leading cause of mortality (USFWS, 2007). Smaller marine mammals such as bottlenose and Atlantic spotted dolphins move more quickly throughout the water column and are often seen riding the bow wave of large ships. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC, 2003).

After reviewing historical records and computerized stranding databases 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. Ship collisions remained infrequent until the 1950s, after which point they increased. Laist *et al.* (2001) report that both the number and speed of motorized vessels have increased over time for trans-Atlantic passenger services, which transit through the area. 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 or segments of populations the impact of ship strikes may be significant.

Although ship strike mortalities may represent a small proportion of 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; Jaquet and Whitehead, 1996) "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, 2006c).

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, 2001; 2007). Vessel collisions are the largest known source of human-caused mortality to adult West Indian manatees (USFWS, 2007), 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).

Accordingly, mitigation measures have been adopted 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 and Marine Corps 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 (*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).

While the lookout requirements described above do not apply to small boats, small boat crews are trained to detect and avoid all objects on or near the water surface as a standard safety measure. In addition, some training exercises that involve small boats also involve a ship that has lookouts. In such

cases, observations of marine species by shipboard lookouts would be transmitted to the small boats and the avoidance measures applicable to the ship would apply to the small boats.

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 Officer of the Deck 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 was updated in 2006, and the additional training materials are now included as required training for Navy ship and submarine lookouts. Additionally, all Commanding Officers and Executive Officers 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.

North Atlantic right whales are of particular concern. On average one or two right whales are killed annually in collisions. Between 2001 and 2007, at least eight right whales, including four adult females, a juvenile male, a juvenile female, and a female calf died as a result of being struck by ships (MMC 2008; RWC 2007).

In order to reduce the risk of ship strikes, the Navy has instituted North Atlantic right whale mitigation measures that cover vessels operating all along the Atlantic coast. Standing mitigation measures and annual guidance have been in place for ships in the vicinity of the right whale critical habitat off the Southeast coast since 1997. In addition to specific operating guidelines, the Navy's efforts in the southeast include annual funding support to the Early Warning System (EWS), and organization of a communication network and reporting system to ensure the widest possible dissemination of right whale sighting information to Department of Defense and civilian shipping.

In 2002 right whale mitigation measures were promulgated for all Fleet activities occurring in the Northeast region and most recently in December 2004, the Navy issued further guidance for all Fleet ships to increase awareness of right whale migratory patterns and implement additional mitigation measures along the mid-Atlantic coast. This includes areas where ships transit between southern New England and northern Florida. The Navy coordinated with NMFS for identification of seasonal right whale occurrence patterns in six major sections of the mid-Atlantic coast, with particular attention to port and coastal areas of key interest for vessel traffic management. The Navy's resulting guidance calls for extreme caution and operation at a slow, safe speed within 20 nautical mile arcs of specified coastal and port reference points. The guidance reiterates previous instructions that Navy ships post two lookouts, one of whom must have completed marine mammal recognition training, and emphasizes the need for utmost vigilance in performance of these watchstander duties.

The Navy has enacted additional protective measures to protect North Atlantic right whales in the mid-Atlantic region. The mid-Atlantic is a principal migratory corridor for North Atlantic right whales that travel between the calving/nursery areas in the Southeastern United States and feeding grounds in the northeast US and Canada. Transit to the Cherry Point Study Area from mid-Atlantic ports requires Navy vessels to cross the migratory route of North Atlantic right whales. Southward right whale migration generally occurs from mid- to late November, although some right whales may arrive off the Florida coast in early November and stay into late March (Kraus *et al*., 1993). The northbound migration generally takes place between January and late March. Data indicate that during the spring and fall migration, right whales typically occur in shallow water immediately adjacent to the coast, with over half the sightings (63.8%) occurring within 18.5 km (10 nm), and 94.1 percent reported within 55 km (30 nm) of the coast.

Given the low abundance of North Atlantic right whales relative to other species, the frequency of occurrence of ship strikes to right whales suggests that the threat of ship strikes is proportionally greater to this species (Jensen and Silber, 2003). Therefore, in 2004, NMFS proposed a right whale vessel collision reduction strategy to consider the establishment of operational measures for the shipping industry to reduce the potential for large vessel ship strikes of North Atlantic right whales while transiting to and from mid-Atlantic ports during right whale migratory periods (NMFS, 2004). Recent studies of right whales have shown that these whales tend to lack a response to the sounds of oncoming vessels (Nowacek *et al*., 2004a). Although Navy and Marine Corps vessel traffic generally represents only 2 to 3 percent of the overall large vessel traffic, based on this biological characteristic and the presence of critical Navy ports along the whales' mid-Atlantic migratory corridor, the Navy was the first federal agency to adopt additional mitigation measures for transits in the vicinity of mid-Alantic ports during right whale migration.

Specifically, the Navy has unilaterally adopted the following mitigation measures:

- During months of expected North Atlantic right whale occurrence, Navy vessels will practice increased vigilance with respect to avoidance of vessel-whale interactions along the mid-Atlantic coast, including transits to and from any mid-Atlantic ports.
- All surface units transiting within 30 nm of the coast in the mid-Atlantic will ensure at least two watchstanders are posted, including at least one lookout that has completed required marine mammal awareness training.
- Navy vessels will avoid knowingly approaching any whale head on and will maneuver to keep at least 460 m (1,500 ft) away from any observed whale, consistent with vessel safety.

For purposes of these measures, the mid-Atlantic is defined broadly to include ports south and east of Block Island Sound southward to South Carolina. These measures are similar to vessel transit procedures in place since 1997 for Navy vessels in the vicinity of designated right whale critical habitat in the southeastern United States.

Summary

Based on the implementation of Navy mitigation measures, especially during times of anticipated right whale occurrence, and the relatively low density of Navy ships in the Study Area, the likelihood that a vessel collision would occur is very low. However, vessel collisions may affect ESA-listed cetaceans in the Cherry Point Study Area.

West Indian manatees are not expected to occur greater than 3 nm offshore or in relatively deep waters of the Cherry Point OPAREA where most of the vessel movements occur. Therefore, vessel collisions will have no effect on West Indian manatees in the Cherry Point OPAREA. However, West Indian manatees are expected to occur in the nearshore zone and may be affected by vessel collisions associated with shallow water training and transiting to and from ports to the offshore portion of the Cherry Point Range Complex.

In accordance with NEPA, collisions associated with vessel movements in territorial waters would have no significant impact on marine mammals. Furthermore, collisions associated with vessel movements in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114. The Navy is working with NMFS through the ESA consultation and MMPA permitting processes accordingly.

Aircraft Overflights

Overview

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. Marine mammals could be exposed to noise associated with subsonic and supersonic fixed-wing aircraft overflights and helicopter operations while at the surface or while submerged (see Section 3.5 – Noise Environment for a description of the existing noise environment and Appendix H for an overview of airborne and underwater acoustics). In addition to sound, marine mammals could react to the shadow of a low-flying aircraft and/or, in the case of helicopters, surface disturbance from the downdraft.

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 degrees 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-degree 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 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.

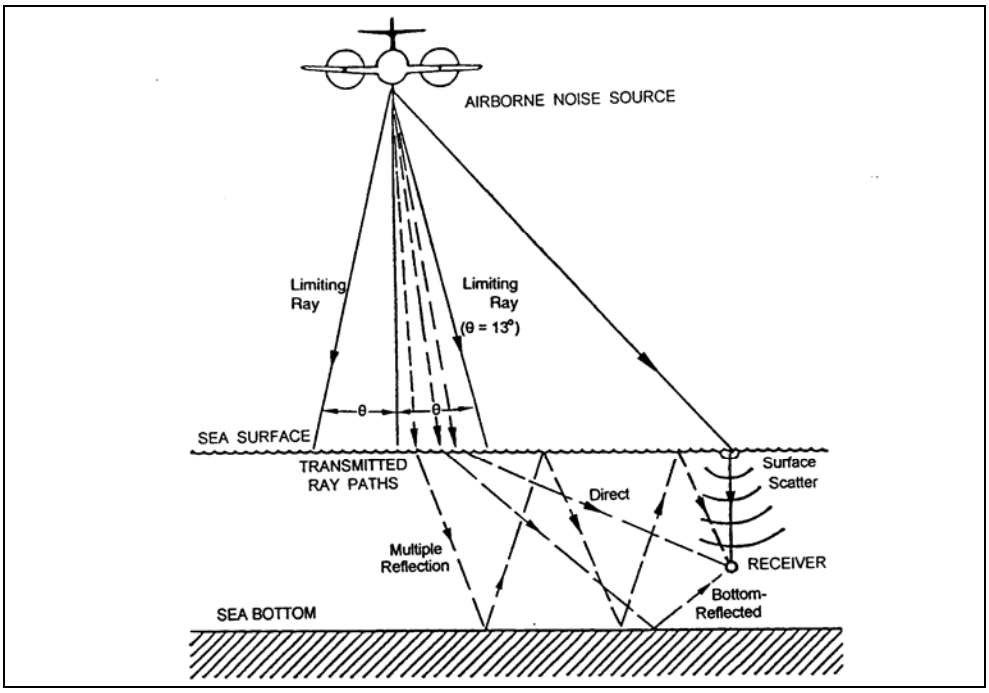


Figure 3.7-5 Characteristics of Sound Transmission through Air-Water Interface

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 knots) at various altitudes (300, 1000, 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 [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 10,000 ft to 28.8 psf at 1,000 ft (Ogden, 1997). Considering an extreme case of a sonic boom that generates maximum overpressure of 50 psf in air, it would become an impulsive wave in water with a maximum peak pressure of 100 psf or about 0.7 pounds per square inch (psi). Therefore, even a worst case situation for 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). Since the paper was written, the threshold has been revised to 23 psi; sonic booms were not analyzed further in the analysis because the 0.7 psi is substantially below the 23 psi threshold.

It should be noted that most of the aircraft overflight exposures analyzed in the studies mentioned above are different than Navy and Marine Corps aircraft overflights. Survey and whale watching aircraft are expected to fly at lower altitudes than typical Navy and Marine Corps 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 and Marine Corps overflights would be very brief, but the noise levels might be higher based on aircraft type and airspeed.

Fixed-Wing Aircraft Overflights

Approximately 3,415 fixed-wing sorties would occur in the OPAREA annually under the No Action Alternative and approximately 98 percent of the sorties would be above 3,000 feet. Under the No Action Alternative, approximately 700 ACM sorties (F/A-18 aircraft) would occur annually (average of 2 sorties per day). Altitudes range from 5,000 to 30,000 feet and typical airspeeds range from very low (less than 100 knots) to high subsonic (less than 600 knots). Sound exposure levels at the sea surface from most ACM overflights are expected to be less than 85 dBA (based on an FA-18 aircraft flying at an altitude of 5,000 feet and at a subsonic airspeed [400 knots]). Some ACM training involves supersonic flight, which produces sonic booms, but such airspeeds are infrequent and occur above 30,000 feet.

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 750 feet) 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) reviewed multiple observations of sperm whale reactions to aircraft. Based on this review, it was concluded that sperm whales do not react to the presence of aircraft every time and that whether a reaction occurs and what type of reaction a whale exhibits is contingent on multiple factors. Reactions included quick diving in response to a brief overflight and a group of sperm whales

responding to a circling aircraft (altitude of 800 to 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. Several sperm whales in the group were observed to turn on their sides, to apparently look up toward the aircraft.

Richter *et al*. (2003) reported that the number of sperm whale blows per surfacing 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.*, 2003).

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 *et al*., 1998). Smaller delphinids also generally display a neutral or startle response (Würsig et al. 1998). Species, such as *Kogia* spp. and beaked whales, that show strong avoidance behaviors with ship traffic, also exhibit disturbance reactions to aircraft (Würsig *et al*., 1998). Although there is little information regarding reactions to aircraft overflights for other cetacean species, it is expected that reactions would be similar to those described above; either no reaction or quick avoidance behavior.

Marine mammals exposed to a low-altitude fixed-wing aircraft overflights could exhibit a short-term behavioral response, but not to the extent where natural behavioral patterns 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. Fixed-wing aircraft overflights would have no effect on the manatee.

Fixed-wing aircraft overflights under the No Action Alternative may affect ESA-listed marine mammals, but are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, fixed-wing aircraft overflights over territorial waters would have no significant impact on marine mammals. Furthermore, fixed-wing aircraft overflights over non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114. The Navy is working with NMFS and USFWS through the ESA consultation and MMPA permitting processes accordingly.

Helicopter Overflights

Approximately 829 helicopter sorties would occur in the Study Area annually under the No Action Alternative. Helicopter overflights can occur throughout the OPAREA. Unlike fixed-wing aircraft, helicopter training operations often occur at low altitudes (75 to 100 ft), which increases the likelihood that marine mammals would respond to helicopter overflights.

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 under the No Action Alternative 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

Helicopter overflights under the No Action Alternative may affect ESA-listed marine mammals, but are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, helicopter overflights over territorial waters would have no significant impact on marine mammals. Furthermore, helicopter overflights over non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114. The Navy is working with NMFS and USFWS through the ESA consultation and MMPA permitting processes accordingly.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, Mine Warfare Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems that are towed through the water by helicopters flying approximately 75 feet above the water at low airspeeds. Under the No Action Alternative, 220 towed device sorties would be conducted per year. Most of these sorties would occur in the Underwater Detonation Area in Onslow Bay, with fewer occurring farther offshore in CVOA North (see Figure 2.2 1). Most of the towed device sorties would occur in shallower waters (30 m or less), where ESA-listed fin whales, humpback whales, and North Atlantic right whales may occur. Blue whales, sei whales, and sperm whales are not expected to occur in the Underwater Detonation Area, but may occur in the CVOA North. The manatee is not expected to occur in the Underwater Detonation Area or the CVOA North. Therefore, towed device use under the No Action Alternative would have no effect on the manatee.

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 would likely 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 MIW 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. The probability of a towed MIW device striking a marine mammal would be extremely low based on mitigation measures. The use of towed MIW devices under the No Action Alternative may affect ESA-listed whales, but the effects of collisions would be discountable because they are extremely unlikely to occur. The use of towed MIW 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. The Navy is working with NMFS and USFWS through the ESA consultation and MMPA permitting processes accordingly.

Munitions Use/Non-Explosive Practice Munitions (NEPM)

Current Navy training operations in the OPAREAs include firing a variety of weapons and employing a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. The majority of ordnance fired in the Cherry Point Study Area consists of NEPM (Table 2.2-6). The analysis presented in this section focuses on NEPM, while potential effects of explosive rounds are analyzed below in the explosives section. Training exercises that involve weapons firing and ordnance use take place in several training areas in the OPAREA (see Table 2.2-6 for a summary of ordnance use by training area).

NEPM Strikes

Direct NEPM strikes and disturbance associated with sound from firing weapons are potential stressors to marine mammals. Ingestion of expended NEPM is also a potential concern for some marine mammal

NEPM Strikes

Direct NEPM strikes and disturbance associated with sound from firing weapons are potential stressors to marine mammals. Ingestion of expended NEPM is also a potential concern for some marine mammal species and is analyzed below under expended materials. The primary concern 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 NEPM was evaluated using statistical probability modeling as described in Appendix I. Model input values include NEPM use data (frequency and type) and marine mammal density data for each season and training area where NEPM use occurs. The model first calculates the probability of a marine mammal being struck and then calculates the number of exposures (marine mammal/NEPM strikes) for the given season and training area. The model outputs for marine mammal/NEPM 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 percent of the time, when in fact, marine mammals spend up to 90 percent of their time under the water (Costa, 1993).
- The model does not take into account standard mitigation measures to avoid and minimize marine mammal/NEPM 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 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 marine mammals would not be struck and that NEPM strikes would have no effect on marine mammals.

Appendix I provides a breakdown of the model input/output values for each group of marine mammals (for which density estimates are available) by training area where NEPM is fired or released. All model output values for every marine mammal species are substantially less than one (Appendix I), indicating that marine mammal/NEPM strikes are extremely unlikely to occur. The probability of a direct NEPM strike is further reduced by Navy mitigation measures (see Chapter 5).

NEPM use under the No Action Alternative would have no effect on ESA-listed marine mammals. For all 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 use in territorial waters would have no significant impact on marine mammals. Furthermore, NEPM use in non-territorial waters would not cause significant harm to marine mammals.

NEPM Disturbance

Sound Transmitted 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, which would produce the highest pressure. Therefore, all analyses were conducted using a 5-inch shell 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 decibels (dB) with reference pressure of one micro Pascal (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 energy flux density (EFD) harassment criteria, the EFD levels (greatest in any 1/3 octave band above 10 Hz) of a 5-inch gun muzzle blast were calculated to be 190 decibels with reference pressure of one micropascal squared in one second (dB re: 1 μPa2-sec) directly below the gun muzzle decreasing to 170 dB re: 1 μPa2-sec at 100 m (328 feet) 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 implementing operations, would 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, non-explosive ordnance use in territorial waters would have no significant impact on marine mammals. Furthermore, non-explosive ordnance use in non-territorial waters would not cause significant harm to marine mammals.

Sound Transmitted 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 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, NEPM use in territorial waters would have no significant impact on marine mammals. Furthermore, NEPM use in non-territorial waters would not cause significant harm to marine mammals.

Underwater Detonations and High Explosive Ordnance

Overview

Explosions that occur in the OPAREA are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), and 5-inch HE naval gun shells (FIREX with IMPASS), as well as underwater detonations associated with Mine Neutralization training (MINEX). Explosive ordnance use and underwater detonations are limited to specific training areas (Figure 3.7-6).

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.

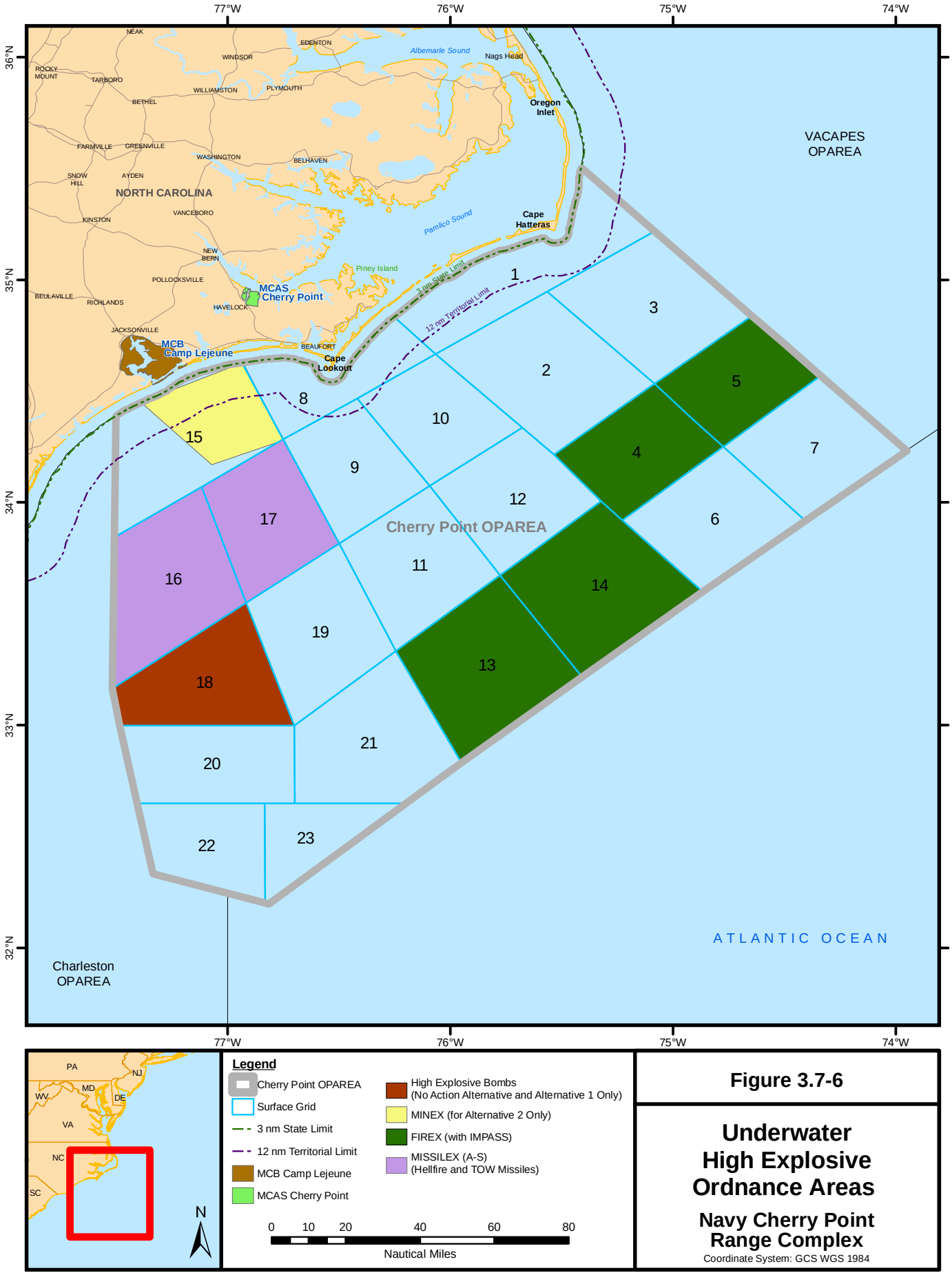


Figure 3.7-6

Underwater High Explosive Ordnance Areas

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

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.

Summary of Exposure Results for Individual Marine Mammals

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. Tables 3.7-13 and 3.7-14 provide summaries of the explosive analysis results for the No Action Alternative. For each species, in order to determine the total non-injurious (MMPA Level B) potential exposures for all operations, the two columns for non-injurious exposures (182 dB/23 psi criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables (Tables 3.7-13 and 3.7-14). For each species, the total for injurious (MMPA Level A) potential exposures can be determined by adding the 205 dB re 1 mPa^2-s/13 psi-ms columns together between the two tables. No mortality potential exposures are predicted.

Table 3.7-13 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – No Action Alternative

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin Whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Atlantic Spotted dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	1	0	0
Total Exposures	1	0	0

Table 3.7-13 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – No Action Alternative (Continued)

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Beaked whale			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
BOMBEX training	3	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	3	0	0
Clymene dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Common dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Minke whale			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pilot whales			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.7-13 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – No Action Alternative (Continued)

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Risso's dolphin			
BOMBEX training	1	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Rough-toothed dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Striped dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.7-14 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – No Action Alternative

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin Whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
BOMBEX training	4	0	0
FIREX training	0	0	0
Total Exposures	4	0	0
North Atlantic right whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0

Table 3.7-14 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – No Action Alternative (Continued)

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Atlantic Spotted dolphin			
BOMBEX training	208	5	0
FIREX training	0	0	0
Total Exposures	208	5	0
Beaked whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
BOMBEX training	1,724	38	0
FIREX training	0	0	0
Total Exposures	1,724	38	0
Clymene dolphin			
BOMBEX training	58	1	0
FIREX training	0	0	0
Total Exposures	58	1	0
Common dolphin			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX training	6	0	0
FIREX training	0	0	0
Total Exposures	6	0	0
Minke whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
BOMBEX training	122	3	0
FIREX training	0	0	0
Total Exposures	122	3	0
Pilot whales			
BOMBEX training	68	2	0
FIREX training	0	0	0
Total Exposures	68	2	0
Risso's dolphin			
BOMBEX training	678	16	0
FIREX training	0	0	0
Total Exposures	678	16	0

Table 3.7-14 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – No Action Alternative (Continued)

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Rough-toothed dolphin			
BOMBEX training	3	0	0
FIREX training	0	0	0
Total Exposures	3	0	0
Striped dolphin			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0

Humpback, sperm whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, *Kogia* spp., pantropical spotted dolphins, pilot whales, Risso's dolphins, and rough-toothed dolphins may be exposed at levels that could result in behavioral disturbance (Table 3.7-14, 177 dB column). Atlantic spotted dolphins, bottlenose dolphins, and Risso's dolphins may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.7-13, 182 dB/23 psi column). Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, pantropical spotted dolphins, pilot whales, and Risso's dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.7-13 and 3.7-14, 205 dB/13 psi-ms column). No marine mammals are expected to be exposed to levels that would result in mortality (Tables 3.7-13 and 3.7-14, 30.5 psi-ms column).

Exposure estimates could not be calculated for several species (blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, Fraser's dolphin, Atlantic white-sided dolphin, and harbor porpoise) 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. In addition to the low likelihood of exposure, mitigation measures presented in Chapter 5 would be implemented prior to the release of ordnance. Therefore, no exposures are expected for blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, Fraser's dolphin, Atlantic white-sided dolphin, and harbor porpoise.

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 would monitor the area before ordnance is used. Fin, humpback whales, and 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, common, pantropical spotted dolphins, Risso's dolphins, and rough-toothed dolphins. Implementation of mitigation measures will likely reduce the potential effects to marine mammals.

Effects on Marine Mammal Populations

Effects from the use of HE 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 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 Tables 3.7-13 and 3.7-14 represent estimated harassment and injury, as described above, they are probably over estimates as the model calculates harassment without taking into consideration standard mitigation measures.

Endangered Species Act Conclusions

Underwater detonations and HE ordnance use in the No Action Alternative may affect fin, North Atlantic right whales, humpback, sei, blue, and sperm whales; however, the effects on blue and sei whales are most likely discountable due to the low likelihood of encountering these species within the Study Area. Underwater detonations and HE ordnance use would have no effect on the manatee because these exercises take place greater than 3 nm offshore where manatees are not expected to occur.

Marine Mammal Protection Act Conclusions

Humpback whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, *Kogia* spp., pantropical spotted dolphins, pilot whales, Risso's dolphins, and rough-toothed dolphins may be exposed at levels that would constitute Level B harassment under the MMPA. Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphin, pantropical spotted dolphins, pilot whales, and Risso's dolphins may be exposed at levels that would constitute Level A harassment under the 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.

National Environmental Policy Act and Executive Order 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under the No Action Alternative would affect individual marine mammals, but any effects observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA, there would be no significant impact to marine mammal populations from explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammal populations resulting from explosive ordnance use during training exercises in non-territorial waters.

Military Expended Materials

Ordnance-Related Materials

Ordnance-related materials include various sizes of non-explosive training rounds and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). The solid metal materials would quickly move through the water column and settle to the sea floor. These components may also change the topography of the benthic habitat by creating craters due to impacts or increasing the height of the sea floor through displacement of sediment or presence of the material themselves. Once on the sea floor, ordnance will become part of the marine environment until broken down by natural processes. Their presence could alter the long-term make up of the benthic habitat and add anthropogenic foreign objects to the marine environment. The analyses presented in Sections 3.2.3 and 3.3.3 indicate that these materials would become encrusted by natural processes and incorporated into the seafloor, with no significant accumulations in any particular area and no negative effects to water quality. However, benthic foraging marine mammals could be exposed to expended ordnance through ingestion. Ingestion of expended ordnance is not expected to occur in the water column because ordnance quickly sinks.

Some materials such as an intact non-explosive practice bomb would be too large to be ingested by a marine mammal, but many materials such as cannon shells, small caliber ammunition, and shrapnel are small enough to be ingested. Records indicate that generally metal debris ingested by marine mammals are 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. A documented instance indicates that certain types of metal debris, in this case a lead sinker, may cause toxicosis in marine mammals (Zabka *et al*., 2006). Ordnance materials, made of different alloys than a sinker, would not necessarily cause a similar physiological reaction. Another instance of lead toxicosis was documented in a captive bottlenose dolphin that had ingested 55 air gun pellets (which contain 40% lead) resulting in mortality (Schlosberg et al. 1997). Expended ordnance which contains lead may have the potential to induce toxicosis in marine mammals in some circumstances.

Ingestion of marine debris in general can also 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 along the coast where ordnance is not used. Blue, fin, North Atlantic right, 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). This behavior has been observed on Stellwagen Bank off eastern Massachusetts. Although observations of humpback whales feeding in mid-Atlantic waters (Swingle *et al.*, 1993; Smith *et al*., 1996) have led to the supposition that a supplemental winter feeding ground may exist in the U.S. mid-Atlantic (Barco *et al.*, 2002), humpback whale feeding primarily takes place farther north than the OPAREA (CETAP, 1982; Whitehead, 1982; Kenney and Winn, 1986; Weinrich *et al*., 1997). Humpback whales are not expected to ingest ordnance because feeding in the OPAREA would be limited and they primarily feed in the water column. 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 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 activities. 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; Smith *et al.*, 1996; Waring *et al.*, 2001; Davis *et al*., 2002). Consequently, the likelihood that a sperm whale would encounter and subsequently ingest a piece of expended ordnance is extremely low. Ordnance ingestion under the No Action Alternative may affect sperm whales, but the effects would be considered discountable because ingestion is extremely unlikely to occur.

Baleen and toothed whales and harbor seals, 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. In addition, an animal would not likely ingest every piece of ordnance that it encounters. Thus, it is unlikely that an animal would both encounter and ingest ordnance. 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

A variety of at-sea target types are 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 airborne 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 lbs, 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) 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 listed 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 percent 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-cm 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. 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 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).

Various types of chaff systems are used in the Navy Cherry Point Study Area. Fixed-wing aircraft use RR-144A/AL chaff cartridges, which contain about 150 grams 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 inches in diameter and 0.13 inches thick (Spargo 2007). As summarized in Table 3.7-15, a total of 6,550 RR-144A/AL cartridges would be used per year under the No Action Alternative. The amount of chaff used on any given day varies based on scheduled training events and could range from 0 to 360 cartridges per day.

Ships use MK-214 or MK-216 Super Rapid Off-board Chaff. The MK-214 contains about 11 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. As summarized in Table 3.7-15, a total of 396 MK-214 and MK-216 cartridges would be used per year in the OPAREA.

Based on the dispersion characteristics of chaff, large areas of open water within the OPAREA would be exposed to chaff, but the chaff concentrations would be low. For example, Hullar *et al.* (1999) calculated that a 4.97 miles by 7.46 miles (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 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 upon 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. Some fibers would likely become entrained in *Sargassum* mats and remain at or near the surface for longer periods of time. Consequently, chaff concentrations in *Sargassum* mats might be relatively higher than those in the water column or on the bottom.

Table 3.7-15 summarizes changes in chaff use and relative environmental concentrations that could occur under the proposed action. Note that the relative environmental concentrations presented in Table 3.7-15 are based on the assumption that the chaff would be evenly distributed in the area where it is used, and are primarily presented for comparison purposes. Actual concentrations would depend upon the factors discussed above and would be dynamic. Nonetheless, actual chaff concentrations are expected to be low. For example, a chaff concentration of 1.8 $fibers/ft^2$ would be expected given a totally unrealistic (worst-case) assumption of simultaneous release of 360 RR-144A/AL chaff cartridges at a single release point.

Several literature reviews and controlled experiments indicate that chaff poses little environmental 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. Nonetheless, some marine mammal species within the OPAREA 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. Manatees would not be exposed to measurable concentrations of chaff because chaff use is limited to the OPAREA and manatees are only expected to occur in shallow, nearshore waters. Therefore, chaff is not considered a potential stressor to manatees and chaff use under the No Action Alternative would have no effect on manatees.

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).

Table 3.7-15 Chaff Use and Relative Environmental Concentrations that Could Occur per Alternative

Annual Chaff Use and Relative Concentration[1]	No Action	Alternative 1	Alternative 2
W-122 - RR-144A/AL Cartridges			
Number of Cartridges	6,550	7,160	7,160
Chaff Released (kg/year)	982.50	1074	1074
Relative Chaff Concentration (kg/nm^2/year)[1]	.052	.057	057
Relative Chaff Concentration (fibers/nm^2/year)[1]	1,726,774	1,887,588	1,887,588
Number of End Caps and Pistons	13,100	14,320	14,320
Relative End Cap/Piston Concentration (pieces/nm^2/year)[1]	.691	.755	.755
OPAREA – MK-214 and MK-216 Cartridges			
Number of Cartridges	396	444	444
Chaff Released (kg/year)	4,030	4,517	4,517
Relative Chaff Concentration (kg/nm^2/year)[1]	0.216	0.243	0.243
Relative Chaff Concentration (fibers/nm^2/year)[1]	7,214,911	8,087,232	8,087,232

[1]*Concentration based on even dispersion in W-122 (18,966 nm^2).*

The potential exits 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 effects of chaff inhalation on marine mammals are 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 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 (Systems Consultants, 1977), 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 (1,000 times the exposure level expected to be found in Chesapeake Bay). 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 second most abundant element in the earth's crust, making up approximately 28.2 percent 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 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) (Takizawa *et al*., 1988).

Aluminum is the third most abundant element in the earth's crust, making up approximately 8.2 percent 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 (as summarized in 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. Rates 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 OPAREA. In addition, 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/L (Haley and Kurnas, 1992). 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 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). In addition, 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 could 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-inch diameter, 0.13-inch 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 (13,100), the low environmental concentration (0.69 pieces/nm^2/year, see Table 3.7-15), and the fact that sperm whale foraging is expected to be limited to areas east of the continental shelf break. If ingested, it is likely that the small, 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 endcap 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. Manatees would not be exposed to chaff because use is limited to offshore areas where these animals are not expected to occur. Chaff use would have no effect on the manatee. 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 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. 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 2,100 self-protection flares would be used 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 OPAREA 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 the wide-spread and infrequent use. Flare end-caps have similar properties as chaff end-caps and pistons, therefore, the analysis of potential impacts from chaff end-caps and pistons is applicable to flare end-caps as well. 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. 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 marker produces chemical flames and regions of surface smoke and is used in various training exercises to mark a surface position to simulate divers, ships, and points of contact on the surface of the ocean. 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. 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 three 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 pounds, 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. Approximately 230 marine markers would be used in the Study Area per year 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 larger 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 (230). Marine markers would have no effect on the manatee because they are used in offshore areas where these animals are not expected to occur. Marine marker ingestion under the No Action Alternative may affect ESA-listed marine mammals, 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.

TOW Missile Guide Wires

The No Action Alternative includes firing four TOW missiles per year in Areas 16 and 17. This missile system has two thin (5.75 mils or 0.146 mm diameter) wires that provide a passive line for transmission of steering commands from the aircraft to the missile. Two wire dispensers are mounted on the rear of the missile. These dispensers contain 3,750 m each of single-strand wire with a minimum tensile strength of 10 pounds. The copper-plated high carbon steel wire has an enamel coating. The guide wires are not recoverable when a missile is fired at sea. Corrosion or degradation rates for the wire in seawater are unknown, but they could persist for relatively long periods given the corrosion resistance of copper and the enamel coating. The length of wire dispensed would generally be equal to the distance the missile travels to impact the target. Undispensed wire would be contained in the dispensers upon impact.

Marine mammals could become entangled in a TOW missile guide wire in the water column or after it has settled to the sea floor. Entanglement could lead to sublethal or lethal effects. As discussed below, the likelihood of a marine mammal encountering and becoming entangled in a TOW missile guide wire depends on several factors. The long length of the guide wire increases the likelihood that a marine mammal could encounter a guide wire and become entangled, but only four missiles would be fired and eight guide wires would enter the water per year. After entering the water, guide wires would be in the water column for a relatively brief period of time as they slowly sink to the bottom. Therefore, the chance of entanglement occurring in the water column would be low. The risk of entanglement would be highest for marine mammal species such as sperm whales or beaked whales that forage on or near the bottom. Sperm whales and beaked whales are expected to occur in deep waters of the Navy Cherry Point Study Area, seaward of the continental shelf break. TOW missiles would be fired in Areas 16 and 17, which are landward of the shelf break in relatively shallow waters (30 to 50 m). While a guide wire could be transported by currents, most are expected to sink in Areas 16 and 17. Therefore, the likelihood of a sperm whale or beaked whale encountering and becoming entangled in a TOW missile guide wire is extremely low.

TOW missile guide wires would have no effect on the manatee because they are used in offshore areas where these animals are not expected to occur. TOW missile guide wires may affect ESA-listed whales under the No Action Alternative, but the effects would be considered discountable because entanglement is extremely unlikely to occur. TOW missile guide wires are 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 TOW missile guide wires in territorial waters because TOW missiles are not used in territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from TOW missile guide wires in non-territorial waters.

3.7.3.4 Alternative 1

Vessel Movements

The number of operations involving vessel movements would increase in the Study Area under Alternative 1 with a total of 950 steaming days per year; an increase of 6% percent over the No Action Alternative (Table 2.2-5). These changes would result in increased potential for short-term behavioral reactions to vessels. Potential for collision would increase slightly compared to the No Action Alternative; however, mitigation measures (see Chapter 5) would reduce the probability. Vessel movements under Alternative 1 would have no effect on the manatee, but may affect ESA-listed whales. Vessel movements are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, vessel movements would have no significant impact on marine mammals in territorial waters. Furthermore, vessel movements would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Aircraft Overflights

The number of operations involving fixed-wing aircraft overflights would increase 10 percent to 3,755 in the Study Area under Alternative 1. These changes would result in increased exposures of marine mammals to fixed-wing overflights. Elevated numbers of overflights would increase the potential for behavioral disturbance from sound and shadow-effects. Operations involving helicopter overflights would increase 16 percent to 878 per year. Behavioral reactions to fixed-wing and helicopter overflights would be the same as discussed under the No Action Alternative, although exposure to aircraft overflights may increase under this alternative. Aircraft overflights under Alternative 1 would have no effect on the manatee, but may affect ESA-listed whales. 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 EO 12114.

Towed Mine Warfare Devices

Towed MIW device activities would decrease 13 percent under Alternative 1; therefore, the analysis presented for the No Action Alternative is applicable to Alternative 1. The use of towed MIW devices under Alternative 1 would have no effect on the manatee. The use of towed MIW devices under Alternative 1 may affect ESA-listed marine mammals, but the effects of collisions would be discountable because they are extremely unlikely to occur. Towed MIW devices are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, towed MIW devices would have no significant impact on marine mammals in territorial waters. Furthermore, towed MIW devices would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Non-Explosive Practice Munitions

Non-Explosive Practice Munitions Strikes

The amount of NEPM fired would increase in the OPAREA under Alternative 1 (Table 2.2-5 and 2.2-6). These changes would result in increased potential exposure for marine mammal ordnance strikes in the OPAREA compared to baseline conditions. However, NEPM strike modeling predicts that no marine mammals would be exposed to direct NEPM strikes under Alternative 1 (see Appendix I). Additionally, 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.

Weapons Firing Disturbance

The number of weapons firings in the OPAREA would increase under Alternative 1. Based on the discussion under the No Action Alternative above, the sound from firing of weapons would not result in an exposure of marine mammals; therefore any additional weapon firings would have no effect on marine mammals. Weapons-firing sound disturbance under Alternative 1 would have no effect on listed marine mammal species. Weapons-firing sound disturbance is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, weapons-firing sound disturbance would have no significant impact on marine mammals in territorial waters. Furthermore, weapons-firing sound disturbance would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Underwater Detonations and High Explosive Ordnance

Overview

The number and location of explosions occurring in the Study Area would not change under Alternative 1 with the exception of MISSILEX (Hellfire and TOW; Tables 2.2-5 and 2.2-7). Under Alternative 1 two additional Hellfire missile explosions and four additional TOW explosions would occur in the OPAREA.

Summary of Exposure Results for Individual Marine Mammals

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, assumptions, and all results of the explosive analysis. Tables 3.7-16 and 3.7-17 provide summaries of the explosive analysis for Alternative 1. As discussed for the No Action Alternative, effects from exposure to explosives vary depending on the level of exposure.

Table 3.7-16 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – Alternative 1

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Atlantic spotted dolphin			
BOMBEX training	0	0	0
MISSILEX Training	1	0	0
MINEX training	1	0	0
Total Exposures	2	0	0

Table 3.7-16 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – Alternative 1 (Continued)

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Beaked whale			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
BOMBEX training	3	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	3	0	0
Clymene dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Common dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Minke whale			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pilot whales			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.7-16 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – Alternative 1 (Continued)

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Risso's dolphin			
BOMBEX training	1	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Rough-toothed dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Striped dolphin			
BOMBEX training	0	0	0
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.7-17 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – Alternative 1

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
BOMBEX training	4	0	0
FIREX training	0	0	0
Total Exposures	4	0	0
North Atlantic right whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0

Table 3.7-17 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – Alternative 1 (Continued)

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Atlantic spotted dolphin			
BOMBEX training	208	5	0
FIREX training	0	0	0
Total Exposures	208	5	0
Beaked whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
BOMBEX training	1,724	38	0
FIREX training	0	0	0
Total Exposures	1,724	38	0
Clymene dolphin			
BOMBEX training	58	1	0
FIREX training	0	0	0
Total Exposures	58	1	0
Common dolphin			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX training	6	0	0
FIREX training	0	0	0
Total Exposures	6	0	0
Minke whale			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
BOMBEX training	122	3	0
FIREX training	0	0	0
Total Exposures	122	3	0
Pilot whales			
BOMBEX training	68	2	0
FIREX training	0	0	0
Total Exposures	68	2	0

Table 3.7-17 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area – Alternative 1 (Continued)

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Risso's dolphin			
BOMBEX training	678	16	0
FIREX training	0	0	0
Total Exposures	678	16	0
Rough-toothed dolphin			
BOMBEX training	3	0	0
FIREX training	0	0	0
Total Exposures	3	0	0
Striped dolphin			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0

Humpback whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphin, *Kogia* spp., pantropical spotted dolphins, pilot whales, Risso's dolphins, and rough-toothed dolphins may be exposed at levels that could result in behavioral disturbance (Table 3.7-17, 177 dB column). Atlantic spotted dolphins, bottlenose dolphins, and Risso's dolphins may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.7-16, 182 dB/23 psi column). Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, pantropical spotted dolphins, pilot whales, and Risso's dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.7-16 and 3.7-17, 205 dB/13 psi-ms column). No mortalities are predicted (Tables 3.7-16 and 3.7-17, 30.5 psi-ms column).

Exposure estimates could not be calculated for several species (blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, Fraser's dolphin, Atlantic white-sided dolphin, and harbor porpoise) 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. For the same reasons discussed under the No Action Alternative, no exposures are expected for blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, Fraser's dolphin, Atlantic white-sided dolphin, and harbor porpoise. As discussed for the No Action Alternative implementation of mitigation measures under Alternative 1 would likely reduce the potential effects to all marine mammals.

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 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 Tables 3.7-16 and 3.7-17 represent estimated harassment and injury, as described above, they are probably over estimates as the model calculates harassment without taking into consideration standard mitigation measures.

Endangered Species Act Conclusions

Underwater detonations and HE ordnance use under Alternative 1 may affect fin, North Atlantic right whales, humpback, sei, blue, and sperm whales; however, the effects on blue and sei whales are most likely discountable due to the low likelihood of encountering these species within the Study Area. Underwater detonations and HE ordnance use would have no effect on the manatee because these exercises take place greater than 3 nm offshore where manatees are not expected to occur.

Marine Mammal Protection Act Conclusions

Humpback whales, Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, *Kogia* spp., pantropical spotted dolphins, pilot whales, Risso's dolphins, and rough-toothed dolphins may be exposed at levels that would constitute Level B harassment under the MMPA. Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphin, pantropical spotted dolphins, pilot whales, and Risso's dolphins may be exposed at levels that would constitute Level A harassment under the 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.

National Environmental Policy Act and Executive Order 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under Alternative 1 would affect individual marine mammals, but any effects observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA, there would be no significant impact to marine mammal populations from explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammal populations resulting from explosive ordnance use during training exercises in non-territorial waters.

Military Expended Materials

Ordnance-Related Materials

The amount of ordnance fired would increase in the OPAREA under Alternative 1 (Table 2.2-5 and 2.2-6). Similar to the No Action Alternative, only sperm whales would potentially be exposed to expended ordnance via ingestion from foraging off the bottom. Based on sperm whale habitat preferences and known feeding behaviors discussed above, it is extremely unlikely that they would encounter and ingest expended ordnance. Ingestion of ordnance under Alternative 1 may affect the sperm whale, but the effects would be discountable. Ordnance ingestion under Alternative 1 would have no effect on the manatee, blue whale, fin whale, humpback whale, North Atlantic right whale, or sei whale based on the feeding habits of these species. Ordnance-related materials would not be 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

The number of targets used in the Study Area would increase under Alternative 1 (Table 2.2-5). As discussed above for the No Action Alternative, species that feed on or near the bottom (*i.e.*, sperm whales) 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 Alternative 1 would also have no effect on listed marine mammals. Targets would not be 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

The amount of chaff used in the OPAREA would increase by about 12 percent per year under Alternative 1 (Tables 2.2-5 and 3.7-14). This increase in chaff use would result in negligible increases in relative environmental concentrations of chaff fibers, end caps, and pistons (Table 3.7-15). Similar to the No Action Alternative, effects of direct body contact, inhalation, and any changes to water or sediment quality would continue to be insignificant. The potential for marine mammals to ingest chaff fibers would increase under Alternative 1, but ingestion of a toxic dose (greater than 1,000 mg/kg) would continue to be highly unlikely based on the anticipated low environmental concentration (1.8 fibers/ft^2). Sperm whales could ingest chaff end caps and pistons under Alternative 1, but the likelihood of ingest remains extremely low based on the low environmental concentration (0.76 pieces/nm^2). If ingested, it is likely that the small end cap or piston would be excreted without causing harm. Chaff use under Alternative 1 would have no effect on the manatee and may affect other ESA-listed marine mammals. Chaff use would not be 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

The number of self-protection flares used in the Study Area would increase under Alternative 1 from 2100 to 2335 per year (11%). Similar to the No Action Alternative, ingestion of flare end caps under Alternative 1 would have no effect on the manatee and may affect marine mammals, but the effects would be considered discountable because ingestion is extremely unlikely to occur. Self-protection flares 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 EO 12114.

Marine Markers

The number of marine markers used in the Study Area would increase from 230 to 250 per year under Alternative 1. Similar to the No Action Alternative, the probability of ingestion is extremely low based on the low number of marine markers expended per year. Marine markers would have no effect on the manatee because they are used in offshore areas where these animals are not expected to occur. Marine marker ingestion under Alternative 1 may affect ESA-listed marine mammals, 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.

TOW Missile Guide Wires

The number of TOW missiles fired under Alternative 1 would increase from four to eight per year and the number of guide wires entering the water would increase from eight to 16 per year. Therefore, the potential for marine mammals to become entangled in a TOW missile guide wire would increase.

As discussed for the No Action Alternative, guide wires would be in the water column for a relatively brief period of time as they slowly sink to the bottom. Therefore, the chance of entanglement occurring in the water column would be low. The risk of entanglement would be highest for marine mammal species such as sperm whales or beaked whales that forage on or near the bottom. Sperm whales and beaked whales are expected to occur in deep waters of the Navy Cherry Point Study Area, seaward of the continental shelf break. TOW missiles would be fired in Areas 16 and 17, which are landward of the shelf break in relatively shallow waters (30 to 50 m). While a guide wire could be transported by currents, most are expected to sink in Areas 16 and 17. Therefore, the likelihood of a sperm whale or beaked whale encountering and becoming entangled in a TOW missile guide wire is extremely low.

TOW missile guide wires would have no effect on the manatee because they are used in offshore areas where these animals are not expected to occur. TOW missile guide wires may affect ESA-listed marine mammals under Alternative 1, but the effects would be considered discountable because entanglement is extremely unlikely to occur. TOW missile guide wires are 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 TOW missile guide wires in territorial waters because TOW missiles are not used in territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from TOW missile guide wires in non-territorial waters.

3.7.3.5 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements that would occur under Alternative 2 would be the same as Alternative 1 (Table 2.2 5). Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Vessel movements under Alternative 2 would have no effect on the manatee and may affect ESA-listed whales. Vessel movements are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, vessel movements would have no significant impact on marine mammals in territorial waters. Furthermore, vessel movements would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Aircraft Overflights

The number of operations involving fixed-wing aircraft overflights would increase 7 percent to 3,668 in the Study Area under Alternative 2. These changes would result in increased exposures of marine mammals to fixed-wing overflights. Elevated numbers of overflights would increase the potential for behavioral disturbance from sound and shadow-effects. Operations involving helicopter overflights would increase 83 percent to 1,390 per year. Behavioral reactions to fixed-wing and helicopter overflights would be the same as discussed under the No Action Alternative, although exposure to aircraft overflights may increase under this alternative. Aircraft overflights under Alternative 2 would have no effect on the manatee and may affect ESA-listed marine mammals. 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 EO 12114.

Towed Mine Warfare Devices

Towed MIW device sorties would increase from 220 to 576 per year (13%) under Alternative 2. Therefore, the potential for marine mammals to be struck by towed devices would increase. Most of these sorties would occur in the proposed Mine Warfare Training Area, which would be established in Onslow Bay under Alternative 2 (Figure 2.2-1). Some towed devices sorties would continue to take place farther offshore in the CVOA North.

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 would likely 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 MIW 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. The probability of a towed MIW device striking a marine mammal would be extremely low based on Navy mitigation measures.

The use of towed MIW devices under Alternative 2 would have no effect on the manatee because these exercises would not take place in the very nearshore waters where manatees could occur. The use of towed MIW devices under Alternative 2 may affect ESA-listed marine mammals, but the effects of collisions would be discountable because they are extremely unlikely to occur. The use of towed devices would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, towed devices would have no significant impact on marine mammals in territorial waters. Furthermore, towed devices would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

As discussed in Chapter 2, new Mine Warfare Training Areas would be established in the inshore area of Onslow Beach. This section addresses potential effects on marine mammals associated with establishing and maintaining these training areas (*i.e.*, temporary mine shape deployment/recovery). The effects of conducting training exercises in these areas are analyzed under aircraft overflights, towed MIW devices, and explosions.

The effects of Mine Warfare Training Area establishment would be limited to short-term and localized disturbances of the water column and benthic habitat associated with deployment and recovery of temporary mine shapes. As discussed in Chapter 2, the mine shape assembly includes a concrete anchor, mooring line, and the inert mine shape. In some cases the entire assembly (mine shape, mooring line, and anchor) would be deployed concurrently from a boat or aircraft and recovered immediately following the exercise. In other cases concrete anchors would be permanently placed on the sea floor and divers would attach the mooring lines and mine shapes for specific exercises. The mine shape deployment and recovery process would have no effect on marine mammals. The mooring lines (0.3-0.5-in diameter) would not present an entanglement risk for marine mammals because they are held taut by the anchor and mine shape. Entanglement of marine mammals usually occurs in fishing gear, ropes, and other flexible material that can wrap around the body or body parts of an animal (Laist, 1997). Mooring lines would only be left in place for as long as the mine shape is in the water (typically 7 to 30 days). Mine shape deployment and recovery under Alternative 2 would have no effect on marine mammals.

Non-Explosive Practice Munitions

NEPM Strikes

The amount of NEPM used would increase in the OPAREA under Alternative 2 (non-explosive practice bombs) (Table 2.2-5 and 2.2-6). These changes would result in increased potential exposure for marine mammal ordnance strikes in the OPAREA compared to baseline conditions. However, NEPM strike modeling predicts that no marine mammals would be exposed to direct NEPM strikes under Alternative 2 (see Appendix I). Additionally, 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.

Disturbance

The number of weapons firings in the OPAREA would increase under Alternative 2. Based on the discussion under the No Action Alternative above, the sound from firing of weapons would not result in an exposure of marine mammals; therefore any additional weapon firings would have no effect on marine mammals. Weapons-firing sound disturbance under Alternative 2 would have no effect on ESA-listed marine mammal species. Weapons-firing sound disturbance is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, weapons-firing sound disturbance would have no significant impact on marine mammals in territorial waters. Furthermore, weapons-firing sound disturbance would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Underwater Detonations and High Explosive Ordnance

Overview

The number and location of explosions occurring in the Study Area would not change under Alternative 2 with the exception of BOMBEX. Under Alternative 2 explosive ordnance associated with BOMBEX would no longer occur.

Summary of Exposure Results for Individual Marine Mammals

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, assumptions, and all results of the explosive analysis. Tables 3.7-18 and 3.7-19 provide summaries of the explosive analysis for Alternative 2. As discussed for the No Action Alternative, effects from exposure to explosives vary depending on the level of exposure.

No marine mammals are expected to be exposed at levels that could result in behavioral disturbance from the use of multiple explosives (Table 3.7-19, 177 dB column). Atlantic spotted dolphins may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.7-18, 182 dB/23 psi column). No marine mammals are expected to be exposed at levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.7-18 and 3.7-19, 205 dB/13 psi-ms column). Under Alternative 2 no marine mammals would be exposed at levels that would result in mortality (Tables 3.7-18 and 3.7-19, 30.5 psi-ms column).
Exposure estimates could not be calculated for several species (blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, Fraser's dolphin, Atlantic white-sided dolphin, and harbor porpoise) because density data could not be calculated due to the limited available data for these species. For the same reasons discussed under the No Action Alternative, no exposures are expected for blue whale, sei whale, Bryde's whale, killer whale, pygmy

killer whale, false killer whale, melon-headed whale, spinner dolphin, Fraser's dolphin, Atlantic white-sided dolphin, and harbor porpoise. As discussed for the No Action Alternative implementation of mitigation measures under Alternative 2 would likely reduce the potential effects to all marine mammals.

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 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 only Atlantic spotted dolphins may be exposed at levels that could result in temporary threshold shift or non-injurious physiological effects (total of 2 exposures). Atlantic spotted dolphins are among the most abundant marine mammals in the study area and the small number of potential exposures would be negligible from a population standpoint.
- The exposure analysis predicts that no marine mammals would be exposed to levels that would result in mortality.
- Although the numbers presented in Tables 3.7-18 and 3.7-19 represent estimated harassment and injury, as described above, they are probably over estimates as the model calculates harassment without taking into consideration standard mitigation measures.

Endangered Species Act Conclusions

Underwater detonations and HE ordnance use under Alternative 2 may affect fin, North Atlantic right whales, humpback, sei, blue, and sperm whales. However, the explosive analysis predicts no exposures for these ESA-listed whales. Therefore, the effects are unlikely to occur and are considered discountable. Furthermore, effects on blue and sei whales are most likely discountable due to the low likelihood of encountering these species within the Study Area. The Navy has initiated the ESA Section 7 formal consultation process with NMFS for listed whales and Alternative 2.

Underwater detonations and HE ordnance use would have no effect on the manatee because these exercises take place greater than 3 nm offshore where manatees are not expected to occur. The Navy has completed the ESA Section 7 informal consultation process with USFWS for the manatee. In a letter dated October 7, 2008 (Appendix C), the USFWS concurred with the Navy's determination that explosive ordnance use under Alternative 2 (the Preferred Alternative) would have no effect on the manatee.

Marine Mammal Protection Act Conclusions

Atlantic spotted dolphins may be exposed at levels that would constitute Level B harassment under the MMPA. No marine mammals would be exposed at levels that would constitute Level A harassment under the 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. The Navy has submitted to NMFS an application for a Letter of Authorization under MMPA for Alternative 2 (the Preferred Alternative).

Although the acoustic analysis for Alternative 2 (the Preferred Alternative) predicted that Atlantic spotted dolphins would be the only species potentially exposed to sound levels that might result in Level B Harassment, NMFS recommended (and the Navy concurred) that the rulemaking consider the potential for the Level B harassment of a very small number of individuals of other common species to ensure MMPA compliance in the unlikely event that individuals of these species are encountered in the

vicinity of an exercise. Due to the higher abundances of Atlantic spotted, bottlenose, common, striped, and Risso's dolphins in the Study Area, and the fact that these species tend to congregate in relatively large groups, there is an increased chance they may be exposure if not detected in advance by Navy watchstanders or lookouts.

National Environmental Policy Act and Executive Order 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under Alternative 2 would affect individual marine mammals (Atlantic spotted dolphins), but any effects observed at the population, stock, or species level would be negligible because only two exposures would occur at levels that could result in temporary threshold shift or non-injurious physiological effects. Therefore, in accordance with NEPA, there would be no significant impact to marine mammal populations from explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammal populations resulting from explosive ordnance use during training exercises in non-territorial waters.

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. Furthermore, the Navy is working with NMFS through the ESA Section 7 consultation process and MMPA permitting process to ensure that unavoidable significant effects to marine mammals do not result from implementation of the proposed action.

Table 3.7-18 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area — Alternative 2

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.7-18 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area — Alternative 2 (Continued)

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Atlantic Spotted dolphin			
MISSILEX Training	1	0	0
MINEX training	1	0	0
Total Exposures	2	0	0
Beaked whale			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Clymene dolphin			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Common dolphin			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Minke whale			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pilot whales			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.7-18 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area — Alternative 2 (Continued)

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Risso's dolphin			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Rough-toothed dolphin			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Striped dolphin			
MISSILEX Training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.7-19 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area — Alternative 2

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
FIREX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
FIREX training	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
FIREX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
FIREX training	0	0	0
Total Exposures	0	0	0
Atlantic Spotted dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0
Beaked whale			
FIREX training	0	0	0
Total Exposures	0	0	0

Table 3.7-19 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Marine Mammals in the Cherry Point Study Area — Alternative 2 (Continued)

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Bottlenose dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0
Clymene dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0
Common dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
FIREX training	0	0	0
Total Exposures	0	0	0
Minke whale			
FIREX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0
Pilot whales			
FIREX training	0	0	0
Total Exposures	0	0	0
Risso's dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0
Rough-toothed dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0
Striped dolphin			
FIREX training	0	0	0
Total Exposures	0	0	0

3.7.5 Summary of Environmental Effects

3.7.5.1 Endangered Species Act

Table 3.7-20 provides a summary of the Navy's determination of effect for Alternative 2 (the Preferred Alternative) for federally listed marine mammals that occur in the Navy Cherry Point Study Area. The analysis presented indicates that actions may affect ESA-listed whales and would have no effect on the manatee. The Navy requested early ESA Section 7 consultation with NMFS in a letter dated November 16, 2007 (Appendix C), to ensure Alternative 2 (the Preferred Alternative) would not likely jeopardize ESA-listed whales. The Navy then submitted the East Coast Biological Evaluation on 4 January 2008

(Appendix C) to initiate consultation, as well as two subsequent addendums in August 2008 and April 2009. The USFWS concurred with the Navy during informal consultation that the Preferred Alternative (Alternative 2) would have no effect on the manatee (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 and Alternative 1 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 and Alternative 1 are provided in Tables 3.7-13; 3.7-14 and 3.7-16;3.7-17, respectively. HE bombs would no longer be used in the Study Area 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. As summarized Tables 3.7-18 and 19, the Atlantic spotted dolphin could be exposed to impacts associated with underwater detonations and HE ordnance use under Alternative 2 that could result in Level B harassment as defined by MMPA provisions applicable to the Navy. 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 only Atlantic spotted dolphins may be exposed at levels that could result in temporary threshold shift or non-injurious physiological effects (total of 2 exposures). Atlantic spotted dolphins are among the most abundant marine mammals in the study area and the small number of potential exposures would be negligible from a population standpoint.
- The exposure analysis predicts that no marine mammals would be exposed to levels that would result in mortality.
- Although the numbers presented in Tables 3.7-18 and 3.7-19 represent estimated harassment and injury, as described above, they are probably over estimates 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 June 5, 2008; Appendix C), for Alternative 2 (the Preferred Alternative). As discussed in Section 3.7.3.5 (see sub-section: Underwater Detonations and High Explosive Ordnance), in its Proposed Rule published March 16, 2009, NMFS will consider authorizing up to 20 Level B harassment events annually for each of these five species.

3.7.5.3 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.7-21, 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 EO 12114 the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to marine mammals in non-territorial waters.

Table 3.7-20 Summary of the Navy's Determination of Effect for Federally Listed Marine Mammals that may Occur in the Navy Cherry Point Study Area for All Alternatives

Stressor	Blue Whale	Fin Whale	Humpback Whale	North Atlantic Right Whale	Sei Whale	Sperm Whale	West Indian Manatee
Vessel Movements							
Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Collisions	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Aircraft Overflights							
Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Towed Mine Warfare Devices							
Towed Device Strikes	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Mine Warfare Training Area Establishment							
Temporary Mine Shape Deployment/Recovery	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Non-Explosive Practice Munitions							
Strikes	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Weapons-Firing Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Underwater Detonations and High Explosive Ordnance Use							
High Explosive Ordnance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Underwater Detonations	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Military Expended Materials							
Ordnance-Related	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect	No Effect
Target-Related	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
TOW Missile Guide Wires	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect

Table 3.7-21 Summary of Environmental Effects of the Alternatives on Marine Mammals in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Low potential for vessel collisions.	Short-term behavioral responses from general vessel disturbance. Low potential for vessel collisions.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. No long-term population-level effects.
Towed Mine Warfare Devices	Low potential for towed MIW device strikes. No long-term population-level effects.	Low potential for towed MIW device strikes. No long-term population-level effects.
Temporary Mine Shape Deployment/Recovery	No effect.	No effect.
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 Detonations and High Explosive Ordnance	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality. 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. 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 and/or flare plastic end caps and pistons.	Low potential for ingestion of ordnance related materials and chaff and/or flare plastic end caps and pistons.
Impact Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.
Alternative 1		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Low potential for vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Low potential for vessel collisions. Slight increase compared to No Action.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed Mine Warfare Devices	Low potential for towed MIW device strikes. Slight decrease compared to No Action. No long-term population-level effects.	Low potential for towed MIW device strikes. Slight decrease compared to No Action. No long-term population-level effects.
Temporary Mine Shape Deployment/Recovery	No effect.	No effect.
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 Detonations and High Explosive Ordnance	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Slight increase (1 non-injurious exposure) compared to No Action.	Acoustic modeling predicts non-injurious and injurious exposures, but no mortality. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Slight increase (1 non-injurious exposure) compared to No Action.
Military Expended Materials	Low potential for ingestion of ordnance related materials and chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of ordnance related materials and chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.
Impact Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.
Alternative 2		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Low potential for vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Low potential for vessel collisions. Slight increase compared to No Action.

Table 3.7-21 Summary of Environmental Effects of the Alternatives on Marine Mammals in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed Mine Warfare Devices	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.
Temporary Mine Shape Deployment/Recovery	No effect.	No effect.
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 Detonations and High Explosive Ordnance	Acoustic modeling predicts 2 non-injurious exposures for Atlantic spotted dolphin only and no injurious or mortality exposures. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Substantial decrease compared to No Action based on elimination of HE BOMBEX.	Acoustic modeling predicts 2 non-injurious exposures for Atlantic spotted dolphin only and no injurious or mortality exposures. Effects would be limited to individual marine mammals and no population- or stock-level effects are expected. Substantial decrease compared to No Action based on elimination of HE BOMBEX
Military Expended Materials	Low potential for ingestion of ordnance related materials and chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of ordnance related materials and chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.
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). 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 five species of sea turtles that potentially occur in the Navy Cherry Point 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 has initiated the ESA Section 7 formal consultation process with NMFS to determine if the action would adversely affect ESA-listed sea turtles or jeopardize the continued existence of a listed species. Critical habitat for listed species has not been designated under the ESA in the Navy Cherry Point Study Area. Copies of correspondence with NMFS are provided in Appendices A and C of this EIS/OEIS.

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. 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 context, intensity, 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 Study Area for sea turtles is described in Section 1.5 and is shown in Figure 1.5-1. The 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 data was conducted to complete this analysis for sea turtles and to ensure that best available information was used. These data sources are described in Section 3.7.1.2.

Marine Resource Assessments

The information contained in this Chapter relies heavily on the data gathered in the Marine Resource Assessments (MRA). 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 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 Cherry Point OPAREA was finalized in 2008 (DoN, 2008).

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 recovery plans, and survey reports.

Navy OPAREA Density Estimate 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 sea turtles. The updated density estimates presented in this EIS/OEIS are derived from *the Navy OPAREA Density Estimates (NODEs) for the Southeast OPAREAs: VACAPES, CHPT, JAX/CHASN, and Southeastern Florida & AUTEC Andros* report (DoN, 2007). The Navy OPAREA density estimate (NODE) report represents the most current density estimates for sea turtles (DoN, 2007) in the Cherry Point OPAREA and were obtained through spatial modeling of survey data provided by NMFS (Southeast and Northeast Fisheries Science Centers).

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 analyses for sea turtles were based on sighting data collected through aerial surveys conducted by NMFS-Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (NMFS-SEFSC) between 1998 and 2005. For specifics of data used in these analyses refer to DoN (2007b). 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, Kemp's ridley turtle, and the group "hardshell turtles". The species incorporated into the hardshell turtles group include green, hawksbill, and unidentified hardshell turtles and were pooled together because the numbers of sightings for each species or group were not sufficient to allow spatial modeling. This 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 Cherry Point Range Complex.

Table 3.8-1
Seasonal Density Estimates for Sea Turtles in the Navy Cherry Point Study Area 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				
4 & 5	0.01399	0.01399	0.01176	0.01399
13 & 14	0.01399	0.01399	0.01176	0.01399
16 & 17	0.01911	0.01911	0.01591	0.01911
UNDET	0.01728	0.01728	0.01277	0.01728
18	0.01639	0.01639	0.02177	0.01639
Leatherback Turtle				
4 & 5	0.00224	0.00224	0.00438	0.00224
13 & 14	0.00224	0.00224	0.00438	0.00224
16 & 17	0.00208	0.00208	0.01089	0.00208

Table 3.8-1
Seasonal Density Estimates for Sea Turtles in the Navy Cherry Point Study Area Where Explosive Ordnance May Occur (Continued)

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
UNDET	0.00268	0.00268	0.00544	0.00268
18	0.00083	0.00083	0.01003	0.00083
Kemp's ridley Turtle				
4 & 5	0.00044	0.00044	0.00044	0.00044
13 & 14	0.00044	0.00044	0.00044	0.00044
16 & 17	0.00001	0.00001	0.00001	0.00001
UNDET	0.00067	0.00067	0.00067	0.00067
18	<0.00001	<0.00001	<0.00001	<0.00001
Hardshell Turtles[(1)]				
4 & 5	0.00297	0.00297	0.00286	0.00297
13 & 14	0.00297	0.00297	0.00286	0.00297
16 & 17	0.01273	0.01273	0.00598	0.01273
UNDET	0.00141	0.00141	0.00245	0.00141
18	0.00529	0.00529	0.00246	0.00529

Source: (DoN, 2007)
[(1)]*Hardshell turtle density estimates include all sightings of unidentified hardshell turtles, green, and hawksbill turtles.*

3.8.1.3 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 sea turtles. 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 EIS/OEIS. As summarized in Table 3.8-2, potential stressors to sea turtles include vessel movements (disturbance and collisions), aircraft overflights (disturbance), towed Mine Warfare (MIW) devices (strikes), temporary mine shape deployment/recovery (habitat alteration), non-explosive practice munitions (NEPM) (disturbance and strikes), underwater detonations and high explosive (HE) ordnance (explosions), and military expended materials (ordnance-related materials, targets, chaff, self-protection flares, marine markers, and TOW missile guide wires). The potential effects of these stressors on sea turtles are analyzed in detail in Section 3.8.3.

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 and Marine Corps 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 sea turtles. Accordingly, the effects of water and air quality changes on sea turtles are not addressed further in this EIS/OEIS.

Table 3.8-2 Summary of Potential Stressors to Sea Turtles[22]

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)									
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓	✓			
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓	✓	✓	✓	✓
Surface Warfare (SUW)									
Bombing Exercise (Air-to-Surface)	W-122 (Area 18)			✓			✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Areas 16 and 17)			✓			✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17)			✓			✓		✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓	✓				✓		✓
GUNEX (Surface-to-Surface) USMC Small Arms Training	Cherry Point OPAREA	✓	✓				✓		✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO) - Ship	Cherry Point OPAREA	✓	✓						
MSO to include VBSS/MIO - Helo	Cherry Point OPAREA	✓	✓	✓					

[22] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations see Table 2.2-4 and Appendix D.

Table 3.8-2 Summary of Potential Stressors to Sea Turtles (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Air Warfare (AW)									
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)			✓					
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)			✓			✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)			✓			✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓					✓
Air Intercept Control	W-122	✓	✓	✓					
Electronic Warfare (EW)									
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122	✓	✓	✓					
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15 & 16)			✓					✓
Chaff Exercise- ship	Cherry Point OPAREA	✓	✓						✓
Flare Exercise- aircraft	W-122 (Areas 1, 8, 15 & 16)			✓					✓

Table 3.8-2 Summary of Potential Stressors to Sea Turtles (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Strike Warfare (STW)									
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, & 21)			✓				✓	✓
Amphibious Warfare (AMW)									
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)	✓	✓				✓		
FIREX - Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Areas 4/5 & 13/14)	✓	✓				✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓					
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓					

3.8.2 Affected Environment

3.8.2.1 Regional Overview

Five sea turtle species are known to occur in the Cherry Point OPAREA (Table 3.8-3). Along the U.S. Atlantic coast, four sea turtle species (leatherback, loggerhead, Kemp's ridley, and green) migrate seasonally from offshore and warmer southern waters far into northern latitudes each summer (Morreale, 2005). Nesting is also documented for beaches bordering the region.

Table 3.8-3 Sea Turtles Known to Occur in the Navy Cherry Point Study Area

Common Name	Scientific Name	Status
Green turtle	*Chelonia mydas*	Threatened[1]
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley turtle	*Lepidochelys kempii*	Endangered
Leatherback turtle	*Dermochelys coriacea*	Endangered
Loggerhead turtle	*Caretta caretta*	Threatened

[1] *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 greens found in the Study Area come from the Florida population.*

Sea turtle distribution in temperate waters generally shifts on a seasonal basis off the U.S. Atlantic coast in response to changes in water temperature and prey availability (Lutcavage and Musick, 1985; Musick and Limpus, 1997; Coles and Musick, 2000). During winter months, sea turtle distribution shifts either south or offshore, where water temperatures are warmer and their prey are more abundant (Epperly *et al*., 1995b; Epperly *et al*., 1995a). Throughout the rest of the year, sea turtles are common residents of inshore and nearshore waters along the U.S. Atlantic coast as far north as Massachusetts. A notable distinction is the increasing proportion of small and apparently young individuals along a northward gradient (Morreale and Standora, 2005). This pattern is evident in loggerheads and greens, and is "starkly obvious" in Kemp's ridleys (Morreale and Standora, 2005). In North Carolina and Virginia, the proportion of breeding adult loggerheads in bays and estuaries is smaller than in Georgia and Florida, with most individuals classified as medium-sized juveniles. Most Kemp's ridleys along the U.S. Atlantic coast are immature. However, a latitudinal gradient still exists (Morreale and Standora, 2005). Only small-sized Kemp's ridleys have been documented in the northeastern waters of New York and Massachusetts, and while a few larger individuals have been reported in the southern and mid-Atlantic states (Florida, Georgia, South Carolina, Virginia), the vast majority are also small individuals (Morealle and Standora, 2005).

3.8.2.2 Green Turtle

General Description **-** The green turtle is the largest hard-shelled sea turtle; adults commonly reach 100 cm in carapace length and 150 kg in weight (NMFS and USFWS, 1991).

Very young green turtles are omnivorous, leaning to carnivory (Bjorndal, 1985; 1997). Salmon *et al*., (2004) reported that posthatchling green turtles were found to feed near the surface on floating *Thalassia* and *Sargassum* or at shallow depths on ctenephores and unidentified gelatinous eggs but ignored large jellyfish (*Aurelia*) 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, 2000; Hochscheid *et al*., 1999; Godley *et al*., 2002; Hatase *et al*., 2006). However, green turtles are also known to forage and rest at depths of 20 to 50 m (Balazs, 1980; Brill *et al*., 1995).

Status and Management **-** The green turtle is classified as threatened under the ESA, with the Florida and Mexican Pacific coast nesting populations listed as endangered (NMFS and USFWS, 1991). There is designated critical habitat for the species in the Caribbean that includes the waters surrounding Culebra, Puerto Rico (NMFS, 1998). Recent population estimates for green turtles in the western Atlantic area are not available (NMFS, 2006). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

Habitat **-** Post-hatchling and early juvenile green turtles reside in convergence zones in the open ocean, 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 (7.9 to 9.8 inches), they migrate to shallow nearshore areas (<50 m deep) where they spend the majority of their lives as late juveniles and adults. The optimal developmental habitats for late juveniles and foraging adults are warm, shallow waters (3 to 5 m in bottom depth), with an abundance of submerged aquatic vegetation, and located proximal to nearshore reefs or rocky areas, used by green turtles for resting (Holloway-Adkins and Provancha, 2005; Witherington *et al*., 2006a).

General Distribution **-** The green turtle has a circumglobal distribution, occurring throughout tropical and, to a lesser extent, subtropical waters (Seminoff and MTSG, 2004). Green turtles found in U.S. waters come from nesting beaches widely scattered throughout the Atlantic (Witherington *et al*., 2006a). In U.S. Atlantic and Gulf of Mexico waters, greens are found around the U.S. Virgin Islands (USVI), Puerto Rico, and along the continental United States from Texas to Massachusetts (NMFS and USFWS, 1991). Juvenile green turtles utilize estuarine waters along the U.S. Atlantic coast as summer developmental habitat, as far north as Long Island Sound, Chesapeake Bay, and North Carolina sounds (Epperly *et al*., 1995b; Epperly *et al*., 1995a; Musick and Limpus, 1997). Limited information is available regarding the occurrence of green turtles in the Chesapeake Bay, although they are presumably present in very low numbers (NMFS, 2006). Nearshore water temperatures play a major role in determining green turtle distribution along the Atlantic and Gulf coasts of the United States (Musick and Limpus, 1997; Witherington *et al*., 2006b). Adults are predominantly tropical and are only occasionally found north of southern Florida. Most sightings of individuals north of Florida occur between late spring and early fall, and are juveniles (Lazell, 1980; CETAP, 1982; Burke *et al*., 1992; Epperly *et al*., 1995a).

Optimal feeding habitats for green turtles in the continental United States include waters in Florida and southern Texas such as the Indian River Lagoon, Florida Keys, Florida Bay, Homosassa Springs, Crystal River, Cedar Keys, and Laguna Madre Complex (NMFS and USFWS, 1991; Hirth, 1997). The inshore waters of North Carolina are also an important feeding habitat for juveniles of this species (Epperly *et al*., 1995a).

Green turtles nest on both island and continental beaches between 30ºN and 30ºS (Witherington *et al*., 2006a). Although Florida is near the northern extent of the green turtle's Atlantic nesting range, it hosts a significant proportion of green turtle nesting (Witherington *et al*., 2006a). Green turtle nesting in Florida has occurred in every coastal county except those bordering the Big Bend area (Meylan *et al*., 1995; Witherington *et al*., 2006a). Approximately 99 percent of the green turtle nesting in Florida occurs on the Atlantic coast, with Brevard through Broward counties hosting the greatest nesting activity (Meylan *et al*., 1995; Witherington *et al*., 2006a). There are scattered nesting records in Georgia, and the Carolinas (Peterson *et al*., 1985; Schwartz, 1989; NMFS and USFWS, 1991).

Cherry Point OPAREA Green Turtle Occurrence **-** Green turtles may occur within the Study Area year-round. Juvenile greens use developmental habitats adjacent to the OPAREA during the summer months as well as travel to and from these habitats during the spring and fall. During spring, summer, and fall, greens may occur offshore off North Carolina. South of Cape Hatteras, greens may occur year-

round in waters between the shoreline and the 50 m isobath, where their preferred habitats of seagrass beds and worm-rock reefs are found.

Cherry Point OPAREA Green Turtle Density - The density estimates for training areas where explosions and/or ordnance use may occur in the Navy Cherry Point Study Area are provided in Table 3.8-1. Seasonal density estimates for the hardshell turtle group in the Navy Cherry Point Study Area, include greens, hawksbills, and unidentified hardshell turtles. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.3 Hawksbill Turtle

General Description - The hawksbill turtle is a small to medium-sized sea turtle; adults range between 65 and 90 cm in carapace length and typically weigh around 80 kg (Witzell, 1983; NMFS and USFWS, 1993). 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 had an average dive time of 56.1 minutes. Average mean dive times during the day ranged from 34 to 65 minutes, while those at night were between 42 and 74 minutes. Data from time-depth recorders indicate that foraging dives of immature hawksbills in Puerto Rico range from 8.6 to 14 minutes 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 with decreasing water temperatures during the winter (Storch *et al*., 2005).

Status and Management - The hawksbill turtle is listed as endangered under the ESA. This species is 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, 1998a). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

Habitat - Hawksbill turtles inhabit oceanic waters as post-hatchlings and small juveniles, where they are sometimes associated with driftlines and floating patches of *Sargassum* (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 recognized as 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 than their foraging areas, 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 or nesting grounds (NMFS and USFWS, 1993).

General 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). The hawksbill turtle has only rarely been recorded away from the tropics. 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; USFWS, 2001). Small hawksbills have stranded as far north as Cape Cod, Massachusetts (NMFS, 2006). In 2000 there was one hawksbill stranding in the Chesapeake Bay and one was reported as being taken incidentally in a fishery just south of the Chesapeake Bay (NMFS, 2006) Adult hawksbills are rarely documented in Florida waters, although nesting females occasionally visit beaches along the southeastern coast and the Florida Keys (Meylan and Redlow, 2006).

Major foraging populations in U.S. waters occur in the vicinity of the coral reefs surrounding Mona Island, Puerto Rico and Buck Island, St. Croix, USVI (Starbird *et al*., 1999). Smaller populations of hawksbills reside in the hard bottom habitats that surround the Florida Keys and other small islands in Puerto Rico and the USVI (Witzell, 1983; NMFS and USFWS, 1993). 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, 1998a).

Virtually all nesting is restricted between latitudes 25ºN and 35ºS. Hawksbill nesting in Florida has been reported from Cape Canaveral National Seashore south to Boca Grande Key and the Marquesas Islands and a single locality on the west coast (Longboat Key) (Meylan and Redlow, 2006).

Cherry Point OPAREA Hawksbill Turtle Occurrence - The hawksbill is rare north of Florida (Lee and Palmer, 1981; Keinath *et al*., 1991; Parker, 1995; Plotkin, 1995; USFWS, 2001). Nesting does not occur on beaches landward of the Cherry Point OPAREA. Although rare, hawksbills may occur within the Cherry Point OPAREA at any time during the year. Based on sighting and stranding records, animals may occur inshore and within shelf waters.

Cherry Point OPAREA Hawksbill Turtle Density - The density estimates for training areas where explosions and/or ordnance use may occur in the Navy Cherry Point Study Area are provided in Table 3.8-1. Seasonal density estimates for the hardshell turtle group in the Navy Cherry Point Study Area, include greens, hawksbills, and unidentified hardshell turtles. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.4 Kemp's Ridley Turtle

General Description - The Kemp's ridley is the smallest living sea turtle. 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). Kemp's ridley turtles feed primarily on portunids (swimming crabs) 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; 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 the maximum dive duration. 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 minutes, with routine dives lasting between 16.7 and 33.8 minutes (Mendonça and Pritchard, 1986; Renaud, 1995). In Cedar Keys, Florida, the average submergence duration was found to be approximately 8.4 minutes (Schmid *et al*., 2002). Renaud and Williams (2005) noted seasonal differences in dive durations, with longer dives (>30 minutes) during the winter and 15 minutes the remainder of the year. Sasso and Witzell (2006) reported longer dives at night than during the day for this species. Over a 12-hour 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; this 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 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) on the eastern coast of Mexico, 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). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

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 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).

General Distribution **-** Feeding grounds and developmental areas are found on the Atlantic and Gulf coasts of the United States. Henwood and Ogren (1987), and Gitschlag (1996) documented sightings and movements of juveniles within and among preferred habitats along both the Atlantic and Gulf coasts. Some Kemp's ridley juveniles may migrate as far north as New York and New England, arriving in these areas around June (Morreale and Standora, 2005). During the winter, they are prompted by cooler water temperatures to leave northern developmental habitats and migrate south to warmer waters in Florida (Marquez-M., 1994). Migrations tend to take place in nearshore waters along the mid-Atlantic coast (Morreale and Standora 2005; Morreale *et al*., 2007); juvenile and adults typically travel inshore of the 18 m isobath (Renaud and Williams, 2005). This migratory corridor is a narrow band running within continental shelf waters, possibly spanning the entire length of the U.S. Atlantic coast (Morreale and Standora, 2005; Morreale *et al*., 2007). Next to loggerheads, the Kemp's ridley is the second most abundant sea turtle found in nearshore and inshore mid-Atlantic waters (Keinath *et al*., 1987; Musick and Limpus, 1997) Seasonal movements continue until turtles reach sexual maturity, at which time, they return to breeding grounds in the Gulf of Mexico (Henwood and Ogren, 1987).

The western coast of Florida (particularly the Cedar Keys area), the coast of Alabama, the mouth of the Mississippi River, and the coastal waters off western Louisiana and eastern Texas are identified as important developmental regions for the Kemp's ridley (Márquez-M., 1990; USFWS and NMFS, 1992; Marquez-M., 1994; Schmid *et al*., 2002). The Gulf of Campeche in the southern Gulf of Mexico is also important foraging habitat.

Individuals are known to over-winter in areas south of Cape Hatteras, North Carolina, although the majority of Kemp's ridleys stay in Florida near Cape Canaveral (Henwood and Ogren, 1987). Over-wintering individuals may occasionally bury in the mud to hibernate (Schwartz, 1989; Marquez-M., 1994). Individuals that over-winter in southern North Carolina may subsequently move into warmer waters (*e.g*., Gulf Stream or areas off South Carolina) during the mid-winter (Renaud, 1995;

Morreale and Standora, 2005). For example, an individual satellite tagged in Beaufort in 1989 stayed in Onslow Bay, North Carolina during the winter and subsequently moved into the Gulf Stream when temperatures cooled close to shore in January 1990 (Renaud, 1995).

Cherry Point OPAREA Kemp's Ridley Turtle Occurrence - Kemp's ridleys utilize developmental habitats in North Carolina from April through October (Morreale, 2005). Kemp's ridley may occur within the Cherry Point OPAREA year-round. Kemp's ridley hatchlings may occur offshore near the eastern edge of the OPAREA and Gulf Stream in *Sargassum*.

Cherry Point OPAREA Kemp's Ridley Turtle Density - The density estimates for training areas where explosions and/or ordnance use may occur in the Navy Cherry Point Study Area are provided in Table 3.8-1. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.5 Leatherback Turtle

General Description - The leatherback turtle is the largest living sea turtle. Mature males and females can be as long as 2 m curved carapace length (NMFS and USFWS, 1992). Specimens less than 145 cm curved carapace length 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). 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), though most dives are much shallower than this (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 minutes (Southwood *et al*., 1999; Hays *et al*., 2004b; Wallace *et al*., 2005). Tagging data revealed that changes in individual turtle diving activity appear to be related to water temperature, suggesting an influence of seasonal prey availability on their diving behavior (Hays *et al*., 2004b).

Leatherbacks dive deeper and longer in the lower latitudes versus the higher (south versus the north) (James *et al*., 2005a). In northern waters, they are also known to dive to waters with temperatures just above freezing (James *et al*., 2006a; Jonsen *et al*., 2007). James *et al*. (2006b) noted a considerable variability in surface time between the northern and southern latitudes. Dives in the north are punctuated by longer surface intervals (equating to much more time spent at the surface per 24-hour 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 listed as endangered under the ESA. Critical habitat for leatherbacks is designated in the Caribbean at Sandy Point, St. Croix, USVI (NMFS, 1979). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

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 continental shelf and nearshore waters (Schroeder and Thompson, 1987; Shoop and

Kenney, 1992; Grant and Ferrell, 1993). 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.*, 2006b). The movements of adult leatherbacks appear to be linked to the seasonal availability of their prey and the requirements of their reproductive cycle (Collard, 1990; Davenport and Balazs, 1991; Luschi *et al.*, 2006).

General 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*., 2005b) 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 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.

According to aerial survey data, there is a northward movement of individuals along the southeast coast of the United States in the late winter/early spring. In February and March, most leatherbacks along the U.S. Atlantic coast are found in the waters off northeast Florida. By April and May leatherbacks begin to occur in larger numbers off the coasts of Georgia and the Carolinas (NMFS, 1995; 2000). In late spring/early summer, leatherbacks appear off the mid-Atlantic and New England coasts, while by late summer/early fall, many will have traveled as far north as the waters off eastern Canada, remaining in the northeast from approximately May through October (CETAP, 1982; Shoop and Kenney, 1992; Wyneken *et al*., 2005). Leatherback foraging areas in the western Atlantic are located on the continental shelf (30 to 50°N) as well as offshore (42°N, 65°W) (Eckert *et al*., 2006). The location of these foraging areas changes seasonally. From March through November, foraging areas occur on the North American continental shelf yet shift to off-shelf waters from December through February (Eckert *et al*., 2006).

Leatherback nesting occurs on isolated mainland beaches in tropical (mainly Atlantic and Pacific, few in Indian Ocean) and temperate oceans (southwest Indian Ocean) (NMFS and USFWS, 1992) and to a lesser degree on some islands, such as the Greater and Lesser Antilles. In the United States, the densest nesting is in Florida along the Atlantic coast from Jensen Beach south to Palm Beach (Stewart and Johnson, 2006). Sporadic nesting occurs in Georgia, South Carolina, and as far north as North Carolina (Rabon *et al*., 2003).

Cherry Point OPAREA Leatherback Turtle Occurrence - Leatherbacks are found year-round in North Carolina waters (Schwartz, 1989); the majority of leatherback sightings occur on the continental shelf, although several bycatch records exist for waters beyond the shelf break (DoN, 2008). As evidenced by a combination of sighting and bycatch records, this species occurs in offshore waters, especially north of Cape Lookout. The greatest concentrations of leatherbacks are expected to occur in North Carolina from mid-April through mid-October. A leatherback nest in North Carolina occurred in 1966. No leatherback nests were recorded after that until 1998. Since then, a handful of nests have been confirmed in North Carolina (Cape Hatteras National Seashore is the northernmost recorded nest). Confirmed nests include 2 in 1998, 4 in 2000, 1 in 2002, 1 in 2003, 2 in 2004 and 1 in 2006 (NPS, 2007). These nests all occur south of the western boundary of the VACAPES OPAREA. Leatherback occurrence is seasonal along the U.S. Atlantic coast, with the number of sightings along the northern area of the coast increasing from winter to summer. The largest concentrations of leatherbacks are within shelf waters off South Carolina and Georgia during the summer. Leatherbacks may occur throughout the OPAREA year-round.

Cherry Point OPAREA Leatherback Turtle Density **-** The density estimates for training areas where explosions and/or ordnance use may occur in the Navy Cherry Point Study Area are provided in Table 3.8-1. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.6 Loggerhead Turtle

General Description **-** 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 weight is 100 to 150 kg (Dodd, 1988; NMFS and USFWS, 1998b). The diet of the loggerhead turtles progressively changes with age and size (Godley *et al*., 1998). The gut contents of post-hatchlings found in masses of *Sargassum* contained parts of *Sargassum*, 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; Frick *et al*., 1999). Adult loggerheads are carnivorous, often foraging on fish, in nearshore waters, as well as benthic invertebrates (mollusks, crustaceans, and coelenterates) (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, 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 can last from 4 to 120 minutes (Byles, 1988; Sakamoto *et al*., 1990; Renaud and Carpenter, 1994; Bentivegna *et al*., 2003; Dodd and Byles, 2003).

Status and Management **-** Loggerhead turtles are listed as threatened under the ESA. The loggerhead is the most abundant sea turtle occurring in U.S. waters. In the continental United States there are four demographically independent loggerhead nesting groups or subpopulations: (1) Northern: North Carolina, South Carolina, Georgia, and northeast Florida; (2) South Florida: occurring from 29°N on the east coast to Sarasota on the west coast; (3) Florida Panhandle: Eglin Air Force Base and the beaches near Panama City, and (4) Dry Tortugas (Witherington *et al*., 2006b). Bowen *et al*. (1995) noted that under a conventional interpretation of the nuclear deoxyribonucleic acid (DNA) data, all breeding populations in the entire southeastern United States would be regarded as a single management unit, yet the mitochondrial DNA data indicate multiple isolated populations, and further suggest this complex population structure mandates a different management strategy at each life stage. The South Florida nesting subpopulation is the largest loggerhead rookery in the Atlantic Ocean (and the second largest in the world), followed by the Northern, Florida Panhandle, and Dry Tortugas subpopulations (Ehrhart *et al*., 2003; Witherington *et al*., 2006b). The South Florida nesting subpopulation produced between 43,500 and 83,400 nests annually over the past decade (USFWS and NMFS, 2003). The South Florida subpopulation also contributes significantly to loggerheads off the Carolinas (66%) and in North Carolina's Albemarle-Pamlico Estuarine Complex (Epperly *et al*., 2001). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

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. Results from tagging data of juvenile loggerheads in both the eastern and western North Atlantic suggest that the location of currents and associated frontal eddies is important to the foraging ecology of the pelagic stage of this species (McClellan, 2007). The neritic juvenile stage and adult foraging stage both occur in the neritic (nearshore) zone. Coral reefs, rocky places, and ship wrecks are

often used as feeding areas. The turtles here are active and feed primarily on the bottom (epibenthic/demersal), though prey is also captured throughout the water column (Bjorndal, 2003; Bolten, 2003). The neritic zone not only provides crucial foraging habitat, but can also provide inter-nesting and over-wintering habitat. Tagging data revealed that migratory routes may be coastal or may involve crossing deep ocean waters; an oceanic route may be taken even when a coastal route is an option (Schroeder *et al*., 2003).

General Distribution **-** Loggerhead turtles are widely distributed in subtropical and temperate waters (Dodd, 1988). Loggerhead turtles can be found along the U.S. Atlantic coast from Cape Cod to the Florida Keys during any season. Loggerheads seem generally restricted to waters of the North Atlantic Ocean south of 38°N, with mean sea surface temperatures around 22.2°C. In the Mid-Atlantic Bight, loggerheads concentrate in continental shelf waters but are also commonly sighted in deeper, offshore waters (Shoop and Kenney, 1992). Low water temperatures affect loggerhead turtle activity. Cold-stunned loggerheads have been found in various locales, including off the northeastern United States (Morreale *et al*., 1992). Immature loggerheads inhabiting cool-temperate areas in the western North Atlantic usually migrate seasonally to avoid cold-stunning (lethargy due to cold water temperatures that could lead to death) (Musick and Limpus, 1997). Some loggerheads are believed to escape cold conditions by burying themselves in the bottom sediment and hibernating (Carr *et al*., 1980; Ogren and McVea, 1995; Hochscheid *et al*., 2005). In early spring, juvenile loggerheads over-wintering in southeastern U.S. waters begin to migrate north to developmental feeding habitats (Morreale and Standora, 2005).

The generally accepted life-history model for the species is summarized well by 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 years old), some individuals begin to recruit to the neritic zone (benthic habitat in shallow coastal waters) close to their natal area, while others remain in the oceanic habitat or move back and forth between the two (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 years old), adults switch from subadult to adult neritic foraging habitats (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.

Cherry Point OPAREA Loggerhead Turtle Occurrence **-** Loggerheads may occur year-round in the Cherry Point OPAREA, using North Carolina waters for over-wintering, foraging, and transiting to nesting beaches. Seasonal water temperatures influence loggerhead occurrence offshore North Carolina although loggerheads are resident year-round south of Cape Hatteras. Loggerheads may occur in both nearshore and offshore waters. Loggerhead nesting beaches are inshore of the OPAREA. Spring and summer represent peak nesting time for loggerheads in North Carolina; during these seasons, individuals may transverse the OPAREA en route to nesting beaches.

Cherry Point OPAREA Loggerhead Turtle Density **-** The density estimates for training areas where explosions and/or ordnance use may occur in the Navy Cherry Point Study Area are provided in Table 3.8-1. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.3 Environmental Consequences

3.8.3.1 Explosive Ordnance Exposure Analysis

The exercises that use explosives are BOMBEX (Area 18), MINEX (Onslow Bay UNDET area), FIREX (Areas 4, 5, 13, and 14), MISSILEX (W-122). Table 2.2-7 summarizes the number of events per year and specific areas where each occurs for each type of explosive ordnance used.

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. 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 FIREX (w/IMPASS) event or a BOMBEX event where the MK-82 or MK-83 bombs are used. 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	Criteria	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-lbs/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	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 for any single exposure	23 psi (peak)
Non-injurious Behavioral	Behavioral Disturbance	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

**PTS: Permament Threshold Shift*

***TTS: Temporary Threshold Shift*

Acoustic Effects Analysis

BOMBEX, FIREX, MISSILEX and MINEX

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 may be found in Appendix J.

3.8.3.2 No Action Alternative

Vessel Movements

Overview

Many of the ongoing and proposed operations within the Navy Cherry Point Study Area involve maneuvers by various types of surface ships, boats, and amphibious vehicles (collectively referred to as vessels). Vessel movements have the potential to affect sea turtles by directly striking or disturbing individual animals. The probability of ship and sea turtle interactions occurring in the Navy Cherry Point Study Area is dependent on 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 mitigation measures implemented by the Navy. Currently, the number of Navy and Marine Corps ships, boats and amphibious vehicles operating in the Navy Cherry Point Study Area varies based on training schedules. Ship sizes range from 445 feet for a guided-missile frigate (FFG) to 1,092 feet for a nuclear aircraft carrier (CVN). Speeds for operations and training typically range from 10 to 14 knots. Smaller vessels used in amphibious assaults within 0-3 nm of the beach range in length from 36 feet for certain amphibious assault vehicles (AAV) to 88 feet for the Landing Craft Air Cushion (LCAC). Speeds for these smaller vessels range from 5-35 knots. Refer to Appendix D for more details. Operations involving vessel movements occur intermittently and are short in duration, ranging from a few hours up to a few weeks. These operations are widely dispersed throughout the Navy Cherry Point Study Area, which is a vast area encompassing 18,617 nm^2 (an area approximately the size of West Virginia). The Navy and Marine Corps would log about 900 total steaming days within the Navy Cherry Point Study Area during a typical year under the No Action Alternative.

Disturbance Associated with Vessel Movements

The ability of turtles to detect approaching water vessels via auditory and/or visual cues would be expected based on knowledge of their sensory biology (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 knots) vessel, but infrequently in encounters with a moderate-moving (5.9 knots) vessel, and only rarely in encounters with a fast-moving (10.3 knots) 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 that 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; Moein Bartol *et al*., 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, 1994; Moein Bartol *et al*., 1999; Ketten and Bartol, 2006). Although it is difficult to determine whether sea turtle response to vessel traffic is visual or auditory in nature, it is assumed that sea turtles can hear approaching vessels given 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.

Given the current ambient sound levels in the marine environment, the amount of sound contributed by the use of Navy and Marine Corps ships, boats, and amphibious vehicles in the proposed exercises is very low. It is anticipated that any sea turtles exposed would exhibit only short-term reactions and would not suffer any long-term consequences from ship sound.

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 result 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 budget (Frid, 2003), displacement from habitat (Southerland 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 was reported to exhibit a TTS for up to two weeks after exposure to these levels (Lenhardt, 2002). Viada et. al. (2008) reported on sea turtle strandings attributed to underwater explosions used in demolishing oil platforms; two juvenile turtles, 100 and 150 ft away from an explosion were killed.

Sea turtles exposed to the general disturbance associated with a passing Navy or Marine Corps vessel could exhibit no response or a short-term behavioral response such as fleeing. Therefore, general vessel disturbance under the No Action Alternative may affect ESA-listed sea turtles. In accordance with NEPA, disturbance from vessels in territorial waters would have no significant impact on sea turtles. Furthermore, disturbance from vessels in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Vessel Collisions

Vessel strikes are known to affect sea turtles in the Study Area. Turtles swimming or feeding at or just beneath the surface of the water are particularly vulnerable to a vessel strike.

According to 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. In addition, sound from surface vessel traffic may cause behavioral responses of sea turtles. Navy considered quantifying potential impacts to sea turtles from ship collisions as part of the Environmental Impact Statements for the Navy's Virginia Capes, Navy Cherry Point, and Jacksonville Range Complexes. However, Navy determined that a quantitative analysis is not appropriate due to 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 ship collisions.
- 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 collisions with sea turtles could not be quantified.

Currently, there are no data available to assess the efficacy of these 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, Navy concluded a qualitative assessment be implemented to analyze potential impacts of ship collisions on sea turtles.

Accordingly, 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.

Vessel collisions under the No Action Alternative may affect sea turtles. The Navy is consulting with NMFS in accordance with the ESA. In accordance with NEPA, vessel collisions in territorial waters would have no significant impact on sea turtles. Furthermore, vessel collisions in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Aircraft Overflights

Fixed-Wing Aircraft Overflights

The general aircraft overflight exposure information presented for marine mammals in Section 3.7.4.1 is also applicable to sea turtles. As discussed in Section 3.7.4.1, 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 and helicopter operations 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. Sound exposure levels would be relatively low because a majority of the overflights would be above 3,000 ft. Fixed-wing aircraft overflights may occur throughout the Cherry Point OPAREA.

Very little information regarding sea turtle reactions to fixed-wing aircraft overflights is available. Based knowledge of their sensory biology (Bartol and Musick, 2003; Ketten and Bartol, 2006;

Lenhardt, 1994; Ridgway *et al*., 1969; Bartol, 1999), 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 3.7.4.1, 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.

Fixed-wing aircraft overflights under the No Action Alternative may affect sea turtles, but the effects would be insignificant. In accordance with NEPA, fixed-wing aircraft overflights over territorial waters would have no significant impact on sea turtles. Furthermore, fixed-wing aircraft overflights over non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Helicopter Overflights

Helicopters overflights occur in conjunction with several different exercises, totaling 829 helicopter sorties annually, throughout the Cherry Point 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 ft).

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 under the No Action Alternative may affect sea turtles. In accordance with NEPA, helicopter overflights over territorial waters would have no significant impact on sea turtles. Furthermore, helicopter overflights over non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, Mine Warfare Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems that are towed through the water by helicopters flying approximately 75 feet above the water at low airspeeds. Under the No Action Alternative, 220 towed Mine Warfare (MIW) device sorties would be conducted per year. Most of these sorties would occur in the Underwater Detonation Area in Onslow Bay, with fewer occurring farther offshore in CVOA North (see Figure 2.2-1). All five species of sea turtles may occur in areas where towed MIW devices would be used.

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 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 MIW 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 MIW device, there are no documented instances of this occurring.

Sargassum mats likely occur in CVOA North based on proximity to the Gulf Stream 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 are expected to be able to see and avoid most *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 MIW device would strike a sea turtle associated with a *Sargassum* mat.

The use of towed MIW 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. Towed MIW devices would not be used in non-territorial waters and therefore would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Non-Explosive Practice Munitions

Non-Explosive Practice Munitions Strikes

Current Navy and Marine Corps training operations in the Cherry Point OPAREA include firing a variety of weapons and employing a variety of NEPM and explosive rounds, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. The majority of ordnance fired in the Cherry Point Study Area consists of NEPM (Table 2.2-6). The analysis presented in this section focuses on NEPM, while potential effects of explosive rounds are analyzed below in the explosions section. Training exercises that involve weapons firing and ordnance use take place in several training areas (see Table 2.2-6 for a summary of ordnance use by training area).

Direct ordnance strikes and disturbance associated with sound from firing weapons are potential stressors to sea turtles. Ingestion of expended ordnance is also a potential concern for some sea turtles and is analyzed below under military expended materials. The primary concern 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 ordnance was evaluated using statistical probability modeling as described in Appendix I. Model input values include ordnance use data (frequency and type) and sea turtle density data for each season and training area where ordnance use occurs. The model first calculates the probability of a turtle being struck and then calculates the number of exposures (sea turtle/ ordnance strikes) for the given season and training area. The model outputs for sea turtle/ ordnance 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 standard mitigation measures to avoid and minimize sea turtle/ ordnance 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 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 sea turtles would not be struck and that NEPM strikes would have no effect on sea turtles.

Appendix I provides a breakdown of the model input/output values for each group of turtles by training area where NEPM is fired or released. All model output values are substantially less than one (Appendix I), indicating that sea turtle/NEPM strikes are extremely unlikely to occur. The probability of a direct NEPM strike is further reduced by mitigation measures (see Chapter 5).

The use of NEPM would have no effect on sea turtles. Therefore, in accordance with NEPA, use of NEPM in territorial waters would have no significant impact on sea turtles. Furthermore, use of NEPM in non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Weapons-Firing Disturbance

Transmitted Gunnery Sound

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, which would produce the highest pressure. Therefore, all analyses were conducted using a 5-inch shell 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 decibels (dB) with reference pressure of one micro Pascal (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 energy flux density (EFD) harassment criteria, the EFD levels (greatest in any 1/3 octave band above 10 Hz) of a 5-inch gun muzzle blast were calculated to be 190 dB with reference pressure of one microPascal squared in one second (dB re: 1 μPa^2-sec) directly below the gun muzzle decreasing to 170 dB re: 1 μPa^2-sec at 100 m (328 feet) into the water (DoN, 2006). The rapid dissipation of the sound pressure wave, coupled with the mitigation measures implemented (see Chapter 5 for details) to detect sea turtles in the area prior to conducting operations, would result in a blast from a gun muzzle having no effect on sea turtle species.

Sound Transmitted 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 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 listed sea turtle species.

Underwater Detonations and High Explosive Ordnance

Explosions that occur in the OPAREA are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch high explosive rounds), as well as underwater detonations associated with Mine Neutralization training (MINEX). HE ordnance use and underwater detonation is limited to a few specific training areas (see Table 2.2-7 for a summary of explosions by training area).

An explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions. Appendix J contains a technical report describing the scientific basis, methods, assumptions, and all results of the explosive analysis. Tables 3.8-5 and 3.8-6 provide summaries of the explosive analysis for the No Action Alternative. For each species, in order to determine the total non-injurious potential exposures for all operations, the two columns for non-injurious exposures (182 dB/23 psi criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables (Tables 3.8-5 and 3.8-6). For each species, the total for injurious potential exposures can be determined by adding the 205 dB re 1 mPa^2-s/13 psi-ms columns (PTS) together between the two tables. No mortality potential exposures are predicted.

Table 3.8-5 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Sea Turtles in the Cherry Point Study Area—No Action Alternative

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	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
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kemp's Ridley turtle			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Leatherback turtle			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Loggerhead turtle			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.8-6 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Sea Turtles in the Cherry Point Study Area—No Action Alternative

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
BOMBEX training	26	1	0
FIREX training	0	0	0
Total Exposures	26	1	0
Kemp's Ridley turtle			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Leatherback turtle			
BOMBEX training	15	0	0
FIREX training	0	0	0
Total Exposures	15	0	0
Loggerhead turtle			
BOMBEX training	96	2	0
FIREX training	0	0	0
Total Exposures	96	2	0

Hardshell, leatherback, and loggerhead turtles may be exposed to levels that could result in behavioral disruption during multiple detonations (Table 3.8-6, 177 dB column). No sea turtles are expected to be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.8-5, 182 dB/23 psi column). Hardshell and loggerhead turtles may be exposed to levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.8-5 and 3.8-6, 205 dB/13 psi-ms column). No sea turtles would be exposed at levels that would result in mortality (Tables 3.8-5 and 3.8-6, 30.5 psi-ms column).

Endangered Species Act Conclusions

Underwater detonations and HE ordnance use in the No Action Alternative may affect green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles.

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.

Military Expended Materials

Overview

A variety of military materials are expended during Navy and Marine Corps training exercises conducted in the Navy Cherry Point 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. 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. Nonetheless, sea turtles could be exposed to a variety of expended materials via contact, ingestion, and/or entanglement.

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, 1994; Tomas, 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 4 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, 1994; Tomas, 2002; McCauley and Bjorndal 1999).

Ordnance-Related Materials

Ordnance-related materials include various sizes of NEPM and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). 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 the materials would be 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 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 prey, there are cases of animals ingesting items such as plastic caps that do not resemble prey (Barreiros, 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.

Water depth in areas where ordnance is fired ranges from about 65 feet to well over 9,000 feet in areas more than 3 nm offshore. While some benthic foraging could occur in these offshore areas, a majority of benthic foraging by green, hawksbill, Kemp's ridley, and loggerhead turtles occurs in nearshore areas (Lutcavage *et al*., 1997). Consequently, ingestion of expended ordnance by these species could occur, but would be considered unlikely. 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*., 2005b). 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 would have no effect on leatherback turtles, but may affect other sea turtle species. In accordance with NEPA, ordnance-related materials would have no significant impact on sea turtles in territorial waters. 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

A variety of at-sea target types are 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 airborne 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 lbs, 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, 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 material would have no significant impact on sea turtles in territorial waters. Furthermore, target-related material would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Chaff Fibers, End-Caps, and Pistons

The background information and general exposure analysis presented in Section 3.7.4.1 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. Sea turtles are not expected to respond to direct contact with chaff or inhalation of chaff. In addition, any changes in water quality from chaff use would be negligible and would not be expected to affect 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 incidentally 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 and aluminum (as described in Section 3.7.4.1). 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 (1.8 fibers/ft^2 for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Silicon dioxide, also known as silica, is an abundant compound in nature that is prevalent in soil, rocks, and sand (USAF, 1997). Silicon is the second most abundant element in the earth's crust, making up approximately 28.2 percent 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 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) (Takizawa *et al*., 1998).

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 0.69 pieces/nm^2/year; Table 3.7-14). 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 very small percentage of the end-caps and pistons released could 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 appears to be extremely unlikely.

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, 2001; Mascarenhas, 2004). Based on their smaller size, subadult and juvenile turtles would be more susceptible to digestive tract blockage if they ingested these materials. Should a sea turtle encounter and ingest a expended 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, 1994; Tomas, 2002). However, these effects are not expected because ingestion of end-caps and pistons would be extremely unlikely due to the low concentration of 0.69 pieces/nm^2/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 use would have no significant impact on sea turtles in territorial waters. Furthermore, chaff use 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 2,100 self-protection flares would be used in the OPAREA 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 OPAREA 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. 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 based on the low number of end-caps (2,100 per year). In accordance with NEPA, flares would have no significant impact on sea turtles in territorial waters. Furthermore, flare would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Marine Markers

The MK-58 marine marker produces chemical flames and regions of surface smoke and is used in various training exercises to mark a surface position to simulate divers, ships, and points of contact on the surface of the ocean. 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. 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 three 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 lbs, 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. Approximately 230 marine markers would be used in the Study Area per year 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 sea turtles 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 (230). Marine marker ingestion under the No Action Alternative may affect ESA-listed sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, there would be no significant impact to sea turtles from marine marker use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to sea turtles resulting from use of marine markers during training exercises in non-territorial waters.

TOW Missile Guide Wires

The No Action Alternative includes firing four TOW missiles per year in Areas 16 and 17. This missile system has two thin (5.75 mils or 0.146 mm diameter) wires that provide a passive line for transmission of steering commands from the aircraft to the missile. Two wire dispensers are mounted on the rear of the missile. These dispensers contain 3,750 m each of single-strand wire with a minimum tensile strength of 10 pounds. The copper-plated high carbon steel wire has an enamel coating. The guide wires are not recoverable when a missile is fired at sea. Corrosion or degradation rates for the wire in seawater are unknown, but they could persist for relatively long periods given the corrosion resistance of copper and the enamel coating. The length of wire dispensed would generally be equal to the distance the missile travels to impact the target. Undispensed wire would be contained in the dispensers upon impact.

Sea turtles could become entangled in a TOW missile guide wire in the water column or after it has settled to the sea floor. Entanglement could lead to sublethal or lethal effects. As discussed below, the likelihood of a sea turtle encountering and becoming entangled in a TOW missile guide wire depends on several factors. The long length of the guide wire increases the likelihood that a sea turtle could encounter a guide wire and become entangled, but only four missiles would be fired and eight guide wires would enter the water per year.

After entering the water, guide wires would be in the water column for a relatively brief period of time as they slowly sink to the bottom. Therefore, the chance of entanglement occurring in the water column would be low. The risk of entanglement would be highest for benthic-foraging sea turtles. TOW missiles would be fired in Areas 16 and 17, which are more than 12 nm offshore. Water depth in these areas ranges from about 30 to 50 m. While some benthic foraging could occur in these offshore areas, a majority of benthic foraging by green, hawksbill, Kemp's ridley, and loggerhead turtles occurs in nearshore areas (Lutcavage *et al*., 1997). As discussed above for ordnance-related materials, leatherbacks feed in the water column. Consequently, it is unlikely that sea turtles would encounter and become entangled in a TOW missile guide wire.

TOW missile guide wires may affect ESA-listed sea turtles under the No Action Alternative, but the effects would be considered discountable because entanglement is extremely unlikely to occur. In accordance with NEPA, there would be no significant impact to sea turtles from TOW missile guide wires in territorial waters because TOW missiles are not used in territorial waters. In accordance with EO 12114, there would be no significant harm to sea turtles resulting from TOW missile guide wires in non-territorial waters.

3.8.3.3 Alternative 1

Vessels Movements

The number of operations involving vessel movements would increase in the Navy Cherry Point Study Area under Alternative 1 with a total of 950 steaming days per year; an increase of 6 percent over the No Action Alternative (Table 2.2-5). These changes would result in increased potential for short-term behavioral reactions to vessels. Potential for collision would increase slightly compared to the No Action Alternative; however, Navy mitigation measures (see Chapter 5) would reduce the probability. Vessel movements under Alternative 1 may affect sea turtles. 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

The number of operations involving fixed-wing aircraft overflights would increase 10 percent to 3,755 per yearin the Navy Cherry Point Study Area under Alternative 1. These changes would result in increased exposures of sea turtles to fixed-wing overflights. Elevated numbers of overflights would increase the potential for behavioral disturbance from sound and shadow-effects. Operations involving helicopter overflights would increase 16 percent to 878 per year. Behavioral reactions to fixed-wing and helicopter overflights would be the same as discussed under the No Action Alternative. Aircraft overflights under Alternative 1 may affect sea turtles, but the effects are expected to be insignificant. In accordance with NEPA, aircraft overflights over territorial waters would have no significant impact on sea turtles. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Towed Mine Warfare Devices

Towed MIW device sorties would decrease slightly (13%) under Alternative 1; therefore, the analysis presented for the No Action Alternative is applicable to Alternative 1. The use of towed MIW devices under Alternative 1 may affect sea turtles, but the effects of collisions would be discountable because they are extremely unlikely to occur. In accordance with NEPA, the use of towed devices in territorial waters would have no significant impact on sea turtles. Furthermore, the use of towed devices in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Non-Explosive Practice Munitions

Non-Explosive Practice Munitions Strikes

The amount of NEPM fired would increase slightly in the Navy Cherry Point Study Area under Alternative 1 (Table 2.2-5 and 2.2-6). These changes would result in increased potential exposure for sea turtle NEPM strikes compared to baseline conditions. However, NEPM strike modeling predicts that substantially less than one sea turtle would be exposed to direct NEPM strikes under Alternative 1 (see Appendix I). Additionally, mitigation measures further reduce the probability of NEPM strikes. NEPM strikes under Alternative 1 would have no effect on sea turtles.

Weapons-Firing Disturbance

The number of weapons firings in the Navy Cherry Point Study Area would increase under Alternative 1. Based on the discussion under the No Action Alternative above, firing of weapons would not result in an exposure of sea turtles, therefore any additional weapon firings would have no effect on sea turtles. Weapons-firing disturbance under Alternative 1 would have no effect on listed sea turtle species.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions (in water) occurring in the Navy Cherry Point Study Area would not change under Alternative 1, with the exception of Hellfire and TOW, missiles (Tables 2.2-5 and 2.2-7). Under Alternative 1, 2 additional Hellfire missile explosions and 4 additional TOW missile explosions, would occur in the OPAREA.

An explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions. Appendix J contains a technical report describing the scientific basis, methods, assumptions, and all results of the explosive analysis. Tables 3.8-7 and 3.8-8 provide summaries of the explosive analysis for Alternatives 1. For each species, in order to determine the total non-injurious potential exposures for all operations, the two columns for non-injurious exposures (182 dB/23 psi criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables (Tables 3.8-7 and 3.8-8). For each species, the total for injurious potential exposures can be determined by adding the 205 dB re 1 mPa^2-s/13 psi-ms columns (PTS) together between the two tables. No mortality potential exposures are predicted.

Hardshell, leatherback, and loggerhead turtles may be exposed to levels that could result in behavioral disruption during multiple detonations (Table 3.8-8, 177 dB column). No sea turtles are expected to be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.8-7, 182 dB/23 psi column). Hardshell and loggerhead turtles may be exposed to levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.8-7 and 3.8-8, 205 dB/13 psi-ms column). No sea turtles would be exposed at levels that would result in mortality (Tables 3.8-7 and 3.8-8, 30.5 psi-ms column).

Table 3.8-7 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Sea Turtles in the Cherry Point Study Area—Alternative 1

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	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
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kemp's Ridley turtle			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Leatherback turtle			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Loggerhead turtle			
BOMBEX training	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.8-8 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Sea Turtles in the Cherry Point Study Area—Alternative 1

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
BOMBEX training	26	1	0
FIREX training	0	0	0
Total Exposures	26	1	0
Kemp's Ridley turtle			
BOMBEX training	0	0	0
FIREX training	0	0	0
Total Exposures	0	0	0
Leatherback turtle			
BOMBEX training	15	0	0
FIREX training	0	0	0
Total Exposures	15	0	0
Loggerhead turtle			
BOMBEX training	96	2	0
FIREX training	0	0	0
Total Exposures	96	2	0

Endangered Species Act Conclusions

Underwater detonations and explosive ordnance in Alternative 1 may affect green, hawksbill, Kemp's ridley leatherback, and loggerhead turtles.

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

Ordnance-Related Materials

The amount of ordnance fired would increase in the Navy Cherry Point Study Area under Alternative 1 (Table 2.2-5 and 2.2-6). Similar to the No Action Alternative, green, hawksbill, Kemp's ridley, and loggerhead turtles would potentially be exposed to expended ordnance via ingestion from foraging off the bottom. Leatherback turtles would not ingest expended ordnance because they do not feed on the bottom. Therefore, ingestion of ordnance would have no effect on leatherback turtles under Alternative 1. The probability of a benthic foraging sea turtle to ingest ordnance would continue to be low under Alternative 1. Ingestion of ordnance under Alternative 1 may affect green, hawksbill, Kemp's ridley, and loggerhead turtles. In accordance with NEPA, ordnance related materials would have no significant impact on sea turtles in territorial waters. 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

The number of targets used in the Navy Cherry Point Study Area would increase Alternative 1 (Table 2.2-5). Analysis of both remotely operated and floating at-sea targets under the No Action Alternative indicates that the use of targets would have no effect on listed sea turtles due to the large size of the target which would prohibit any sea turtle from ingesting it. Increased numbers of these targets under Alternative 1 would have no effect on listed sea turtles.

Chaff Fibers, End-Caps, and Pistons

The amount of chaff used in the OPAREA would increase by about 12 percent per year under Alternative 1 (Tables 2.2-5 and 3.7-14). This increase in chaff use would result in negligible increases in relative environmental concentrations of chaff fibers, end-caps, and pistons (Table 3.7-14). Similar to the No Action Alternative, effects of direct body contact, inhalation, and any changes to water or sediment quality would continue to be insignificant. The potential for sea turtles to ingest chaff fibers would increase under Alternative 1, but ingestion of a toxic dose (greater than 1,000 mg/kg) would continue to be highly unlikely based on the anticipated low environmental concentration (1.8 fibers/ft^2). Sea turtles could ingest chaff end-caps and pistons under Alternative 1, but the likelihood of ingestion remains extremely low based on the low environmental concentration (0.76 pieces/nm^2).

Chaff use under Alternative 1 may affect ESA-listed sea turtles; however the effects are expected to be insignificant or discountable. In accordance with NEPA, chaff use would have no significant impact on sea turtles in territorial waters. Furthermore, chaff use would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Self-Protection Flares

The number of self-protection flares used in the Study Area would increase under Alternative 1 from 2,100 to 2,335 per year (11%). Similar to the No Action Alternative, ingestion of flare end-caps under Alternative 1 may affect sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, flare use would have no significant impact on sea turtles in territorial waters. Furthermore, flare use would not cause significant harm to sea turtles in non-territorial waters in accordance with Executive Order 12114.

Marine Markers

The number of marine markers used in the Study Area would increase from 230 to 250 (9 percent) per year under Alternative 1. Similar to the No Action Alternative, the probability of ingestion is extremely low based on the low number of marine markers expended per year. Marine marker ingestion under Alternative 1 may affect ESA-listed sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, there would be no significant impact to sea turtles from marine marker use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to sea turtles resulting from use of marine markers during training exercises in non-territorial waters.

TOW Missile Guide Wires

The number of TOW missiles fired under Alternative 1 would increase from four to eight per year and the number of guide wires entering the water would increase from eight to 16 per year. Therefore, the potential for sea turtles to become entangled in a TOW missile guide wire would increase.

As discussed for the No Action Alternative, guide wires would be in the water column for a relatively brief period of time as they slowly sink to the bottom. Therefore, the chance of entanglement occurring in the water column would be low. The risk of entanglement would be highest for benthic-foraging sea turtles. TOW missiles would be fired in Areas 16 and 17, which are more than 12 nm offshore. Water depth in these areas ranges from about 30 to 50 m. While some benthic foraging could occur in these offshore areas, a majority of benthic foraging by green, hawksbill, Kemp's ridley, and loggerhead turtles occurs in nearshore areas (Lutcavage *et al*., 1997). As discussed above for ordnance-related materials, leatherbacks feed in the water column. Consequently, it is unlikely that sea turtles would encounter and become entangled in a TOW missile guide wire.

TOW missile guide wires may affect ESA-listed sea turtles under Alternative 1, but the effects would be considered discountable because entanglement is extremely unlikely to occur. In accordance with NEPA, there would be no significant impact to sea turtles from TOW missile guide wires in territorial waters because TOW missiles are not used in territorial waters. In accordance with EO 12114, there would be no significant harm to sea turtles resulting from TOW missile guide wires in non-territorial waters.

3.8.3.4 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements that would occur under Alternative 2 would be the same as Alternative 1 (Table 2.2 5). Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Vessel movements under Alternative 2 may affect sea turtles. 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

The number of operations involving fixed-wing aircraft overflights would increase 7 percent to 3,668 per year in the Navy Cherry Point Study Area under Alternative 1. These changes would result in increased exposures of sea turtles to fixed-wing overflights. Elevated numbers of overflights would increase the potential for behavioral disturbance from sound and shadow-effects. Under Alternative 2, operations involving helicopter overflights would increase 83 percent to 1,390 per year. Behavioral reactions to fixed-wing and helicopter overflights would be the same as discussed under the No Action Alternative. Aircraft overflights under Alternative 2 may affect sea turtles, but the effects are expected to be insignificant. In accordance with NEPA, aircraft overflights over territorial waters would have no significant impact on sea turtles. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Towed Mine Warfare (MIW) Devices

Towed MIW device sorties would increase from 220 to 576 per year (162%) under Alternative 2. Therefore, the potential for sea turtles to be struck by towed devices would increase. Most of these sorties would occur in the proposed Mine Warfare Training Area, which would be established in Onslow Bay under Alternative 2 (Figure 2.2-1). Some towed devices sorties would continue to take place farther offshore in the CVOA North. All five species of sea turtles may occur in areas where towed MIW devices would be used.

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 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 MIW 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 MIW device, there are no documented instances of this occurring in the Study Area.

Sargassum mats likely occur in CVOA North based on proximity to the Gulf Stream 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 are expected to be able to see and avoid most *Sargassum* mats. Therefore, any disturbance to *Sargassum* would be limited to very small patches not visible to the air crew. Most of the additional towed device sorties under Alternative 2 would occur in the Mine Warfare Training Area, where *Sargassum* is not expected to occur.

The use of towed MIW devices under Alternative 2 may affect sea turtles, but the effects of collisions would be discountable because they are extremely unlikely to occur. In accordance with NEPA, the use of towed devices in territorial waters would have no significant impact on sea turtles. Furthermore, the use of towed devices in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

Temporary Mine Shape Deployment/Recovery

As discussed in Chapter 2, a new Mine Warfare Training Areas would be established in the inshore area of Onslow Bay. This section addresses potential effects on sea turtles associated with establishing and maintaining these training areas (*i.e.*, temporary mine shape deployment/recovery). The effects of conducting training exercises in these areas are analyzed under aircraft overflights, towed MIW devices, and explosions.

The effects of Mine Warfare Training Area establishment would be limited to short-term and localized disturbances of the water column and benthic habitat associated with deployment and recovery of mine shapes. Mine shape assemblages will not be deployed in waters less than 10 m deep as discussed in Chapter 2. Mine shape assemblages deployed in waters deeper than 10 m will not impede the ingress and egress of sea turtles from the nesting beach in the area of Onslow Bay. As discussed in Chapter 2, the mine shape assembly includes a concrete anchor, mooring line, and the inert mine shape. In some cases the entire assembly (mine shape, mooring line, and anchor) would be deployed concurrently from a boat or aircraft and recovered immediately following the exercise. In other cases concrete anchors would be permanently placed on the sea floor and divers would attach the mooring lines and mine shapes for specific exercises. The inert mine shape deployment and recovery process would have no effect on sea turtles. The mooring lines would not present an entanglement risk for sea turtles because they are held taut by the anchor and mine shape. Mooring lines would only be left in place for as long as the mine shape is in the water. Establishment of Mine Warfare Training Areas under Alternative 2 would have no effect on sea turtles.

Underwater Detonations and High Explosive Ordnance

The potential for underwater detonations and HE ordnance use to affect sea turtles would be substantially lower for Alternative 2 compared to the No Action Alternative and Alternative 1 because HE bombs would no longer be used in the Study Area. The number and location of other explosions occurring under Alternative 2 would be the same as Alternative 1 (Tables 2.2-5 and 2.2-7). An explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions. Appendix J contains a technical report describing the scientific basis, methods, assumptions, and all results of the explosive analysis. Tables 3.8-9 and 3.8-10 provide summaries of the explosive analysis for Alternative 2. No exposures are predicted.

Table 3.8-9 Summary of Potential Exposures (per year) from Single Detonation Explosive Ordnance for Sea Turtles in the Cherry Point Study Area—Alternative 2

Species/Training Operation	Potential Exposures @ 182 dB re 1 μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kemp's Ridley turtle			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Leatherback turtle			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Loggerhead turtle			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

Table 3.8-10 Summary of Potential Exposures (per year) from Multiple Detonation Explosive Ordnance for Sea Turtles in the Cherry Point Study Area—Alternative 2

Species/Training Operation	Potential Exposures @ 177 dB re 1 μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB re 1 μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
FIREX training	0	0	0
Total Exposures	0	0	0
Kemp's Ridley turtle			
FIREX training	0	0	0
Total Exposures	0	0	0
Leatherback turtle			
FIREX training	0	0	0
Total Exposures	0	0	0
Loggerhead turtle			
FIREX training	0	0	0
Total Exposures	0	0	0

Endangered Species Act Conclusions

Underwater detonations and explosive ordnance use in Alternative 2 may affect green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles.

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

The amount of military expended materials entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Tables 2.2 5 and 2.2 6). Non-explosive practice bombs are too large to present an ingestion risk to sea turtles. Therefore, the analysis of military expended materials presented for Alternative 1 is applicable to Alternative 2. Military expended materials may affect ESA-listed sea turtles under Alternative 2. In accordance with NEPA, military in territorial waters would have no significant impact on sea turtles. Furthermore, military expended materials in non-territorial waters would not cause significant harm to sea turtles in accordance with Executive Order 12114.

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

3.8.5.1 Endangered Species Act

Table 3.8-11 provides a summary of the Navy's determination of effect for the No Action Alternative, Alternative 1, and Alternative 2 (the Preferred Alternative) and federally listed sea turtles that occur in the Navy Cherry Point Study Area. The analysis presented indicates that the alternatives may affect ESA-listed sea turtles. Accordingly, the Navy requested formal ESA Section 7 consultation with NMFS to ensure the proposed action would not likely jeopardize ESA-listed sea turtles. The Study Area does not contain designated critical habitat for any listed species. Consequently, the alternatives would have no effect on critical habitat.

3.8.5.2 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.8-12, 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 3.8-11 Summary of the Navy's Determination of Effect for Federally Listed Sea Turtles that Occur in the Navy Cherry Point Study Area for All Alternatives

Stressor	Green Turtle	Hawksbill Turtle	Kemp's Ridley Turtle	Leatherback Turtle	Loggerhead Turtle
Vessel Movements					
Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect
Collisions	May Affect	May Affect	May Affect	May Affect	May Affect
Aircraft Overflights					
Aircraft Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect
Towed Mine Warfare Devices					
Towed Device Strikes	May Affect	May Affect	May Affect	May Affect	May Affect
Mine Warfare Training Area Establishment					
Temporary Mine Shape Deployment/Recovery	No Effect	No Effect	No Effect	No Effect	No Effect
Non-Explosive Practice Munitions					
Weapons-Firing Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect
Strikes	No Effect	No Effect	No Effect	No Effect	No Effect
Underwater Detonations and High Explosive Ordnance					
Underwater Detonation	May Affect	May Affect	May Affect	May Affect	May Affect
High Explosive Ordnance	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
Target-Related Materials	No Effect	No Effect	No Effect	No Effect	No Effect
Chaff	May Affect	May Affect	May Affect	May Affect	May Affect
Shelf-Protection Flares	May Affect	May Affect	May Affect	May Affect	May Affect
Marine Markers	May Affect	May Affect	May Affect	May Affect	May Affect
TOW Missile Guide Wires	May Affect	May Affect	May Affect	May Affect	May Affect

Table 3.8-12 Summary of Environmental Effects of the Alternatives on Sea Turtles in the Navy Cherry Point Study Area

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (Territorial Waters, 0 to 12 nm)**	**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.	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. No long-term population-level effects.
Towed Mine Warfare Devices	Low potential for towed MIW device strikes. No long-term population-level effects.	Low potential for towed MIW device strikes. No long-term population-level effects.
Temporary Mine Shape Deployment/Recovery	No effect.	No effect.
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 Detonations and High Explosive Ordnance	Explosive analysis predicts no exposures to underwater detonations associated with MINEX.	Explosive analysis indicates non-injurious and injurious exposures to HE ordnance explosions associated with BOMBEX.
Military Expended Materials	Low potential for ingestion of chaff and/or flare plastic end-caps and pistons.	Low potential for ingestion of chaff and/or flare plastic end-caps and pistons; and entanglement in TOW missile guide wires.
Impact Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.
Alternative 1		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed Mine Warfare Devices	Low potential for towed MIW device strikes. Slight decrease compared to No Action. No long-term population-level effects.	Low potential for towed MIW device strikes. Slight decrease compared to No Action. No long-term population-level effects.
Temporary Mine Shape Deployment/Recovery	No effect.	No effect.
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 Detonations and High Explosive Ordnance	Same as No Action.	Same as No Action.
Military Expended Materials	Low potential for ingestion of chaff and/or flare plastic end-caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of chaff and/or flare plastic end-caps and pistons; and entanglement in TOW missile guide wires. Slight increase compared to No Action.
Impact Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.

Table 3.8-12 Summary of Environmental Effects of the Alternatives on Sea Turtles in the Navy Cherry Point Study Area (Continued)

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	**NEPA (Territorial Waters, 0 to 12 nm)**	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
Alternative 2		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed Mine Warfare Devices	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.	No effect.
Temporary Mine Shape Deployment/Recovery	No effect.	No effect.
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 Detonations and High Explosive Ordnance	Same as No Action.	Explosive analysis predicts no exposures. Substantial decrease compared to No Action based on elimination of HE bombs.
Military Expended Materials	Low potential for ingestion of chaff and/or flare plastic end-caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of chaff and/or flare plastic end-caps and pistons; and entanglement in TOW missile guide wires. Slight increase compared to No Action.
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), the Sustainable Fisheries Act (SFA), and the Endangered Species Act (ESA).

One of the most significant mandates in the SFA is the EFH provision, which provides the means to conserve fish habitat. The SFA requires that regional Fishery Management Councils (FMC) identify EFH for federally managed species (*i.e.*, species covered under fishery management plans [FMP]). The SFA requires federal agencies to consult with the NMFS on activities that may adversely affect EFH, or when the NMFS independently learns of a federal activity that may adversely affect EFH. An adverse effect is defined 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 - Affected Environment, EFH has been designated in the Navy Cherry Point Study Area.

This section of the EIS/OEIS includes the Navy's EFH Assessment for the Navy Cherry Point Range Complex. An EFH Assessment is a critical review of the proposed project and its potential impacts to EFH. As set forth in 50 CFR 600.920[e][3], EFH Assessments must include (1) a description of the proposed action (see Chapters 1 and 2); (2) an analysis of the effects of the action on EFH and managed species; (3) the federal agency's conclusions regarding the effects of the action on EFH; and (4) proposed mitigation (see Chapter 5), if applicable. Once NMFS learns of a federal or state activity that may have adverse effects on designated EFH, NMFS is required to develop EFH conservation recommendations for the activity. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH (NMFS, 2004a,b).

As discussed in Appendix K, the ESA established protection over and conservation of threatened and endangered species. Portions of the Navy Cherry Point Study Area are within the historic ranges of the shortnose sturgeon (*Acipenser brevirostrum*) and smalltooth sawfish (*Pristis pectinata*), which are federally listed as endangered and are the only two fish species listed under ESA in the Study Area. Therefore, the ESA requirements discussed in Appendix K are applicable to the analysis for the shortnose sturgeon and smalltooth sawfish. The Navy is consulting with the NMFS in accordance with Section 7 of the ESA. Critical habitat for listed species has not been designated under the ESA in the Navy Cherry Point Study Area.

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 is described in Section 1.5 and is shown in Figure 1.5-1. The 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 ensure that best available information was used in the EFH Assessment and this analysis for fish and EFH. 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, 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. The primary sources of information used to describe the affected environment for fish and EFH were the Navy's Marine Resources Assessment (MRA) report for the Cherry Point OPAREA (DoN, 2008). The MRA report provides compilations 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 document.

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. 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 depends 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 fish and EFH. 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 EIS/OEIS. As summarized in Table 3.9-1, potential stressors to fish and EFH include vessel movements (disturbance and collisions), aircraft overflights (disturbance), towed

Mine Warfare devices (strikes), temporary mine shape deployment/recovery (habitat alteration), non-explosive practice munitions (strikes), underwater detonations and HE ordnance, and military expended materials (ordnance related materials, targets, chaff, self-protection flares, and marine markers). 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 and Marine Corps training in the Study Area would be negligible and localized, and impacts to water and air quality would be less than 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 any effects on EFH would be temporary and/or minimal. Accordingly, the effects of water and air quality changes on fish and EFH are not addressed further in this EIS/OEIS.

3.9.2 Affected Environment

3.9.2.1 Regional Overview

The Study Area encompasses marine habitats in the Atlantic Ocean, which support diverse, abundant, and dynamic fish assemblages, many of which are recreationally and commercially important. The zoogeography of marine fish is closely tied to oceanographic processes and their position to continents (Moyle and Cech, 1988). Fish residing on continental shelves are affected by the topography of the continental shelf, water temperatures, and currents. Climates throughout the world along with topographic features divide the continental shelves into five categories: tropical regions, north temperate regions, south temperate regions, arctic regions, and Antarctic regions. In addition to continental shelf regions, there are also pelagic and deep sea regions, which support various fish species. Fish distributions in these regions such as the mesopelagic zone (200 to 1,000 m) and the offshore area of the epipelagic zone (0 to 200 m) are not confined to specific geographic locations because they are farther offshore (Moyle and Cech, 1988). In addition, the distributions of marine invertebrates, like those of marine fish, are also subjected to currents, ocean temperatures, and topographic features, but are largely dependent on the composition (firmness, texture, and stability) of the substrate upon which they reside (Sumich, 1988). Their larval stage allows extensive distributions by drifting along stretches of open water and miles of coastline (Hare and Govoni, 2005).

Over 685 species of fish are found off the coast of North Carolina and even more invertebrates (Schwartz, 1989). The topography in the Study Area is divided into four distinct habitats: coastal (1 to 18 m depth), open-shelf (18 to 55 m depth), shelf-edge (55 to 110 m depth), and outer-shelf or continental slope (110 to 182 m depth) (Struhsaker, 1969). The coastal habitat receives influxes of freshwater from river discharge, while the open shelf habitat is more affected by winds, tides, and major currents in the area (*i.e.*, Gulf Stream). The mixing of the warm, northward flowing waters of the Gulf Stream Current with the deeper, cooler, southward flowing waters of the Labrador Intermediate Water creates a dynamic environment that provides food and suitable habitat (water temperatures) off the North Carolina coast to sustain a diverse assemblage of temperate and subtropical-tropical fish and invertebrates (*e.g.*, Lophelia Banks off Cape Lookout) (Ross, 2004).

Table 3.9-1 Summary of Potential Stressors to Fish and Essential Fish Habitat[23]

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)									
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓	✓			
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓	✓	✓	✓	✓
Surface Warfare (SUW)									
Bombing Exercise (Air-to-Surface)	W-122 (Area 18)			✓			✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Areas 16 and 17)			✓			✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17)			✓			✓		✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓	✓				✓		✓
GUNEX (Surface-to-Surface) USMC Small Arms Training	Cherry Point OPAREA	✓	✓				✓		✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO) - Ship	Cherry Point OPAREA	✓	✓						
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA	✓	✓	✓					

[23] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations see Table 2.2-4 and Appendix D.

Table 3.9-1 Summary of Potential Stressors to Fish and Essential Fish Habitat (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Air Warfare (AW)									
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)			✓					
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)			✓			✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)			✓			✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓					✓
Air Intercept Control	W-122	✓	✓	✓					
Electronic Warfare (EW)									
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122	✓	✓	✓					
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15 & 16)			✓					✓
Chaff Exercise- ship	Cherry Point OPAREA	✓	✓						✓
Flare Exercise- aircraft	W-122 (Areas 1, 8, 15 & 16)			✓					✓

Table 3.9-1 Summary of Potential Stressors to Fish and Essential Fish Habitat (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Strike Warfare (STW)									
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, & 21)			✓				✓	✓
Amphibious Warfare (AMW)									
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)	✓	✓				✓		
FIREX - Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Areas 4/5 & 13/14)	✓	✓				✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓					
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓					

Since the warm waters of the Gulf Stream are deflected from the U.S. coast at Cape Hatteras, North Carolina, this region of North Carolina is known as a transitional zoogeographic zone between the temperate fish of northern waters and the subtropical-tropical species found in more southerly waters (Moyle and Cech, 1988). The Study Area encompasses an area of seasonally mixed finfish species (*i.e.*, amberjack, cobia, king mackerel, Spanish mackerel, crevalle jack, spadefish, tarpon, and barracuda) (VMRC, 2002). The nearshore coastal pelagic fish (*i.e.*, king mackerel, Spanish mackerel, cero mackerel, spot, red drum, and porgies) of North Carolina are subjected to cold water temperatures in the winter (4° to 10°C) and fairly mild temperatures in the summer (22° to 25°C) (Mathews and Pashuk, 1977; Huntsman and Manooch, 1978). The reef (live hard bottom and shelf edge habitat) associated fish of North Carolina (*i.e.*, snappers and groupers) are seasonally dependent, which leads to increases in abundances in the summer months and decreases in the winter months as the water temperature changes (Grimes *et al*., 1982). The offshore reef fish of the Study Area and vicinity inhabit deeper water that does not fluctuate in temperature as much as the nearshore reef habitats. Reef habitats in the South Atlantic Bight, of which Cape Hatteras represents the northernmost boundary, comprise less than 20 percent of the continental shelf but support more than 70 percent of the offshore fisheries (NURC, 2003). The fish residing among live hard bottom in the offshore, shelf edge waters of the Study Area and vicinity are tropical/subtropical; the most commonly occurring offshore species are black sea bass, red porgy, vermillion snapper, tomtate, and gray triggerfish (Huntsman and Manooch, 1978; Grimes *et al*., 1982).

Highly migratory species, including billfish (marlin and sailfish), swordfish, tuna, and shark species, are distributed from coastal waters seaward into the open ocean of the Study Area. These species are capable of moving great distances seasonally (north to south or inshore to offshore), as well as vertically in the water column. In contrast to temperate and subtropical fish, highly migratory species are not correlated with areas or features that typify most nearshore coastal pelagics and offshore reef fish habitat (bottom substrate or submerged vegetation) but are instead associated with physiographic and hydrographic features such as ocean fronts, current boundaries, the continental shelf margin, and sea mounts (Leggett, 1977; NMFS, 1999a, 1999b, 2003a, and 2003b).

The transport of fish larvae off the North Carolina shelf is influenced primarily by the Gulf Stream and its associated warm-core rings (Hare *et al.*, 2002). Although the Study Area does not include any estuarine areas, the importance of estuaries as nursery and developmental areas for various fish species cannot be overlooked (Schwartz, 1989). In addition, estuaries also provide vital habitat for various adult fish species, including the Atlantic sharpnose shark, smooth dogfish, spiny dogfish, skates, stingrays, herring, anchovies, and sea bass (Ross and Bichy, 2002).

3.9.2.2 Essential Fish Habitat and Federally Managed Species

There are 146 species (corals included as one species) with designated EFH for at least one life stage occurring in the Navy Cherry Point Range Complex. These species include fish and invertebrates (Table 3.9-2). The EFH that occurs in the Study Area generally includes the following (GMFMC, 2007; MAFMC, 2007; NEFMC, 2007; SAFMC, 2007b; NMFS, 2007a):

- *Benthic Habitat* - rocks, gravel, cobbles, pebbles, sand, clay, mud, silt, shell fragments, and hard bottom as well as the water-sediment interface used by many species for spawning/nesting, development, dispersal, and feeding.
- *Structured Habitat* - including artificial reefs, shipwrecks, and biogenic habitat created by living organisms such as sponges, mussels, algae, and corals, including proposed deepwater coral Habitat Areas of Particular Concern (HAPC) (see Figures 3.6-1 through 3.6-5).
- *Sargassum Habitat* - mats of *Sargassum fluitans* and *S. natans* which provide important habitat for numerous fishes, and their larval stages.

- *Gulf Stream Current Habitat* - a diverse and productive pelagic habitat which enhances the dispersal of larvae of many fish and invertebrate species.
- *Water Column Habitat* - extending from the ocean surface to the ocean floor. Depending upon the species, the habitat might only include a part of the water column (*e.g.*, surface waters).

The FMCs classify EFH for temperate and subtropical-tropical managed species in terms of five basic life stages: (1) eggs, (2) larvae, (3) juveniles, (4) adult, and (5) spawning adult. Eggs are those individuals that have been spawned but not hatched and are completely dependent on the egg's yolk for nutrition. Larvae are individuals that have hatched and can capture prey, while juveniles are those individuals that are not sexually mature but possess fully formed organ systems that are similar to adults. Adults are sexually mature individuals that are not necessarily in spawning condition. Finally, spawning adults are those individuals capable of spawning.

Table 3.9-2 Representative Species with Essential Fish Habitat That are Expected to Occur in the Navy Cherry Point Study Area

Species	Group(1)	Jurisdiction(2)
Almaco jack (*Seriola rivoliana*)	ST/T	3
Atlantic bluefin tuna (*Thunnus thynnus*)	HM	5
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	HM	5
Atlantic spadefish (*Chaetodipterus faber*)	ST/T	3
Atlantic yellowfin tuna (*Thunnus albacares*)	HM	5
Banded rudderfish (*Seriola zonata*)	ST/T	3
Bank sea bass (*Centropristis ocyurus*)	ST/T	3
Bar jack (*Caranax rubber*)	ST/T	3
Bigeye thresher shark (*Alopias superciliosus*)	HM	5
Bigeye tuna (*Thunnus obesus*)	HM	5
Bignose shark (*Carcharhinus altimus*)	HM	5
Black grouper (*Mycteroperca bonaci)*	ST/T	3
Black margate (*Anisotremus surinamensis*)	ST/T	3
Black sea bass (*Centropristis striata*)	T	2,3
Black snapper (*Apsilus dentatus*)	ST/T	3
Blackfin snapper (*Lutjanus buccanella*)	ST/T	3
Blacktip shark (*Carcharhinus limbatus*)	HM	5
Blue marlin (*Makaira nigricans*)	HM	5
Blue runner (*Caranx crysos*)	ST/T	3
Blue shark- (*Prionace glauca*)	HM	5
Blue stripe grunt (*Haemulon sciurus*)	ST/T	3
Bluefish (Pomatous saltatrix)	T	2
Blueline tilefish (Caulolatilus microps)	ST/T	3
Bonnethead shark (Sphyrna tiburo)	HM	5
Brown shrimp (Penaeus aztecus)	ST/T	3,4
Bull shark (Carcharhinus leucas)	HM	5
Butterfish (Peprilus triacanthus)	T	2
Calico scallops (Argopecten gibbus)	ST/T	3

Table 3.9-2 Representative Species with Essential Fish Habitat That are Expected to Occur in the Navy Cherry Point Study Area (Continued)

Species	Group(1)	Jurisdiction(2)
Cero (*Scomberomorus regalis*)	ST/T	2,3,4
Clearnose skate (*Raja eglanteria*)	T	2
Cobia (*Rachycentron canadum*)	ST/T	2,3,4
Coney (*Epinephelus fulvus*)	ST/T	3
Corals: stony corals, octocorals, and black corals	ST/T	3,4
Cottonwick (*Haemulon melanurum*)	ST/T	3
Crevalle jack (*Caranx hippos*)	ST/T	3
Cubera snapper *(Lutjanus cyanopterus)*	ST/T	3
Dog snapper (*Lutjanus jocu*)	ST/T	3
Dolphin, common (*Coryphaena hippurus)*	ST/T	3,4
Dusky shark (*Carcharhinus obscurus*)	HM	5
Finetooth shark (*Carcharhinus isodon*)	HM	5
French grunt (*Haemulon flavolineaum*)	ST/T	3
Gag (*Mycteroperca microlepis*)	ST/T	3
Golden crab (*Chaceon fenneri*)	ST/T	3
Golden tilefish *(Lopholatilus chamaeleonticeps)*	ST/T	2,3
Goliath grouper (*Epinephelus itajara*)	ST/T	3
Grass porgy (*Calamus arctifrons*)	ST/T	3
Gray snapper (*Lutjanus griseus*)	ST/T	3
Gray triggerfish (*Balistes capriscus*)	ST/T	3
Graysby (*Epinephelus cruentatus*)	ST/T	3
Greater amberjack (*Seriola dumerili*)	ST/T	3
Hogfish (*Lachnolaimus maximus*)	ST/T	3
Jolthead porgy (*Calamus bajonado*)	ST/T	3
King mackerel (*Scomberomorus cavalla*)	ST/T	2,3,4
Knobbed porgy (*Calamus nodosus*)	ST/T	3
Lane snapper (*Lutjanus synagris*)	ST/T	3
Lesser amberjack *(Seriola fasciata)*	ST/T	3
Little skate (*Leucoraja erinacea*)	T	2
Little tunny (*Euthynnus alletteratus)*	ST/T	2,3,4
Longbill spearfish (Tetrapturus pfluegeri)	ST/T	3
Longfin mako shark (*Isurus paucus*)	HM	5
Longspine porgy (*Stenotomus caprinus*)	ST/T	3
Longfin inshore squid (*Loligo pealeii*)	T	2
Mahogany snapper (*Lutjanus mahogoni*)	ST/T	3
Margate (*Haemulon album*)	ST/T	3

Table 3.9-2 Representative Species with Essential Fish Habitat That are Expected to Occur in the Navy Cherry Point Study Area (Continued)

Species	Group(1)	Jurisdiction(2)
Misty grouper (*Epinephelus mystacinus*)	ST/T	3
Monkfish (goosefish) (*Lophius americanuse*)	ST/T	1,2
Mutton snapper (*Lutjanus analis*)	ST/T	3,4
Nassau grouper (*Epinephelus striatus*)	ST/T	3
Night shark (*Carcharhinus signatus*)	HM	5
Ocean triggerfish (*Canthidermis sufflamen*)	ST/T	3
Oceanic whitetip shark (*Carcharhinus longimarus*)	HM	5
Pink shrimp (*Penaeus duorarum)*	ST/T	3,4
Pompano dolphin (*Coryphaena equiselis*)	ST/T	3
Porkfish (*Anisotremus virginicus*)	ST/T	3
Puddingwife (*Halichoeres radiatus*)	ST/T	3
Queen snapper (*Etelis oculatus*)	ST/T	3
Queen triggerfish (*Balistes vetula*)	ST/T	3
Red drum (*Sciaenops ocellatus*)	ST/T	3,6
Red grouper (*Epinephelus morio*)	ST/T	3
Red hake (*Urophyus chuss*)	T	2
Red hind (*Epinephelus guttatus*)	ST/T	3
Red porgy (*Pagrus pagrus*)	ST/T	3
Red snapper (*Lutjanus campechanus*)	ST/T	3
Ridged slipper lobster (*Scyllarides notifer*)	ST/T	3
Rock hind (*Epinephelus adscensionis*)	ST/T	3
Rock sea bass (*Centropristis philadelphica*)	ST/T	3
Rock shrimp (*Sicyonia brevirostris*)	ST/T	3
Royal red shrimp (*Pleoticus robustus*)	ST/T	3,4
Sailfish (*Istiophorus platypterus*)	HM	5
Sailors choice (*Haemulon parrai*)	ST/T	3
Sand tiger shark (*Odontaspis taurus*)	HM	5
Sand tilefish (*Malacanthus plumieri)*	ST/T	3
Sandbar shark (*Carcharhinus plumbeus*)	HM	5
Sargassum weed (*Sargassum natans)*	ST/T	3
Saucereye porgy (*Calamus calamus*)	ST/T	3
Scalloped hammerhead (*Sphyrna lewini*)	HM	5
Scamp (*Mycteroperca phenax*)	ST/T	3
Schoolmaster (*Lutjanus apodus*)	ST/T	3
Scup (*Stenotomus chrysops*)	T	2,3
Seabob shrimp (*Xiphopenaeus kroyers*)	ST/T	3,4
Sheepshead (*Archosargus probatocephalus*)	ST/T	3
Shortfin mako shark (*Isurus oxyrinchus*)	HM	5

Table 3.9-2 Representative Species with Essential Fish Habitat That are Expected to Occur in the Navy Cherry Point Study Area (Continued)

Species	Group[1]	Jurisdiction[2]
Silk snapper (*Lutjanus vivanus*)	ST/T	3
Silky shark (*Carcharhinus falciformis)*	HM	5
Smallmouth grunt (*Haemulon chrysargyreum*)	ST/T	3
Snowy grouper (*Epinephelus niveatus*)	ST/T	3,4
Spanish grunt (*Haemulon macrostomun*)	ST/T	3
Spanish mackerel (*Scomberomorus maculatus*)	ST/T	2,3,4,6
Speckled hind (*Epinephelus drummondhayi)*	ST/T	3,4
Spinner shark (*Carcharhinus brevipinna*)	HM	5
Spiny dogfish (*Squalus acanthias*)	T	2,6
Spiny lobster (*Panulirus argus*)	ST/T	3,4
Summer flounder (*Paralichtys dentatus*)	T	2
Swordfish (*Xiphias gladius*)	HM	5
Tiger grouper (*Mycteroperca tigris*)	ST/T	3
Tiger shark (*Galeocerdo cuvier)*	HM	5
Tilefish (*Lopholatilus chamaeleonticeps*)	T	2
Tomtate (*Haemulon aurolineatum*)	ST/T	3
Vermilion snapper (*Rhomboplites aurorubens*)	ST/T	3
Wahoo (*Acanthocybium solanderi*)	ST/T	3
Warsaw grouper (*Epinephelus nigritus)*	ST/T	3
White grunt (*Haemulon plumieri*)	ST/T	3
White marlin (*Tetrapturus albidus*)	HM	5
White shrimp (*Penaeus setiferus*)	ST/T	3,4
Whitebone porgy (*Calamus leucosteus*)	ST/T	3
Windowpane flounder (*Scophthalmus aquosus*)	T	2
Witch flounder (*Glyptocephalus oynoglossus*)	T	2
Wreckfish (*Polyprion americanus*)	ST/T	3
Yellow jack (*Caranx bartholomaei)*	ST/T	3
Yellowedge grouper (*Epinephelus flavolimbatus*)	ST/T	3
Yellowfin grouper (*Mycteroperca venenosa*)	ST/T	3
Yellowmouth grouper (*Mycteroperca interstitialis*)	ST/T	3
Yellowtail snapper (*Ocyurus chrysurus*)	ST/T	3

[1]Group: T=temperate; ST/T=subtropical/tropical; HM= highly migratory

[2]Jurisdictions: 1=New England Fishery Management Council (NEFMC); 2=Mid Atlantic Fishery Management Council (MAFMC); 3=South Atlantic Fishery Management Council (SAFMC); 4=Gulf of Mexico Fishery Management Council (GMFMC); 5=NMFS; Atlantic States Marine Fisheries Commission (ASMFC)

Sources: GMFMC, 2007; MAFMC, 2007; NEFMC, 2007; SAFMC, 2007b; NMFS, 2007a.

Although the individual life stage terms and definitions are the same as those defined by the FMCs, NMFS categorizes the life stages of managed tuna, swordfish, and billfish somewhat differently,

resulting in three categories that are based on common habitat usage by all life stages in each group: (1) spawning adults, eggs, and larvae; (2) juveniles and subadult; and (3) adult. Subadults are those individuals just reaching sexual maturity. The category of spawning adult, eggs, and larvae is associated with spawning location and the circulation patterns that control the distribution of the eggs and larvae.

NMFS uses a different life stage classification system for sharks; the system bases the life stage combinations on the general habitat shifts that accompany each developmental stage. The three resulting categories are: (1) neonate and early juvenile (including newborns and pups less than one year old), (2) late juvenile and subadult (age one to adult), and (3) adult (sexually mature sharks). In Amendment 1 to the Fisheries Management Plan for the Atlantic Tunas, Swordfish, and Sharks, the first two life stages were modified as follows: the neonate and early juvenile category was renamed "neonate," which primarily includes neonates and small young-of-the-year sharks; and the late juveniles and subadults category was renamed "juveniles," which includes all immature sharks from young to late juveniles.

Detailed descriptions of individual species, their life-histories, distribution, and maps of species designated EFH-HAPC are contained in the *Marine Resources Assessment Update for the Cherry Point Operating Area* (DoN, 2008) and the *Essential Fish Habitat Study for the Southeast Operating Areas: Virginia Capes, Cherry Point, and Charleston/Jacksonville* (DoN, 2005). Section 3.6 – Marine Communities also provides descriptions of benthic habitats and maps for benthic communities (Figures 3.6-1 and 3.6-2); coral, coral reefs, live, or hard bottom EFH (Figure 3.6-3); existing coral, coral reefs, live, or hard bottom HAPC (Figure 3.6-4); proposed deepwater coral HAPC (Figure 3.6-4); deepwater snapper grouper marine protected areas (Figure 3.6-4); and artificial habitats (Figure 3.6-5).

3.9.2.3 Fishery Management Plans and Managed Species

Table 3.9-3 provides and overview of fishery management plans for federal waters in the Navy Cherry Point Range Complex. Species within federal waters of the study area fall primarily under the jurisdiction of two fishery management councils and one federal agency: SAFMC (jurisdiction is federal waters from North Carolina to eastern Florida at Key West), the Mid-Atlantic Fishery Management Council (MAFMC; jurisdiction is federal waters from New York to North Carolina), and NMFS (jurisdiction limited to Highly Migratory Species in federal waters off the U.S. Atlantic and the Gulf of Mexico). As noted in Table 3.9-3, many species are co-managed by more than one FMC and/or commission. The Atlantic States Marine Fisheries Commission (ASMFC), a consortium of the 15 coastal states from Florida through Maine, manages some species in state waters and works cooperatively with FMCs on management of some species in federal waters.

3.9.2.4 Habitat Areas of Particular Concern

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.

Table 3.9-3 Fishery Management Plans for Federal Waters and Managed Species in the Navy Cherry Point Range Complex

Management Plan	Species	Reference
Consolidated Atlantic Highly Migratory Species FMP	**Billfish Management Unit** Blue marlin, longbill spearfish, sailfish, and white marlin **Tuna Management Unit** Albacore, bluefin, bigeye, Atlantic yellowfin, and skipjack tuna **Swordfish Management Unit** Swordfish **Large Coastal Shark Management Unit** Blacktip, bull, lemon, nurse, sandbar, great hammerhead, scalloped hammerhead, smooth hammerhead, silky, spinner, and tiger sharks **Small Coastal Shark Management Unit** Atlantic sharpnose, blacknose, bonnethead, and finetooth sharks **Pelagic Management Unit** Blue, oceanic whitetip, shotfin mako, and thresher sharks **Prohibited Species Management Unit** Atlantic angel, basking, bigeye sandtiger, bigeye thresher, bignose, bluntnose sixgill, dusky, longfin mako, night, sand tiger, sharpnose sevengill, and whale sharks	NMFS, 2007a
Bluefish FMP	Bluefish	MAFMC, 2007
Dogfish FMP	Spiny dogfish	MAFMC, 2007
Coastal Migratory Pelagics FMP	King mackerel, Spanish mackerel, cero mackerel, cobia, and little tunny	SAFMC, 2007e
Atlantic mackerel, squid, and butterfish	Atlantic mackerel, butterfish, and longfin inshore squid	MAFMC, 2007e
Coral and Live Bottom Habitat FMP	Coral belonging to the Class Hydrozoa (fire corals and hydrocorals); coral belonging to the Class Anthozoa, Subclass Hexacorallia, Orders Scleractinia (stony corals) and Antipatharia (black corals); seafans, Gorgonia flabellum or G. ventalina; coral in a coral reef, except for allowable octocoral; coral in an HAPC, including allowable octocoral; live rock – living marine organisms, or an assemblage thereof, attached to a hard substrate, including dead coral or rock (excluding individual mollusk shells)	SAFMC, 2007f
Dolphin and Wahoo FMP	Common dolphin, pompano dolphin, and wahoo	SAFMC, 2007g
Golden Crab FMP	Golden crab	SAFMC, 2007h
Monkfish FMP	Monkfish	NEFMC, 2007
Red Drum FMP	Red drum	SAFMC, 2007d
Shrimp FMP	White, pink, brown, seabob, royal red, and rock shrimp	SAFMC, 2007i
Snapper/Grouper Complex FMP	Includes 73 species consisting of snappers, groupers, porgys, triggerfish, jacks, tilefish, grunts, spadefish, wrasses, and sea basses	SAFMC, 2007j
Summer flounder, Scup, and Black Seabass FMP	Summer flounder, scup, and black seabass	MAFMC, 2007
Tilefish FMP	Tilefish	MAFMC, 2007
Spiny lobster	Spiny lobster and ridged slipper lobster	SAFMC, 2007
Calico Scallop FMP	Calico scallop	SAFMC, 2007k
Sargassum FMP	*Sargassum natans* and *Sargassum fluitans*	SAFMC, 2007a

Table 3.9-4 summarizes existing HAPC in the Navy Cherry Point Range Complex. Coral, coral reef, and live/hardbottom HAPCs are shown in Figure 3.6-4. Mapping for other HAPCs are provided in the *Marine Resources Assessment Update for the Cherry Point Operating Area* (DoN, 2008). In response to research revealing the distribution, importance, and uniqueness of deepwater coral habitats in the South Atlantic, SAFMC has proposed establishment of four new deepwater coral HAPCs (Figure 3.6-4) (SAFMC, 2008). Action to establish the new deepwater coral HAPCs will be taken through the Comprehensive Fishery Ecosystem Plan Amendment, which was under development as of October 2008 (SAFMC, 2008). Two of these proposed sites, Cape Lookout Lophelia Bank and Cape Fear Lophelia Bank, are in the OPAREA. A very small portion of the largest proposed deepwater coral HAPC (Stetson Reef/Savannah and East Florida Lithoherms/Miami Terrace) extends into the south part of the OPAREA.

Table 3.9-4 Species Groups with Designated Habitat Areas of Particular Concern in the Study Area

Species Group	Essential Fish Habitat-Habitat Area of Particular Concern
Penaeid shrimp MU (brown, pink, and white shrimp), all lifestages	All coastal inlets, state-designated nursery areas, and state-identified overwintering areas are designated as HAPC. These are not located within the boundaries of the OPAREA.
Red drum, all lifestages	All coastal inlets; all state-designated nursery habitats of particular importance to red drum; documented sites of spawning aggregation; barrier islands and their inlets; submerged aquatic vegetation beds in Virginia, North Carolina, and Florida; the entire estuarine systems in South Carolina and Georgia; and the inlets, adjoining channels, sounds, and outer bars of ocean inlets are designated HAPC. None of these are within the boundaries of the OPAREA.
Snapper-grouper MU (18 species), all lifestages	Medium to high profile, offshore, hard bottom habitat where spawning normally occurs (areas of known spawning aggregation); pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; FMC-designated artificial reef special management zones; areas with fishing gear restrictions or harvest regulations; the Point (NC); Ten Fathom Ledge (NC); and Big Rock (NC) are designated HAPC within the OPAREA. Additional HAPC designated for this MU include: seagrass habitat, mangrove habitat, oyster/shell habitat, all coastal inlets, all state-designated nursery habitats, nearshore hard bottom habitat (<4 m), Charleston Bump (SC) and the *Oculina* Bank HAPC.
Coastal migratory pelagic MU (cobia, king mackerel, and Spanish mackerel), all lifestages	Sandy shoals associated with Cape Lookout, NC, Cape Fear, NC, and Cape Hatteras, NC from shore to the ends of the respective shoals but shoreward of the Gulf Stream; the Point (NC); Ten Fathom Ledge (NC); Big Rock (NC); and pelagic *Sargassum* have been designated as HAPC in the OPAREA. Additional areas designated as HAPC include: New River and Bogue Sound (NC) for Spanish mackerel; Broad River (SC) for cobia; Charleston Bump (SC); Hurl Rocks (SC), the Point off Jupiter Inlet (FL); *Phragmatopoma* (worm) reefs (central east-coast of FL); nearshore hard bottom (<4 m) south of Cape Canaveral, FL; the Hump off Islamorada, FL; the Marathon Hump (FL); and the "Wall" off the Florida Keys.

Table 3.9-4 Species Groups with Designated Habitat Areas of Particular Concern in the Study Area (Continued)

Species Group	Essential Fish Habitat-Habitat Area of Particular Concern
Coral, coral reef and live/hard bottom habitat	Areas designated as HAPC in the OPAREA include the Ten Fathom Ledge (NC), Big Rock (NC), and the Point (NC). Additional designated HAPC not found within the boundaries of the OPAREA include: Hurl Rock (SC), Charleston Bump (SC), Gray's National Marine Sanctuary (GA), *Oculina* Bank, *Phragmatopoma* (worm) reefs (central east coast of Florida); nearshore hard bottom (<4 m) from Cape Canaveral, FL to Broward County, FL; offshore (5 to 30 m) hard bottom from Palm Beach County, FL to Fowey Rocks, FL; Biscayne Bay, FL; Biscayne National Park FL; and the Florida Keys National Marine Sanctuary.
Dolphin and wahoo, all lifestages	The Point (NC); Ten Fathom Ledge (NC); and Big Rock (NC) are designated HAPC in the OPAREA. Additional designated HAPC include Charleston Bump (SC); Georgetown Hole (SC); Amberjack Lump (FL); the Hump off Islamorada (FL); Marathon Hump (FL); and the "Wall" off the Florida Keys.
Sandbar shark, all lifestages	HAPC are designated in the shallow areas at the mouth of Great Bay, New Jersey (NJ), lower and middle Delaware Bay, lower Chesapeake Bay, and near the Outer Banks, NC in areas of Pamlico Sound adjacent to Hatteras and Ocracoke Islands; and offshore of these barrier islands, since they represent important nursery and pupping grounds. Only those within NC are in the OPAREA.

The Cape Lookout Lophelia Bank and the Cape Fear Lophelia Bank were originally proposed for HAPC designation in 2004 and reviewed in June 2006. A final determination has not yet been made. The northernmost area (Cape Lookout Lophelia Bank) contains the most extensive coral mounds off North Carolina (Reed, 2004). The main mound system rises vertically nearly 262 ft over a distance of about 0.62 mi at depths of 121 to 1,476 ft on the western edge of the Blake Plateau. Sides and tops of these mounds are covered with extensive *Lophelia pertusa*. Both living and dead corals are common. Many fish species have been observed and collected along these banks. In addition, these areas support a well-developed invertebrate fauna (Reed, 2004). Many of the fish species are thought to be rare and/or outside their reported ranges (Reed and Ross, 2005), and this is the only area off North Carolina where wreckfish (coastal FMP (0-3nm) managed by ASMFC) have been observed.

SAFMC has established a series of eight deepwater marine protected areas in the South Atlantic region through the development and implementation of Amendment 14 to the Snapper Grouper Fishery Management Plan. The marine protected areas are designed to protect a portion of the long-lived, deepwater snapper grouper species and their habitat from directed fishing pressure (NMFS, 2008a). Juvenile and adults of most snapper grouper species are demersal and associate with live/hard bottom that has moderate to high relief (*e.g.*, coral reef systems, artificial reef structures, rocky hard bottom substrates, and limestone outcroppings) (SAFMC and NMFS, 2006). Therefore, the marine protected areas represent areas of important live/hard bottom habitat. Two of the marine protected areas (from north to south; Snowy Grouper and Northern South Carolina) are located within the OPAREA (Figure 3.6-4).

3.9.2.5 Endangered Species Act-Listed Fish Species

Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*) was originally listed as an endangered species throughout its range under the Endangered Species Preservation Act of 1966 and remained on the

endangered species list with the enactment of the ESA in 1973 (NMFS, 1998). Critical habitat has not been designated for this species. Historically, the range of the shortnose sturgeon extended along the Atlantic coast from Saint John River, New Brunswick, Canada to Indian River, Florida (Gruchy and Parker, 1980). Currently, NMFS recognizes 19 distinct population segments of shortnose sturgeons inhabiting 25 river systems from Saint John River, New Brunswick, Canada, to St. Johns River, Florida (NMFS, 1998). The Cape Fear River distinct population segment is located in North Carolina.

Shortnose sturgeons inhabit rivers and estuaries, occasionally moving short distances to the mouths of estuaries and nearby coastal waters, with populations confined mostly to natal rivers and estuarine habitats (Dadswell *et al*., 1984). The species appears to be estuarine anadromous in the southern part of its range, but in some northern rivers it is "freshwater amphidromous" (adults spawn in freshwater but regularly enter saltwater habitats during their life) (NMFS, 1998). Spawning occurs in freshwater rivers, usually above tidal influence, and eggs are demersal and adhesive (Dadswell *et al*., 1984). Juveniles may remain inland of saline waters until they reach a length of 18 inches (two to eight years) (Dadswell *et al*., 1984). In estuarine systems, the shortnose sturgeon occurs in areas with little or no current over a bottom composed primarily of mud and sand. Sturgeons prefer freshwater swamps or areas with fast flows and gravel cobble bottoms in the riverine areas (Gilbert, 1992). Adults are found in deep water (32 to 98 feet) in winter and in shallow water (6 to 32 feet) in summer. Juveniles are nonmigratory, typically inhabiting deep channels of swiftly flowing river above the salt wedge (Burkhead and Jenkins, 1991). Shortnose sturgeons are not known to participate in coastal migrations (NMFS, 1998).

Besides the self-sustaining population in the Cape Fear River drainage, the status and distribution of the shortnose sturgeon in North Carolina has never been well known, although some populations have probably been recently extirpated (Collins *et al*., 2000). No data on population dynamics currently exist for the Albemarle Sound/Roanoke and Chowan rivers and the Pamlico Sound/Pamlico and Neuse rivers. Some of the historical information from the North, New, Neuse, and lower Chowan Rivers, Beaufort, and nearshore ocean (Oregon Inlet) cannot be validated and may be misidentifications of Atlantic sturgeon (Ross *et al*., 1988; NMFS, 1998). Counties in North Carolina where the shortnose sturgeon has been reported within the past 23 years include Currituck, Camden, Pasquotank, Dare, Hyde, Pamlico, Carteret, and Onslow (LeGrand *et al*., 2001; NOS, 2001; USFWS, 2002).

The shortnose sturgeon is not expected to occur in the Study Area because individuals generally remain within their natal river or estuary, only occasionally moving to marine environments.

Smalltooth Sawfish

The distinct population segment of smalltooth sawfish (*Pristis pectinata*) in the United States was listed as an endangered species in 2003 (NMFS, 2003c). NMFS proposed critical habitat for this species on November 20, 2008 (73 FR 70290); however, the areas proposed to be designated as critical habitat fro smalltooth sawfish are located on the southwestern coast of Florida. It is believed the current population is less than five percent of its historical size (Simpfendorfer and Wiley, 2006). Prior to around 1960, smalltooth sawfish occurred commonly in shallow waters of the Gulf of Mexico and eastern seaboard up to North Carolina, and more rarely as far north as New York. Currently its distribution is limited to peninsular Florida and, within that area, smalltooth sawfish can only be found with any regularity off the extreme southern portion of the state. The current distribution is centered in the Everglades National Park, including Florida Bay (NMFS, 2003c). The smalltooth sawfish typically inhabits nearshore, shallow subtropical-tropical estuarine and marine waters, but may also be found utilizing freshwater habitats in large rivers (Simpfendorfer, 2002; Schultz, 2004).

There have been multiple reports of the smalltooth sawfish in North Carolina waters from the late 1800s and early 1900s. This species was reported from Core Sound, Bogue Sound, New River, and Cape Lookout. Since 1915, there have been three published records of captures in North Carolina: 1937,

1963, and the latest in 1999 (Burgess and Curtis, 2003; NMFS, 2006). The smalltooth sawfish is not expected to occur in the Study Area because its current distribution is limited to peninsular Florida, no recent records exist for the Study Area, and it rarely occurs offshore.

Candidate Species

"Candidate species" refer to (1) species that are the subject of a petition to list under the ESA and for which NMFS determined that listing may be warranted, and (2) species that are not the subject of a petition but for which NMFS has announced the initiation of a status review in the *Federal Register*. In other words, any species that is undergoing a status review that NMFS has announced in a *Federal Register* notice will be considered a candidate species. Initiation of a status review does not mean an ESA listing is imminent. Even after a status review has been conducted, it is possible that available information will be insufficient to make a determination on the status of the species or that the information will indicate an ESA listing is not warranted. Candidate species do not carry any procedural or substantive protections under the ESA, and Section 7 consultation requirements do not apply. One candidate species, the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), may occur in the Study Area.

The Atlantic sturgeon is found along the Atlantic coast from Labrador, Canada, to the St. Johns River, Florida. It is anadromous (migrates from the ocean into coastal estuaries and rivers to spawn), lives approximately 60 years, and reaches sexual maturity between five and 34 years (NMFS, 2007a). Atlantic sturgeon feed on benthic invertebrates, mussels, worms, and shrimp. First identified as a species of concern in 1988, its status was reviewed in 1998 and found not to warrant listing at that time although a country-wide moratorium on fishing was ordered by the federal government in 1998. Reasons for its decline are fishing (harvesting for flesh and eggs [caviar]), estuarine and freshwater habitat degradation, and locks and dams. The Atlantic sturgeon is managed under the Atlantic States Marine Fisheries Commission Fishery Management Plan, and rebuilding of stock is estimated to take 20 to 40 years (ASMFC, 2007). The Atlantic Sturgeon Status Review Team completed a second status review in February 2007 and determined that Atlantic sturgeon populations should be divided into five distinct population segments: 1) Gulf of Maine, 2) New York Bight, 3) Chesapeake Bay, 4) Carolina, and 5) South Atlantic (Atlantic Sturgeon Status Review Team, 2007). The NMFS is currently using the information contained in the status review to make listing determinations for each distinct population segment.

Species of Concern

"Species of concern" are those species about which NMFS has concern regarding status and threats, but for which insufficient information is available to indicate a need to list the species under ESA. Species of concern do not carry any procedural or substantive protections under the ESA, and Section 7 consultation requirements do not apply. Species of concern status serves to promote conservation and research efforts for these species. The following species of concern potentially occur in the Study Area: alewife (*Alosa pseudoharengus*), barndoor skate (*Dipturus laevis*), blueback herring (*Alosa aestivalis*), dusky shark (*Carcharhinus obscurus*), night shark (*Carcharinus signatus*), opossum pipefish (*Microphis brachyurus lineatus*), sand tiger shark (*Carcharias taurus*), speckled hind (*Epinephelus drummondhayi*), thorny skate (*Amblyraja radiata*), and Warsaw grouper (*Epinephelus nigritus*) (NMFS, 2007b).

3.9.3 Environmental Consequences

Potential effects of the action on the shortnose sturgeon and smalltooth sawfish, which are federally listed as endangered, are analyzed separately below. Table 2.2-5 summarizes the proposed changes in operational parameters that have the potential to affect fish and EFH.

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, 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 and Marine Corps 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

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 5,000 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.

Towed Mine Warfare Devices

Effects on Essential Fish Habitat

As described in Chapter 2 and Appendix D, Mine Warfare Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems towed through the water by helicopters flying approximately 75 to 100 feet above the water at low airspeeds. Under the No Action Alternative, 220 towed device sorties would be conducted per year. Most of these sorties would occur in the Underwater Detonation Area in Onslow Bay, with fewer occurring farther offshore in CVOA North (see Figure 2.2-1).

The use of towed Mine Warfare devices would result in short-term and localized disturbance to the water column, but benthic habitats would not be affected because these devices are not towed on the bottom. *Sargassum* mats likely occur in CVOA North based proximity to the Gulf Stream. 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 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, the use of towed devices in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. In accordance with EO 12114, towed devices would not cause significant harm to fish populations or habitat in non-territorial waters.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment / Recovery)

The No Action Alternative does not include establishment of Mine Warfare Training Areas where temporary mine shapes would be deployed.

Non-explosive Practice Munitions

Effects on Essential Fish Habitat

Current Navy operations in the Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. NEPM may be used throughout the OPAREA, but it is not used in state waters (0 to 3 nm from shore) (see Table 2.2-6 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 communities and the associated magnitude of effects 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, both soft bottom and hard bottom communities occur in the Study Area. 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 greater than 12 nm offshore in waters over 65 ft 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. 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) compared to soft bottom areas (NRC, 2002).

Large, heavy items such as non-explosive practice bombs, missiles, and naval gun shells (Table 3.9-5) 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 654 non-explosive practice bombs would be dropped per year under the No Action Alternative in the 18,617-nm^2 OPAREA. Assuming an even distribution, the relative concentration of non-explosive practice bombs would be 3.5 per 100 nm^2/year. Actual concentrations would vary based on specific training scenarios, but would nonetheless be extremely low. Non-explosive practice missiles use (five per year for No Action Alternative) would be widely dispersed in Areas 9, 10, 11, and 12. A total of 1,259 non-explosive naval gun shells (5 in and 76 mm) would be fired per year under the No Action Alternative in the OPAREA.

The maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be approximately 4,488 ft^2 (0.00012 nm^2) per year or 44,880 ft^2 (0.0012 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 3.9-6).

Table 3.9-5 Size of Non-Explosive Practice Bombs, Missiles, and Naval Gun Shells Used in the Navy Cherry Point OPAREA

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
AIM-7	500	144	8	8
Hellfire	100	64	7	3.1
5 in	70	26	5	0.9
76 mm	14	14	3	0.3

[(1)]Alternative 2 only.
[(2)]Length x diameter.

Table 3.9-6 Estimates of Marine Benthic Habitat That Would be Affected by Non-Explosive Practice Bombs, Missiles, and Naval Gun Shells in the NAVY Cherry Point OPAREA

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 - OPAREA						
BDU-45	165	1,670	182	1,842	194	1,963
MK-76	489	678	538	746	565	783
MK-83(I)	0	0	0	0	52	1,203
Subtotal =	**654**	**2,348**	**720**	**2,588**	**811**	**3,950**
Non-Explosive Practice Missiles – Areas 9, 10, 11, and 12						
AIM-7	4	64	8	128	8	128
Hellfire	1	6	2	12	2	12
Subtotal =	**5**	**70**	**10**	**140**	**10**	**140**
Non-Explosive Practice Naval Gun Shells - OPAREA						
5 in	1,088	1,964	1,140	2,058	1,140	2,058
76 mm	171	106	190	118	190	118
Subtotal =	**1,259**	**2,071**	**1,330**	**2,176**	**1,330**	**2,176**
Total =		**4,488**		**4,904**		**6,226**

[(1)]Assumed that the area of marine benthic habitat affected per year = footprint x 2 x #/yr.

As shown in Figures 3.6-1 through 3.6-5, live hard bottom and artificial habitats are found in portions of the OPAREA, including hard bottom EFH, proposed deepwater coral HAPC, and deepwater snapper grouper marine protected areas. The probability of non-explosive practice bombs, missiles, and naval gun shells striking artificial habitats would be low because these resources occupy a relatively small area and most artificial reefs are located less than 12 nm offshore.

Based on the distribution of hard bottom EFH (Figure 3.6-3), proposed deepwater coral HAPC (Figure 3.6-4), and deepwater snapper group marine protected areas (Figure 3.6-4), it is possible that a small percentage of non-explosive practice bombs, missiles, and naval gun shells would strike in these areas. The potential for strikes to adversely affect benthic communities in these areas would depend on the substrate and community types found at the point of physical impact. 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, missiles, and naval gun shells that would strike soft bottom habitats versus more sensitive areas such as live hard bottom. Nonetheless, the total area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be small (about 4,488 ft^2 per year) and only a percentage of the total area affected (less than 4,488 ft^2 per year) would be sensitive benthic habitat such as live hard bottom.

Non-explosive practice bomb, missile, 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 (DoN, 2000a; 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 (DoN, 2000a; 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 (2007) 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

Explosions that occur in the OPAREA are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch HE rounds), as well as underwater detonations associated with Mine Neutralization training (MINEX). Underwater detonation and HE ordnance use is limited to specific training areas (see Table 2.2-7 for a summary of explosions by training area) and does not occur in state waters of the Atlantic Ocean (0 to 3 nm from shore). 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, some of which could be designated as EFH for spawning adults. 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, and shipwrecks, 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). As discussed in Section 3.6.2.2, there are considerable hard bottom and coral communities in the Study Area (Figure 3.6-1 through 3.6-4) as well as shipwrecks (Figure 3.6-5). Mine Neutralization exercises conducted under the No Action Alternative in the UNDET Area would include underwater detonations set on or near the sea floor, as well as in the water column. The Navy does not set underwater explosive charges associated with Mine Neutralization exercises within 1,000 ft of known live/hard bottom, artificial reefs, and shipwrecks (see Section 5.7.10 for detailed description of Navy mitigation measures for underwater detonations). Therefore, only unconsolidated, soft bottom and water column habitats would 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, 2000b). Assuming a worst –case scenario where all twenty 20-lb charges were detonated directly on the bottom, up to 151 to 235 ft^2 of soft bottom benthic habitat could be disturbed by underwater detonations per year under the No Action Alternative. 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. There have been no studies of sediment deposition rates in the area of the proposed

action, but the Minerals Management Service (2002) indicates that sandy sediments are quickly redeposited within 1,312 feet of oil-well blowouts, and finer sediments are widely dispersed and redeposited over a period of 30 days or longer within 3,000 feet. 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 reduce the quality or quantify of EFH in the Study Area.

Explosions associated with BOMBEX, MISSILEX, and FIREX (with IMPASS) occur at or near the water's surface in areas where depths range from 20 m to over 2,900 m. Of the ordnance types used during these exercises, the MK-84 HE bomb has the highest net explosive weight (NEW) (944.7 lbs). Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by a MK-84 HE bomb explosion would be about 11.9 m (39 ft). The gas bubble would not extend to the bottom based on the minimum water depth (20 m) and a detonation depth of 1 m below the surface. Likewise, the gas bubbles produced by other ordnance types used in BOMBEX, MISSILEX, and FIREX (with IMPASS) would not extend to the bottom because they have smaller NEWs. Therefore, explosions during BOMBEX, MISSILEX, and FIREX are not expected to result in disturbance to benthic or artificial habitats because detonations would occur near the surface in deep waters. Effects of explosions on *Sargassum* habitats would be minimal because Navy mitigation measures specify that HE ordnance is not targeted to impact near observed *Sargassum* mats. Therefore, HE ordnance 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, some of which could be designated as EFH for spawning adults. Underwater detonations associated with Mine Neutralization training would disturb soft bottom benthic habitats, but the effects would be minimal and temporary. Underwater detonations and HE ordnance use are not expected to have adverse effects on, coral, coral reefs, live, or hard bottom EFH or HAPC; proposed deepwater coral HAPC; proposed deepwater snapper grouper marine protected areas; or artificial habitats. Navy mitigation measures further reduce the potential for these resources and *Sargassum* habitats to be affected by explosions. Impacts to EFH from underwater detonations and HE ordnance would be temporary and/or minimal. Underwater detonations and HE ordnance use under the No Action Alternative would not reduce the quantity or quality of EFH in the Study Area. 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 3 to 87 percent (46% average) 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) found that anchovy and smelt larvae died 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 net explosive weight (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 3.9-7 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. 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).

Table 3.9-7 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					
20-lb NEW UNDET Charge	20	30	666	464	299
Missile Exercise					
Hellfire	8	3.3	317	221	142
TOW	15	3.3	380	265	170
Firing Exercise with IMPASS					
HE Naval Gun Shell, 5-inch	8	1	244	170	109
Bombing Exercise					
MK-82[(3)]	192.2	3.3	772	539	346
MK-83	415.8	3.3	959	668	430
MK-84[(3)]	945	3.3	1,206	841	541

[(1)]Alternative 2 only.
[(2)]Alternatives 1 and 2 only.
[(3)]No Action Alternative and Alternative 1 only.

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.

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, 2008; Popper, 2003; 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. Sound from a single explosion could also affect fish recruitment if it occurred in the vicinity of a spawning event. The sound from the explosion could alter the behavior of the fish and disrupt, delay, or prevent the spawning event from occurring. Given the spatial and temporal dispersion of training activities and spawning events, the probability of an explosion disrupting spawning is expected to be low. If a spawning event were disrupted, the effects would be localized and a measureable reduction in fish recruitment would not be expected.

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 menhaden, herring, 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. Figures 3.6-1 through 3.6-5 show training areas where explosions would occur in relationship to habitat features such as live hard bottom and artificial habitats that often support dense aggregations of fish. Navy mitigation measures reduce the possibility that large numbers of fish would be affected.

Nonetheless, the training areas where explosions would take place do contain designated EFH and do support many important species of fish.

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 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. If ingested, some military expended materials could lodge in the digestive system and interfere with food consumption and digestion; resulting in sublethal or lethal effects.

Ordnance-related Materials

Ordnance-related materials include various sizes of NEPM and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). 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.

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 (0.69 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

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. 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 2,100 self-protection flares would be used 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 (USAF, 1997). The light generated by flares would have no effect on fish based on short burn time, relatively high altitudes where they are used, and the wide-spread and infrequent use. 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. The number of fish potentially affected by ingestion of self-protection flare end caps would be low based on the low environmental concentration. 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 sink to the bottom after burning out. Chemical components of the marker would be consumed during the burning process. 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 (230 per year).

TOW Missile Guide Wires

The No Action Alternative includes firing four TOW missiles per year in Areas 16 and 17. This missile system has two thin (5.75 mils which equates to 0.146 mm diameter) wires that provide a passive line for transmission of steering commands from the aircraft to the missile. Two wire dispensers are mounted on the rear of the missile. These dispensers contain 3,750 m each of single-strand wire with a minimum tensile strength of 10 pounds. The copper-plated high carbon steel wire has an enamel coating. The guide wires are not recoverable when a missile is fired at sea. Corrosion or degradation rates for the wire in seawater are unknown, but they could persist for relatively long periods given the corrosion resistance of copper and the enamel coating. The length of wire dispensed would generally be equal to the distance the missile travels to impact the target. Fish could become entangled in a TOW missile guide wire as it moves through the water column or after it has settled to the sea floor. Entanglement could lead to sublethal or lethal effects. The long length of the guide wire increases the likelihood that a fish would encounter a guide wire and become entangled, but only four missiles would be fired per year. Therefore, the number of fish affected by TOW missile guide wires is expected to be low and population-level effects are not anticipated.

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 would be negligible to minor. Military expended materials under the No Action Alternative would not result in adverse effects to fish populations. 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.

Shortnose Sturgeon

As discussed in Section 3.9.2.3, the shortnose surgeon is not expected to occur in the Study Area because individuals generally remain within their natal river or estuary, only occasionally moving to marine environments. The No Action Alternative would have no effect on the shortnose sturgeon. The No Action Alternative would have no effect on critical habitat because none has been designated for the shortnose sturgeon.

Smalltooth Sawfish

As discussed in Section 3.9.2.3, the smalltooth sawfish is not expected to occur in the Study Area because its current distribution is limited to peninsular Florida, no recent records exist for the Study Area, and it rarely occurs offshore. The No Action Alternative would have no effect on the smalltooth sawfish. The No Action Alternative would have no effect on critical habitat because none has been designated for the smalltooth sawfish.

Candidate Species

The effects of the No Action Alternative on the Atlantic sturgeon would be the same as those described above for other fish species. The No Action Alternative would not result in significant adverse effects to candidate species.

Species of Concern

The effects of the No Action Alternative on species of concern would be the same as those described above for other fish species. The No Action Alternative would not result in significant adverse effects to species of concern.

3.9.3.2 Alternative 1

Vessel Movements

The number of operations per year involving vessel movements would increase by about six percent in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased potential for vessel collision-related fish mortalities and injuries (primarily eggs and larvae) to occur compared to baseline conditions. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to vessel movements would continue to be low relative to total ichthyoplankton biomass. Vessel movements would continue to result in short-term and localized disturbances to water column and *Sargassum* habitats, but benthic habitats would not be affected. Mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of habitat disturbance and injury or mortality. 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 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 would include a 10 percent increase in fixed-wing aircraft sorties per year and a 16 percent increase in helicopter sorties per year in the Study Area (Table 2.2-5). The magnitude of individual exposures would not increase because Alternative 1 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to or less than the noise levels generated by the helicopters that they would replace.

Based on the increased operations under Alternative 1 more fish could be exposed to noise and/or the number of times an individual fish is exposed could increase. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions (*e.g.,* swimming away and increased heart rate) and the general health of individual fish would not be compromised. 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.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would decrease by 13 percent per year under Alternative 1. Similar to the No Action Alternative, use of towed devices under Alternative 1 would result in short-term and localized disturbances to the water column, but benthic habitats would not be affected because the equipment is not towed on the bottom. Ichthyoplankton (fish eggs and larvae) in the upper portions of the water column could be displaced, injured, or killed by towed devices. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to towed devices would be low relative to total ichthyoplankton biomass. Disturbances to water column and *Sargassum* habitats would be short-term and localized. Impacts to EFH from towed Mine Warfare device use under Alternative 1 would be temporary and minimal. Towed Mine Warfare device use would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, the use of towed devices in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. In accordance with EO 12114, towed devices would not cause significant harm to fish populations or habitat in non-territorial waters.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

Alternative 1 does not include establishment of Mine Warfare Training Areas where temporary mine shapes would be deployed.

Non-explosive Practice Munitions

The amount of NEPM used would increase in the Study Area under Alternative 1 (Tables 2.2-5 and 2.2-6). The number of non-explosive practice bombs dropped in the OPAREA would increase from 654 to 720 per year, non-explosive practice missiles would increase from 5 to 10 per year, and non-explosive practice naval gun shells would increase from 1,259 to 1,330 (Table 3.9-6). These changes would result in increased potential for fish/NEPM strikes and associated fish mortalities and injuries to occur compared to baseline conditions. However, as discussed for the No Action Alternative the number of fish affected would continue to be small. Mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of NEPM-related injury or mortality.

As discussed for the No Action Alternative, disturbances to water column habitats from NEPM strikes would be short-term and localized. NEPM strikes would cause little or no physical damage to soft

bottom benthic habitat, and any damage would be localized. The area affected by non-explosive practice bombs, missiles, and naval gun shells would increase under Alternative 1. The relative non-explosive practice bomb concentration would increase from 3.5 to 3.9 per 100 nm^2/year in the OPAREA. The probability of non-explosive practice bombs, missiles, and naval gun shells striking hard bottom EFH, artificial habitats, proposed deep water coral HAPC, and deepwater snapper grouper marine protected areas would increase under Alternative 1. However, the total area of benthic habitat affected would continue to be small. As shown in Table 3.9-6, the maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would increase from 4,488 ft^2 (0.00012 nm^2) per year to 4,904 ft^2 (0.00013 nm^2) per year or 49,040 ft^2 (0.0013 nm^2) over a ten-year period. Only a percentage of the total area affected (less than 4,904 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bomb, missile, and naval gun shell strikes under Alternative 1 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, 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

The number and location of explosions that would occur under Alternative 1 would be the same as the No Action Alternative, with the exception of increases in air-to-surface MISSILEX (Tables 2.2-5 and 2.2-7). Eight additional explosions associated with air-to-surface MISSILEX would occur per year under Alternative 1. As discussed for the No Action Alternative, the air-to-surface MISSILEX explosions would occur in Areas 16, 17, and 18. Explosions under Alternative 1 would not result in significant impacts to fish populations based on the low number of fish that would be affected. The amount of benthic habitat affected by underwater detonations would continue to be small (up to 250 to 390 ft^2) and the effects would be short-term and localized. Habitat disturbance and fish injury and mortality from explosions are reduced by mitigation measures. Large *Sargassum* mats where some fish species tend to concentrate are avoided and underwater detonation charges are not set within 1,000 ft of live/hard bottom, artificial reefs, and shipwrecks. 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 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

Alternative 1 would include slight increases in ordnance-related expended material, chaff, marine markers, self-protection flares, and TOW missile guide wires (Table 2.2-5). These changes would result in increased exposure of fish and EFH to military expended materials. 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.

Shortnose Sturgeon

As discussed in Section 3.9.2.3, the shortnose sturgeon is not expected to occur in the Study Area. Alternative 1 would have no effect on the shortnose sturgeon. Alternative 1 would have no effect on critical habitat because none has been designated for the shortnose sturgeon.

Smalltooth Sawfish

As discussed in Section 3.9.2.3, the smalltooth sawfish is not expected to occur in the Study Area. Alternative 1 would have no effect on the smalltooth sawfish. Alternative 1 would have no effect on critical habitat because none has been designated for the smalltooth sawfish.

Candidate Species

The effects of Alternative 1 on the Atlantic sturgeon would be the same as those described above for other fish species. Alternative 1 would not result in significant adverse effects to candidate species.

Species of Concern

The effects of Alternative 1 on species of concern would be the same as those described above for other fish species. Alternative 1 would not result in significant adverse effects to species of concern.

3.9.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements that would occur under Alternative 2 would be the same as Alternative 1 (Table 2.2-5). Therefore, the analysis presented above for Alternative 1 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 would include a 7 percent increase in fixed-wing aircraft sorties per year and an 83 percent increase in helicopter sorties per year in the Study Area (Table 2.2-5). The magnitude of individual exposures would not increase because Alternative 1 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to or less than the noise levels generated by the helicopters that they would replace.

Based on the increased operations under Alternative 2 more fish could be exposed to noise and/or the number of times an individual fish is exposed could increase. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions (*e.g.,* swimming away and increased heart rate) and the general health of individual fish would not be compromised. 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.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase from 220 to 576 per year (162%) under Alternative 2 (Table 2.2-5). Most of these sorties would occur in the proposed Mine Warfare Training Area, which would be established in Onslow Bay under Alternative 2 (Figure 2.2-1). Some towed devices sorties would continue to take place farther offshore in the CVOA North. Similar to the No Action Alternative, use of towed devices under Alternative 2 would result in short-term and localized disturbances to the water column and *Sargassum* habitats, but benthic habitats would not be affected because the equipment is not towed on the bottom. Mitigation measures would limit disturbance to *Sargassum* habitats. Ichthyoplankton (fish eggs and larvae) in the upper portions of the water column could be displaced, injured, or killed by towed devices. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to towed devices would be low relative to total ichthyoplankton biomass. Impacts to EFH from towed Mine Warfare device use under Alternative 2 would be temporary and minimal. Towed Mine Warfare device use would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, the use of towed devices in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. In accordance with EO 12114, towed devices would not cause significant harm to fish populations or habitat in non-territorial waters.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment / Recovery)

As discussed in Chapter 2, a littoral Mine Warfare Training Area would be designated in Onslow Bay under Alternative 2 (Figure 2.2-1). This section addresses potential effects on fish and EFH associated with establishing and maintaining this training area (*i.e.*, temporary mine shape deployment/recovery). The effects of conducting training exercises in this area are the same as those analyzed under aircraft overflights and towed Mine Warfare devices.

The process of deploying and recovering mine shape assemblies would result in localized disturbances to benthic habitat. As discussed in Chapter 2, the mine shape assembly would include a concrete anchor, mooring line (steel cable or chain), and the mine shape. Up to 315 mine shapes would be temporarily placed in the training area. The entire assembly (mine shape, mooring line, and anchor) would be deployed concurrently from a boat and recovered following the exercise (typically within seven to 30 days). Approximately 6.25 ft^2 of benthic habitat would be disturbed when a concrete anchor makes contact with the sea floor. The same area would be disturbed when a concrete anchor is recovered. The total area affected per year would be less than 2,000 ft^2 based on 315 deployments/recoveries per year (Table 2.2-5). Benthic organisms could be crushed, injured, or killed by the impact of the concrete anchor.

The effects of mine shape deployment on benthic communities would depend on the community type at the specific deployment locations. Soft bottom habitats, live/hard bottom habitats (including coral and sponge patches), artificial reefs, and shipwrecks exist in the proposed training area (Figure 3.6-2). Mine shapes would not be deployed in locations with known artificial reefs or shipwrecks because these features could interfere with subsequent training operations. Soft bottom and live/hard bottom habitats, including coral and sponge patches, could be impacted by the concrete anchors. However, major reef systems such as the Ben Franklin Temperate Reef and *Lophelia* Banks are located outside the Mine Warfare Training Area and would not be impacted. The recolonization process would occur faster in areas of soft bottom substrate than it would in hard bottom substrate (NRC, 2002). Impacts to soft bottom habitat would be minimal based on the small area affected (less than 2,000 ft^2 per year) and temporary based on the relatively short recovery time. Recovery times would be longest for corals because these species have low growth rates. Nonetheless, impacts to hard bottom habitat would be

minimal based on the small area affected. No population- or community-level effects are expected based on the small area that would be affected.

Additionally, the temporary mine shapes may provide refuge or orientation cues for a number of animals and result in short-term, localized increases in species richness. However, no long-term changes to community structure or function are expected based on the small area affected and the short period of time the mine shapes would be in the water (7 to 30 days).

Impacts to EFH from temporary mine shape deployment/recovery under Alternative 2 would be minimal based on the small area affected. Temporary mine shape deployment/recovery would not reduce the quality or quantity of EFH in the Study Area. In accordance with NEPA, Mine Warfare Training Area establishment in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Mine Warfare Training Area establishment would not be established in non-territorial waters.

Non-explosive Practice Munitions

The amount of NEPM used would increase under Alternative 2 (Tables 2.2-5 and 2.2-6). The number of non-explosive practice bombs dropped in the OPAREA would increase from 654 to 811 per year. These changes would result in increased potential for fish/NEPM strikes and associated fish mortalities and injuries to occur compared to baseline conditions. However, as discussed for the No Action Alternative the number of fish affected would continue to be small. Mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of NEPM-related injury or mortality.

As discussed for the No Action Alternative and Alternative 1, disturbances to water column habitats from NEPM strikes would be short-term and localized. NEPM strikes would cause little or no physical damage to soft bottom benthic habitat, and any damage would be localized. The area affected by non-explosive practice bombs, missiles, and naval gun shells would increase under Alternative 2. The relative non-explosive practice bomb concentration would increase from 3.5 to 4.4 per 100 nm^2/year in the OPAREA. The probability of non-explosive practice bombs, missiles, and naval gun shells striking hard bottom EFH, artificial habitats, proposed deep water coral HAPC, and deepwater snapper grouper marine protected areas would increase under Alternative 2. However, the total area of benthic habitat affected would continue to be small. As shown in Table 3.9-6, the maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would increase from 4,488 ft^2 (0.00012 nm^2) per year to 6,266 ft^2 (0.00017 nm^2) per year or 62,660 ft^2 (0.0017 nm^2) over a ten-year period. Only a percentage of the total area affected (less than 6,266 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bomb, missile, and naval gun shell strikes under Alternative 2 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, missiles, 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

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs, which would not be used in the Study Area under Alternative 2 (Tables 2.2-5 and 2.2-7). As such, water column disturbances and fish mortality associated with BOMBEX explosions would not occur under Alternative 2. Consequently, the number of fish injured or killed by explosions would be substantially lower than the No Action Alternative and

Alternative 1. Impacts from other explosions (underwater detonations, FIREX with IMPASS, and air-to-surface MISSILEX) would be the same as those described for Alternative 1. 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 under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Tables 2.2-5 and 2.2-6). These changes would result in increased exposure of fish and EFH to military expended materials. 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 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.

Shortnose Sturgeon

As discussed in Section 3.9.2.3, the shortnose sturgeon is not expected to occur in the Study Area. Alternative 2 would have no effect on the shortnose sturgeon. Alternative 2 would have no effect on critical habitat because none has been designated for the shortnose sturgeon.

Smalltooth Sawfish

As discussed in Section 3.9.2.3, the smalltooth sawfish is not expected to occur in the Study Area. Alternative 2 would have no effect on the smalltooth sawfish. Alternative 2 would have no effect on critical habitat because none has been designated for the smalltooth sawfish.

Candidate Species

The effects of Alternative 2 on the Atlantic sturgeon would be the same as those described above for other fish species. Alternative 2 would not result in significant adverse effects to candidate species.

Species of Concern

The effects of Alternative 2 on species of concern would be the same as those described above for other fish species. Alternative 2 would not result in significant adverse effects to species of concern.

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

3.9.5.1 Endangered Species Act

Table 3.9-8 provides a summary of the Navy's determination of effect for the No Action Alternative, Alternative 1, and Alternative 2 (the Preferred Alternative) and federally listed fish that potentially occur or historically occurred in the Study Area. The alternatives would have no effect on the shortnose sturgeon or smalltooth sawfish because these species are not expected to occur in the Study Area. The

alternatives would have no effect on critical habitat because none has been designated for the shortnose sturgeon or smalltooth sawfish.

Table 3.9-8 Summary of the Navy's Determination of Effect for Federally Listed Fish Potentially Occurring in the Navy Cherry Point Study Area for All Alternatives

Stressor	Shortnose Sturgeon	Smalltooth Sawfish
Vessel Movements		
Vessel Disturbance	No Effect	No Effect
Vessel Collisions	No Effect	No Effect
Aircraft Overflights		
Aircraft Disturbance	No Effect	No Effect
Towed Mine Warfare Devices		
Towed Device Strikes	No Effect	No Effect
Mine Warfare Training Area Establishment		
Temporary Mine Shape Deployment/Recovery	No Effect	No Effect
Non-explosive Practice Munitions		
Strikes	No Effect	No Effect
Underwater Detonations and High Explosive Ordnance		
Underwater Detonations	No Effect	No Effect
High Explosive Ordnance	No Effect	No Effect
Military Expended Materials		
Ordnance-Related Materials	No Effect	No Effect
Target-Related Materials	No Effect	No Effect
TOW Missile Guide Wires	No Effect	No Effect
Chaff	No Effect	No Effect
Shelf Protection Flares	No Effect	No Effect
Marine Markers	No Effect	No Effect

3.9.5.2 Sustainable Fisheries Act – Essential Fish Habitat

As summarized in Table 3.9-9, 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.

3.9.5.3 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.9-9, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on fish populations and habitat in territorial waters. Furthermore, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to fish populations and habitats in non-territorial waters.

Table 3.9-9 Summary of Environmental Effects of the Alternatives on Fish and Essential Fish Habitat in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and SFA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 and SFA (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.
Mine Warfare Training Area Establishment	Not applicable. Mine Warfare training areas would not be established under the No Action Alternative.	Not applicable. Mine Warfare training areas would not be established under the No Action Alternative.

Table 3.9-9 Summary of Environmental Effects of the Alternatives on Fish and Essential Fish Habitat in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and SFA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 and SFA (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, missiles, and naval gun shells would be small (about 4,488 ft^2 per year) and only a percentage of the total area affected (less than 4,488 ft^2 per year)would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bombs, missiles, and naval gun shells could result in long-term, minor effects to hard bottom EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to hard bottom 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.
Underwater Detonations and High Explosive Ordnance	**EFH –** Underwater explosions in territorial waters would be limited to MINEX UNDETs, which would result in disturbance to water column habitats. However, water column disturbances would be short-term and localized, and associated effects to water column EFH would be temporary and minimal. Assuming a worst–case scenario where all 20 MINEX 20-lb charges were detonated directly on the bottom, up to 151 to 235 ft^2 of soft bottom benthic habitat could be disturbed by underwater detonations per year. Crater effects are usually temporary in sand and mud bottoms and repopulation of displaced sediments should be relatively rapid compared to hard bottom areas (NRC, 2002). Impacts to EFH would be temporary and minimal. **Fish/Managed Species –** A limited number of fish would be killed in the	**EFH –** MINEX UNDETs may also occur in non-territorial waters and the effects would be the same as described for territorial waters. Explosions associated with BOMBEX, MISSILEX, and FIREX with IMPASS 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

Table 3.9-9 Summary of Environmental Effects of the Alternatives on Fish and Essential Fish Habitat in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and SFA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)**
	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.	similar to those described for territorial waters, but additional fish would be affected because explosions associated with BOMBEX, MISSILEX, and FIREX with IMPASS 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	**SFA –** 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.	**SFA –** 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 -** 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.
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	**EFH –** Similar to No Action with increase in sorties. **Fish/Managed Species -** Similar to No Action with increase in sorties.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Mine Warfare Training Area Establishment	Not applicable. Mine Warfare training areas would not be established under the No Action Alternative.	Not applicable. Mine Warfare training areas would not be established under the No Action Alternative.
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-	**EFH –** Similar to No Action with increase in non-explosive practice bombs, missiles, and naval gun shells. The total area of benthic habitat affected by non-explosive practice bombs, missiles, and naval gun shells would be small (about 4,904 ft^2 per year) and only a

Table 3.9-9 Summary of Environmental Effects of the Alternatives on Fish and Essential Fish Habitat in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and SFA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)**
	territorial waters.	percentage of the total area affected (less than 4,904 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bombs, missiles, and naval gun shells could result in long-term, minor effects to hard bottom EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to hard bottom 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 NEPM use.
Underwater Detonations and High Explosive Ordnance	**EFH –** Same as No Action. **Fish/Managed Species –** Same as No Action.	**EFH -** Similar to No Action, with increase in HE missiles (8 per year). **Fish/Managed Species -** Similar to No Action, with increase in HE missiles (8 per year).
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	**SFA –** 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.	**SFA –** 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 -** 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.
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	**EFH –** Similar to No Action with increase in sorties. **Fish/Managed Species -** Similar to No Action with increase in sorties.	**EFH –** Same as territorial waters. **Fish/Managed Species –** Same as territorial waters.
Mine Warfare Training Area Establishment	**EFH –** Deployment/recovery of concrete anchors would disturb approximately 2,000 ft^2 of benthic habitat per year, some of which could be hard bottom. Impacts to benthic EFH would be minimal based on the small area affected. **Fish/Managed Species –** A small number of benthic organisms could be crushed, but no population-level effects would occur.	Not applicable. Mine Warfare training area would not be established in non-territorial waters.
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-	**EFH –** Similar to No Action with increase in non-explosive practice bombs, missiles, and naval gun shells. The total area of benthic habitat affected by non-explosive practice

Table 3.9-9 Summary of Environmental Effects of the Alternatives on Fish and Essential Fish Habitat in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA and SFA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)**
	territorial waters, but lower magnitude because most NEPM is used in non-territorial waters.	bombs, missiles, and naval gun shells would be small (about 6,226 ft^2 per year) and only a percentage of the total area affected (less than 6,226 ft^2 per year) would be sensitive benthic habitat such as live hard bottom. Non-explosive practice bombs, missiles, and naval gun shells could result in long-term, minor effects to hard bottom EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to hard bottom 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 NEPM use.
Underwater Detonations and High Explosive Ordnance	**EFH –** Same as No Action. **Fish/Managed Species –** Same as No Action.	**EFH –** Elimination of HE BOMBEX would result in a substantial decrease in water column disturbance compared to No Action. **Fish/Managed Species -** Elimination of HE BOMBEX 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	**SFA –** 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.	**SFA –** 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

The Navy Cherry Point Study Area does not include land areas. While the general Study Area for this EIS/OEIS extends up to the shoreline (mean high tide line), all of the proposed activities, except amphibious exercises and use of land impact areas, would take place greater than 1 mile offshore.. Birds using wetlands, mud flats, beaches, and other shoreline habitats would not be exposed to stressors associated with most of the proposed activities. Therefore, this section does not address shorebirds and wading birds in detail. The MCB Camp Lejeune Environmental Assessment (DoN, 2009), which is incorporated into this EIS/OEIS by reference, analyzes the potential effects of amphibious and land-based training on shorebirds and wading birds at MCB Camp Lejeune. Therefore, this section focuses on seabirds and landbirds that could seasonally migrate through open water areas of the Study Area. 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 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 DoD 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). Three federally listed bird species (Bermuda petrel, *Pterodroma cahow*; piping plover (*Charadrius melodus*); and roseate tern, *Sterna dougallii*) potentially occur within the Study Area. Therefore, the ESA requirements discussed in Appendix K are applicable to the analysis of the Bermuda petrel and roseate tern. The Navy has completed informal consultation with the U.S. Fish and Wildlife Service (USFWS) for the Preferred Alternative in accordance with Section 7 of the ESA. Copies of correspondence with the USFWS are provided in Appendix C of this EIS/OEIS.

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 is described in Section 1.5 and is shown in Figure 1.5-1. The 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 seabirds and migratory birds 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, 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. A primary source of information used to describe the affected environment for pelagic seabirds was the *Pelagic Bird Assessment for the Navy's Atlantic Operating Areas* (DoN, 2007), which provides information that describes and documents the life history and distribution of seabirds occurring along the U.S. Atlantic coast and in the offshore waters of the Navy's Atlantic OPAREAs. Descriptions of literature and data searches conducted during preparation of the pelagic bird assessment report are described in detail in that document.

Factors Used to Assess 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 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), towed Mine Warfare Devices (strikes), temporary mine shape deployment/recovery (disturbance), non-explosive practice munitions (NEPM) (disturbance and strikes), underwater detonations and HE ordnance (explosions), and military expended materials (targets, chaff, self-protection flares, and marine markers). 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 EIS/OEIS.

Table 3.10-1 Summary of Potential Stressors to Seabirds and Migratory Birds[24]

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)										
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓	✓	✓			
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓	✓	✓	✓	✓	✓
Surface Warfare (SUW)										
Bombing Exercise (Air-to-Surface)	W-122 (Area 18)			✓	✓			✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Areas 16 and 17)			✓	✓			✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17)			✓	✓			✓		✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓	✓					✓		✓
GUNEX (Surface-to-Surface) USMC Small Arms Training	Cherry Point OPAREA	✓	✓					✓		✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO) - Ship	Cherry Point OPAREA	✓	✓							
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA	✓	✓	✓	✓					

[24] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations see Table 2.2-4 and Appendix D.

Table 3.10-1 Summary of Potential Stressors to Seabirds and Migratory Birds (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Air Warfare (AW)										
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)			✓	✓					
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)			✓	✓			✓		✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)			✓	✓			✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓	✓					✓
Air Intercept Control	W-122	✓	✓	✓	✓					
Electronic Combat (EC)										
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122	✓	✓	✓	✓					
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15 & 16)			✓	✓					✓
Chaff Exercise- ship	Cherry Point OPAREA	✓	✓							✓
Flare Exercise- aircraft	W-122 (Areas 1, 8, 15 & 16)			✓	✓					✓

Table 3.10-1 Summary of Potential Stressors to Seabirds and Migratory Birds (Continued)

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Temporary Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Strike Warfare (STW)										
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, & 21)			✓	✓				✓	✓
Amphibious Warfare (AMW)										
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)	✓	✓					✓		
FIREX - Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Areas 4/5 & 13/14)	✓	✓					✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	✓					
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	✓					

3.10.2 Affected Environment

3.10.2.1 Seabirds

Table 3.10-2 provides a list of seabirds that could potentially occur in the 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 sea ducks, 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 (Hunter *et al.*, 2006).

Table 3.10-2 Seabirds Potentially Occurring in the Study Area

Family and Scientific Name	Common Name
Alcidae	
Alca torda	Razorbill
Alle alle	Dovekie
Cepphus grylle	Black guillemot
Fratercula arctica	Atlantic Puffin
Uria lomvia	Thick-billed murre
Uuria aalge	Common murre
Diomedeidae	
Thalassarche chlororhynchos	Yellow-nosed albatross
Fregatidae	
Fregata magnificens	Magnificent frigatebird
Gaviidae	
Gavia immer	Common loon
Hydrobatidae	
Oceanites oceanicus	Wilson's storm-petrel
Oceanodroma castro	Band-rumped storm-petrel
Oceanodroma leucorhoa	Leach's storm-petrel
Pelagodroma marina	White-faced storm-petrel
Laridae	
Anous stolidus	Brown noddy
Larus argentatus	Herring gull
Larus atricilla	Laughing gull
Larus delawarensis	Ring-billed gull
Larus fuscus	Lesser black-backed gull
Larus glaucoides	Iceland gull
Larus hyperboreous	Glaucous gull
Larus marinus	Great black-backed gull
Larus minutus	Little gull
Larus ridibundus	Black-headed gull
Larus thayeri	Thayer's gull
Larus philadelphia	Bonaparte's gull
Rissa tridactyla	Black-legged kittiwake
Stercorarius maccormicki	South polar skua
Stercorarius skua	Great skua
Sterna anaethetus	Bridled tern
Sterna antillarum	Least tern(2)
Sterna caspia	Caspian tern
Sterna dougallii	Roseate tern(3)
Sterna forsteri	Forster's tern
Sterna fuscata	Sooty tern
Sterna hirundo	Common tern
Sterna maxima	Royal tern
Sterna nilotica	Gull-billed tern

Table 3.10-2 Seabirds Potentially Occurring in the Study Area (Continued)

Family and Scientific Name	Common Name
Sterna sandvicensis	Sandwich tern
Pelecanidae	
Pelecanus erythroryhyncos	American white pelican
Pelecanus occidentalis	Brown pelican
Phaethontidae	
Phaethon aethereus	Red-billed tropicbird
Phaethon lepturus	White-tailed tropicbird
Phalacrocoracidae	
Phalacrocorax auritus	Double-crested cormorant
Phalacrocorax carbo	Great cormorant
Procellariidae	
Calonectris diomedea	Cory's shearwater
Fulmarus glacialis	Northern fulmar
Pterodroma arminjoniana	Herald petrel
Pterodroma cahow	Bermuda petrel (=cahow)[(4)]
Pterodroma feae	Fea's petrel
Pterodroma hasitata	Black-capped petrel
Puffinus gravis	Greater shearwater
Puffinus griseus	Sooty shearwater
Puffinus lherminieri	Audubon's shearwater
Puffinus puffinus	Manx shearwater
Scolopacidae	
Phalaropus fulicarius	Red phalarope
Phalaropus lobatus	Red-necked phalarope
Sulidae	
Sula dactylatra	Masked booby
Sula leucogaster	Brown booby
Stercorariidae	
Stercorarius parasiticus	Parasitic jaeger
Stercorarius longicaudus	Long-tailed jaeger
Stercorarius pomarinus	Pomarine jaeger

Sources: DoN, 2007 and Golder, 2004

[(1)]Number in the Outer Continental Shelf Important Bird Area as reported in Golder, 2004.

[(2)]Least tern is federally listed as endangered on U.S. west coast and interior rivers. Birds that might occur in Study Area are not federally listed.

[(3)]Northeast breeding population of the roseate tern is federally listed as endangered. Listed as threatened in other areas.

[(4)]Bermuda petrel is federally listed as endangered throughout its range.

Pelagic seabirds are generally widely distributed, but they tend to congregate in areas along the Gulf Stream, around the Continental Shelf Break, near upwellings, and in areas with large *Sargassum* mats. The most significant congregating site in the southeastern United States is off Cape Hatteras, North Carolina and partially within the OPAREA. Identified as the Outer Continental Shelf Important Bird Area (IBA) by Audubon North Carolina, this area covers about 716 nm^2 on the western boundary of the Gulf Stream in an area with water depth of 300 to 3,000 feet (Figure 3.10-1). The cool waters from the Labrador Current and the warm waters of the Gulf Stream meet in this area to form one of the richest and most important areas for pelagic birds in the western Atlantic. Large mats of *Sargassum* form in this area, resulting in a high concentration of seabirds and many forms of marine life. It should be recognized that the IBA boundary shown in Figure 3.10-1 should be considered a "soft edge" based on the dynamic nature of the physical and biological environment of the Gulf Stream. This IBA has the greatest diversity of seabirds in the southeastern United States and probably has the greatest density of tropical seabirds in the southeastern United States (Golder, 2004; Hunter *et al.*, 2006). No current

population estimates exist for pelagic seabirds in the Southeastern United States region (Hunter *et al*., 2006).

Productive inshore ocean waters provide important foraging areas for a great variety of birds during all months of the year, including pelicans, loons, terns, and gulls. Inshore ocean waters near Cape Hatteras, North Carolina were identified as the Outer Banks, Inshore Ocean IBA by Audubon North Carolina (Figure 3.10-1). This IBA covers about 235 nm^2 and extends from the surf zone seaward to about 3.1 miles offshore and is important for coastal birds throughout the year. During spring and summer, this IBA is a key foraging area for terns nesting on nearby beaches and islands. During winter months, the site supports North Carolina's largest population of northern gannets and red-breasted mergansers. Many species of gulls and terns forage in the area during migration, while loons and sea ducks use it as a migration corridor (Golder, 2004). Several other IBA are located landward of the Study Area boundary (Figure 3.10-1).

The Bermuda petrel and roseate tern, both of which could potentially occur in the Study Area, are listed under the ESA. Additional information about these 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 black-capped petrel, masked and brown boobies, razorbill, sooty shearwater, and northern gannet (Hunter *et al*., 2006). The black-capped petrel is of particular concern because the worldwide breeding population is currently estimated at 1,000 pairs (BirdLife International, 2007a). Waters in or adjacent to the Gulf Stream between northern Florida and southern Virginia comprise the primary non-breeding range of black-capped petrels. The main foraging area appears to be offshore from Cape Hatteras National Seashore, North Carolina (Hunter *et al*., 2006).

3.10.2.2 Endangered Species Act-Listed Birds

Bermuda Petrel

The rarest of the four gadfly petrels found in the North Atlantic, the Bermuda petrel (also known as cahow) was once likely abundant on Bermuda until human settlement led to habitat destruction, exploitation of petrels as a food source, and the introduction of predatory mammals such as rats. Bermuda petrels feed at the sea surface primarily on small squid, shrimp, and small fish. They may often feed at night to avoid predators and capture prey that surfaces to feed on plankton (Brinkley and Humann, 2001).

Status and Management **-** The Bermuda petrel is listed as endangered under the ESA throughout its range. Critical habitat has not been designated for this species. Thought to be extinct for nearly 300 years until it was rediscovered in the first half of the 20th century, the Bermuda petrel population was estimated at 250 birds in 2005 (BirdLife International, 2007a). A record number of young (40) fledged in 2003 and another 35 fledged in 2005 (BirdLife International, 2007a). While current population numbers are extremely low, the Bermuda petrel population is increasing. Bermuda petrel breeding habitat is limited to small islets in Castle Harbor, Bermuda. The habitat is protected and intensely managed for this species. Potential threats to Bermuda petrels in the pelagic environment include: (1) fisheries interactions, (2) exposure to oil and hazardous materials, (3) debris ingestion and entanglement, (4) collisions with lighted vessels, platforms, and wind energy turbines (Hunter *et al*., 2006).

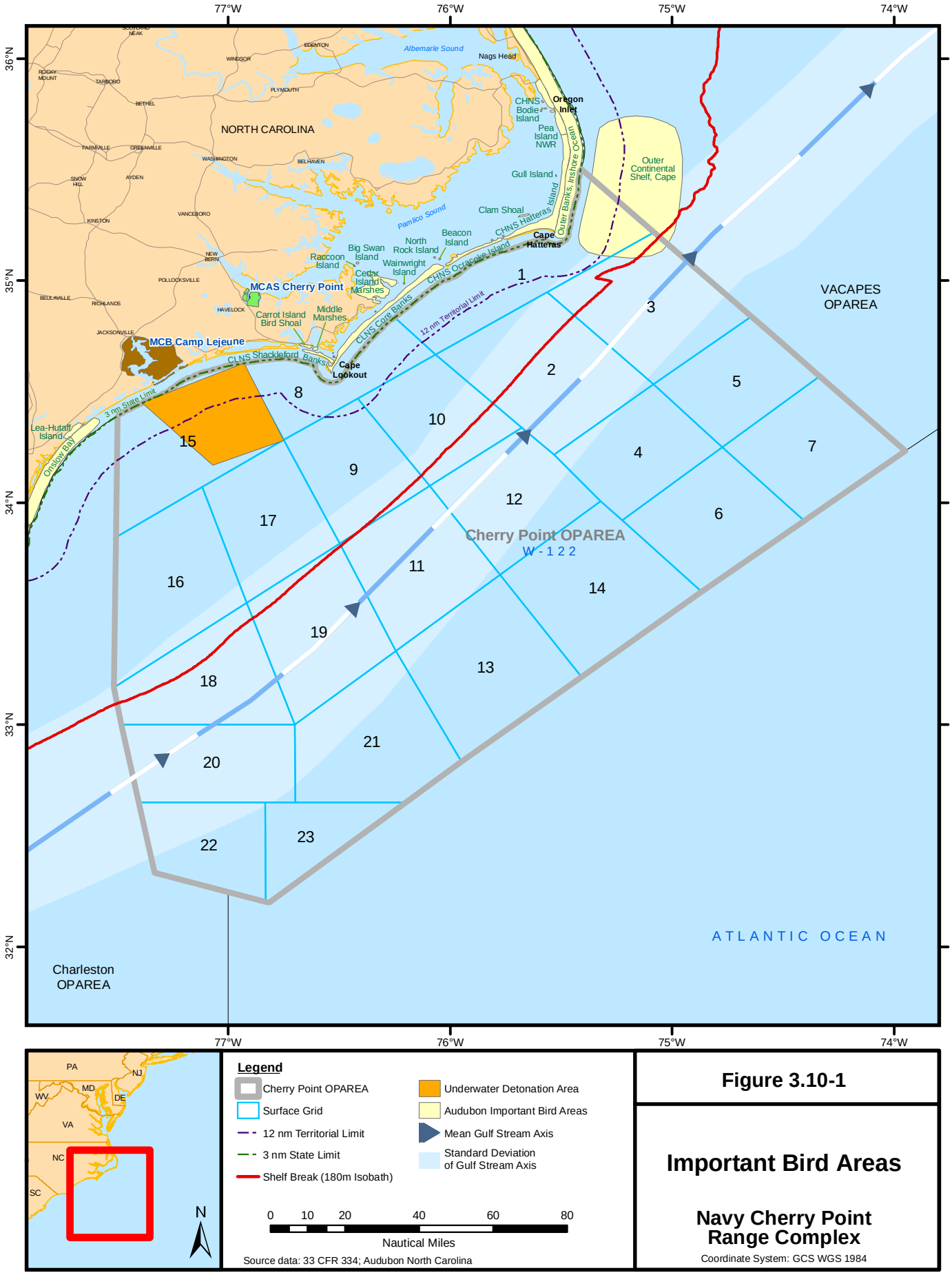


Figure 3.10-1

Important Bird Areas

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

Distribution – From late October through early June Bermuda petrels can be observed in small breeding colonies on several islets in Castle Harbor, Bermuda. Adult breeding pairs arrive at nesting sites as early as October and begin a courtship period that involves paired nocturnal flights. A single egg is laid usually in January and chicks hatch in late February or early March. The chick is ready to fledge in late May to early June; however, it is not uncommon for the parents to abandon the chick two weeks or more before it is able to fly (BirdLife International, 2007a).

When not breeding, the Bermuda petrel may be distributed throughout the North Atlantic but is primarily found in the warm waters of the Gulf Stream between Bermuda and North Carolina. However, a single capture occurred in 2002 on the Azores in the eastern Atlantic, indicating the species is capable of a wide distributional range (BirdLife International, 2007a). In recent years several confirmed sightings have occurred off of the coast of North Carolina, where the Gulf Stream separates from the U.S. coast and flows away from shore into the Atlantic (BirdLife International, 2007a). The full range of the Bermuda petrel is difficult to identify because of its low worldwide population (estimated 250 individuals) and its similar appearance to other species, such as the black-capped petrel, in the same region (BirdLife International, 2007a).

Bermuda Petrel Occurrence in Navy Cherry Point Study Area - Increasing observations and photographic documentation provide evidence that Bermuda petrels regularly forage in the Gulf Stream waters off North Carolina (Hunter *et al*., 2006). Bermuda petrels would most likely be found in the Study Area from May through August, but non-breeding adults and juveniles may also be present in this region at other times of the year (DoN, 2007). At least one published record off North Carolina was for a sighting in December (Lee, 1987). Outside of the breeding season, Bermuda petrels are most likely to move north of Bermuda and follow the western/northern wall of the Gulf Stream while foraging (BirdLife International, 2007a). This species is not expected to occur in nearshore waters of the Navy Cherry Point Study Area. While density data for the Bermuda petrel in the Study Area or other areas is not available, the maximum density would be very low based on the small worldwide population (250 birds).

Piping Plover

Status and Management - Piping plovers are small shorebirds measuring just 7.25 in. in length with a 19-in.wingspan (Sibley, 2000). 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). This species has experienced major declines over its entire range, followed by some recovery; however, regional population declines are still occurring in some areas (Elliott-Smith and Haig, 2004). Threats include disturbance by humans, predation, and pressure from development occurring within its habitat.

Distribution and Habitat - The piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. These birds winter primarily on the Atlantic Coast, from North Carolina to Florida, although some migrate to the Bahamas and West Indies. Piping plover nests are situated above the high tide line on coastal beaches, sandflats at the ends of sandpits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and washover areas cut into or between dunes. They may also nest on areas where suitable dredge material has been deposited. Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass (*Ammophila breviligulata*) or other vegetation (USFWS, 2008).

Atlantic Coast piping plover migration patterns are not well documented. Most piping plover surveys have focused on breeding or wintering sites, and it is sometimes difficult to distinguish local nesting birds and fledged young feeding on neutral feeding areas, from non-local breeders on stopover during southward migration. Northward migration to the breeding grounds occurs during late February, March

and early April, and southward migration to the wintering grounds is during late July, August, and September. Both spring and fall migration routes are believed to follow a narrow strip along the Atlantic Coast (USFWS, 2008).

In general, wintering plovers on the Atlantic Coast are found at accreting ends of barrier islands, along sandy peninsulas, and near coastal inlets. Plovers appear to prefer sandflats adjacent to inlets or passes, sandy mudflats along prograding spits, and overwash areas as foraging habitats. Roosting plovers are generally found along inlets and adjacent ocean and estuarine shorelines and their associated berms (with wrack and other debris often used as wind-shields), and on nearby exposed tidal flats (USFWS, 2008).

Piping Plover Occurrence in Navy Cherry Point Study Area – Piping plovers have been documented at Onslow Beach, MCB Camp Lejeune adjacent to the Navy Cherry Point Study Area. Within the Study Area, this shorebird is only expected to occur very close to shore, possibly foraging in intertidal areas below the mean high tide line. This species is not expected to occur in open waters offshore. Although Onslow Beach is utilized for foraging and resting at any time of the year, no nesting has been documented on MCB Camp Lejeune. MCB Camp Lejeune conducts breeding season surveys and is committed to the protection of any piping plover nests that are discovered on the installation (USMC, 2007). Recently, researchers from Virginia Polytechnic Institute and State University (Ray *et. al*., 2008, unpublished data) completed a season-long survey of shorebird use on Onslow Beach at MCB Camp Lejeune. The early breeding survey period was from March 15 through May 31, 2008; this covers the timeframe of spring migration, pair establishment, nesting, and egg-laying for most breeding species. Surveys were also completed from June 1 through August 15, 2008 which would cover the hatching, rearing, and fledging life-cycle stages. In order to assess the potential effects of human disturbance on shorebird activity, data were analyzed for approximately 11.5 km (7.1 miles) of Onslow Beach as follows: 5.0 km (3.1 mi) of "developed recreational beach" to the north, a central "amphibious training beach" of 2.9 km (1.8 mi), and 3.5 km (2.2 mi) of a generally undisturbed "south beach/overwash area" (near New River Inlet). Piping plovers were observed in various portions of Onslow Beach throughout the spring and summer months. Of the 20 instances that piping plovers were observed, the majority (17, or 85%) of the sightings were in the more undisturbed areas of south beach, the washover area, and the adjoining impact buffer. Only one (5%) time were they found in the amphibious/training portion of Onslow Beach (at 7:30 pm on April 20, 2008), where three individuals were observed foraging.

Roseate Tern

Status and Management **-** The northeastern breeding population of roseate terns is listed as endangered under the ESA. The range of this population extends along the U.S. Atlantic coast from Canada south to North Carolina (USFWS, 2007a and 2007b). Roseate terns in this population are known to occur in Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, North Carolina, and Virginia as well as in Newfoundland, Nova Scotia, and Quebec. Beyond the northeastern region, the roseate tern is listed as threatened in the Western Hemisphere and adjacent oceans, essentially wherever it is not listed as endangered. Threatened populations are known to occur in Florida, Georgia, North Carolina, South Carolina, Puerto Rico, and the U.S. Virgin Islands (USFWS, 2007a).

The global population is estimated to be 40,000 breeding pairs. The northeastern population has been fluctuating at around 3,500 pairs, recording a low of 3,125 pairs in 1992 and a high of 3,775 pairs in 1996 (BirdLife International, 2007b; USFWS, 2007b). In 1993, the Caribbean population was estimated to be between 5,000 and 8,500 pairs with 350 of those pairs breeding in the Florida Keys (USFWS, 2007b).

Distribution **-** The roseate tern is widespread in the Atlantic, Indian, and southwestern Pacific oceans; although local populations are generally small (BirdLife International, 2007b; NatureServe, 2007). In

the Atlantic, the northeastern breeding population is concentrated in isolated colonies mainly between Cape Cod, Massachusetts and Long Island, New York. Additionally, a Caribbean population breeds in the Florida Keys, the Bahamas, the West Indies, and in other locations in central and northern South America. Non-breeding populations are found in and around the Bahamas, Cuba, and the Lesser Antilles (NatureServe, 2007). Roseate terns prey on small schooling fish by plunge diving from the air into water (NatureServe, 2007).

The northern population migrates to their Caribbean wintering grounds well off the Atlantic Coast and are only rarely observed during pelagic trips or in coastal areas in the Southeastern United States (Hunter *et al.*, 2006). Roseate terns are occasional visitors along the Outer Banks, south of Cape Hatteras, particularly at Cape Point within Cape Hatteras National Seashore, during the months of July and August. They may be seen in late spring and early summer on a rare occasion (USFWS, 2007c).

Roseate Tern Occurrence in Navy Cherry Point Study Area - Roseate terns are not expected to occur in the Navy Cherry Point Study Area except as occasional transient individuals.

3.10.3 Environmental Consequences

3.10.3.1 No Action Alternative

Vessel Movements

Many of the ongoing and proposed operations within the Study Area involve maneuvers by various types of Navy and Marine Corps 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 (typically 0 to 10 vessels at any given time, maximum density less than 0.0005 vessels/nm^2, see Section 3.7.3 for overview of vessel movements). The Navy and Marine Corps would log about 900 total vessel hours per year in the Study Area under the No Action Alternative (Table 2.2-5)

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). 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 such as alert response, startle response, fleeing the immediate area, and/or 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 and Marine Corps vessel density and patchy distribution of seabirds in the Study Area, the probability of bird/vessel collisions is extremely low. Navy and Marine Corps training activities attempt to simulate war like conditions; therefore, vessels do not typically use large deck lights or strobes in an attempt to remain visually disguised. This reduces the potential attraction of nocturnal foraging seabirds. Furthermore, the concentrated food sources that attracted seabirds to commercial fishing vessels are not present around Navy and Marine Corps vessels. 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 Bermuda petrel and roseate tern 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). Seabirds and other migratory birds could be exposed to airborne noise associated with subsonic and supersonic fixed-wing aircraft overflights and helicopter operations while foraging or migrating in open water environments within the Atlantic Ocean (see Section 3.5 – Noise Environment - for a description of the existing noise environment and Appendix H for an overview of airborne acoustics). Exposure of birds to aircraft noise while on land would be negligible because few overflights occur in nearshore areas. The effects of aircraft overflights that occur over land, including helicopter operations associated with amphibious operations are addressed in a separate Environmental Assessment prepared by the Marine Corps (see Chapter 1).

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; Bowles, *et al*., 1990 in Larkin, 1996). 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.

Approximately 3,415 fixed-wing sorties would occur in the Study Area annually under the No Action Alternative. The majority of the flight time would be above 3,000 feet. Bird 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. It is possible that seabirds at or near the sea surface would not respond to overflight noise based on the relatively high flight altitudes (3,000 to 30,000 feet). 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.

Approximately 829 helicopter sorties would occur in the Study Area annually under the No Action Alternative. Helicopter overflights occur throughout the Study Area, with most occurring in the Mine Warfare Training Area in Onslow Bay. Unlike fixed-wing aircraft, helicopter training operations occur mostly at low altitudes (approximately 90% below 3,000 ft AGL and 10% below 200 feet AGL), which increases the likelihood that birds would respond to helicopter overflights. 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). 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 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. Helicopter overflights are more likely to elicit responses than fixed-wing aircraft, but the general health of individual birds would not be compromised. 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 and Marine Corps 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, 53 (3%) involved identified seabirds. Forty-one (77%) of the identified seabird strike events involved gulls (Navy Safety Center, 2004), which commonly occur in terrestrial environments or over nearshore waters. Other identified seabirds involved in strikes included pacific loon, double-crested cormorant, brown pelican, gull-billed tern, common tern, magnificent frigatebird, Caspian tern, wedge-tailed shearwater, western grebe, and white-tailed tropicbird. 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.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, Mine Warfare Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems towed through the water by helicopters flying as low as 75 feet above the water at low airspeeds. Under the No Action Alternative, 220 towed device sorties would be conducted per year. Most of these sorties would occur in the Underwater Detonation Area in Onslow Bay, with fewer occurring farther offshore in CVOA North (see Figure 2.2-1).

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 device use in territorial waters would have no significant impact on birds. In accordance with EO 12114, towed device use in non-territorial waters would not cause significant harm birds.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

The No Action Alternative does not include establishment of Mine Warfare Training Areas where temporary mine shapes would be deployed.

Non-explosive Practice Munitions

Weapons-Firing Disturbance

Current Navy and Marine Corps operations in the Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. While NEPM use may occur throughout the OPAREA, its use in nearshore areas (0 to 3 nm) is limited to the N-1/BT-3 impact area (Tables 2.2-5 and 2.2-6). Disturbance associated with weapons-firing noise and direct NEPM strikes are potential stressors to birds.

Bird responses to weapons-firing noise are expected to be similar to those described above for fixed-wing aircraft and helicopter operations, including short-term behavioral or physiological responses such as alert response, startle response, and/or temporary increase in heart rate. These operations are often preceded by some other type of human activity in the general area, such as a vessel movement or target setting, which might disperse birds away from the area in which weapons-firing noise would occur. 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, 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 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 and missiles that would be expended in the Study Area annually (Tables 2.2-5 and 2.2-6), coupled with the often patchy distribution of seabirds (Schneider and Duffy, 1985; Haney, 1986; Fauchald *et al*., 2002), suggest that the probability of these types of ordnance striking a seabird would be extremely low. The number of cannon and gun shells that would be expended annually during gunnery exercises is much higher (Tables 2.2-5 and 2.2-6). 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.

Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of NEPM strikes. 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 struck the target area (assuming birds were not struck by the initial rounds).

There would be a very small possibility that some individual seabirds may be directly impacted if they are in the target area and at the point of physical impact at the time of ordnance delivery. However, 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

Explosions that occur in the Study Area are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch HE rounds), as well as underwater detonations associated with Mine Neutralization training (MINEX). Underwater detonations and HE ordnance use are limited to a few specific training areas within the OPAREA. Table 2.2-7 provides a summary of underwater detonations and HE ordnance use by training area.

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. Although seabird density data are not available for the Study Area, relatively high concentrations of pelagic seabirds are expected to occur in the Outer Continental Shelf IBA and other areas along the western frontal boundary of the Gulf Stream (Figure 3.10-1). Under the No Action Alternative, most of the HE ordnance would be used in Surface Grid 18, which may support relatively high concentrations of seabirds based its proximity to the western frontal boundary of the Gulf Stream.
- 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 bombs, air-to-surface missiles (except HARM missiles), and naval gunshells occur at or immediately below the sea surface, while underwater detonations occur on the bottom and at various depths in the water column. Explosions associated with air-to-air missiles occur in the air at relatively high altitudes.
- 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, expressed as net explosive weight (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 would occur in the Study Area, HE bombs would have the largest ZOIs (see Table 2.2-7 for NEW values).

In general, the effects of explosions would correspond to the distance of the bird from the explosion, and would range from lethal injury in the immediate vicinity of an explosion to short-term behavioral effects on the outer edges of the ZOI. 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 to 33 percent at slant ranges of 31 to 33 feet, and no mortality was observed at a slant range of 36 feet. However, 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.

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 changes 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 based on the total number of explosions that would take place per year (256) under the No Action Alternative. A majority of these explosions would be associated with HE bombs (145 per year), which have relatively large NEWs (192 to 945 lbs) and ZOIs. All bomb explosions would occur in Surface Grid 18 (145 per year), which is expected to have relatively high seabird concentrations based on proximity to the western frontal boundary of the Gulf Stream. As such, the potential for seabirds to be exposed to impacts from explosions is highest for BOMBEX in Surface Grid 18.

Birds could also be exposed to impacts from explosions associated with Air-to-Surface MISSILEX, FIREX with IMPASS, and Mine Neutralization. However, the probability of exposure is substantially lower than that of BOMBEX based on number of operations; the lower NEWs and associated ZOIs; and location of the operations. Explosions associated with air-to-surface missiles (seven per year, 8- to 15.33-lb NEWs) would take place in Surface Grids 16 and 17, portions of which are located along the extreme western boundary of the Gulf Stream. Naval gunshell explosions (78 per year, 8-lb NEW) would occur in Surface Grids 4, 5, 13, and 14, which are located east of the Gulf Stream. Underwater detonations (20 per year, 20-lb NEW) would occur in relatively nearshore areas in the Underwater Detonation Area.

The southern portions of the Outer Continental Shelf IBA are located in Surface Grids 1 and 3. The only HE ordnance used in Surface Grids 1 and 3 under the No Action Alternative would be associated with Air-to-Air MISSILEX. Up to two HE missiles per year could be fired in these surface grids, but the explosions would occur in the air at relatively high altitudes. These exercises can also occur in other surface grids (Table 2.2-4), so it is possible that Surface Grids 1 and 3 would not be used routinely for Air-to-Air MISSILEX.

Mitigation measures are expected to reduce, but not eliminate, the potential for seabird mortality from explosions. As discussed in Chapter 5, mitigation measures include 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 in flight during an explosion would be less susceptible to harm than birds 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 such as FIREX with IMPASS events, which can last for several hours and involve firing 39 HE 5-inch rounds per event. Two FIREX with IMPASS events would be conducted per year in the Study Area (total of 78 HE rounds per year). Some bombing exercises involve two aircraft, each dropping one or two HE bombs per event. However, the interval between bomb drops is only about three minutes, so all bombs would be dropped within a span of three to 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

Various types of military materials are expended during Navy and Marine Corps training exercises. The types and quantities of military expended materials and information regarding fate and transport of these materials within the marine environment are discussed in Section 3.2. Most of the military expended materials rapidly sink to the sea floor, and seabirds would not be exposed to these materials. However, seabirds could be exposed to some military expended materials. Specifically:

- Ordnance-related materials would sink in relatively deep waters, would not present an ingestion risk to seabirds, and would have no effect on birds.
- Copper guide wires from TOW missiles would sink, would not present an entanglement 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. Marine markers are non-recoverable pyrotechnic devices used in training to mark a surface position on the ocean and sink after use. Targets and marine markers would have no effect on birds.
- Seabirds could be exposed to chaff fibers in the air or at the sea surface through direct contact, inhalation, or ingestion.
- Seabirds could ingest chaff end-caps and pistons and self-protection flare end-caps if these materials become entrained in *Sargassum* mats at the surface.

Much of the background information and exposure analysis presented in Section 3.7.4.1 for chaff is applicable to seabirds and is not repeated here. 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. Seabirds would be exposed to chaff because it is used in much of the OPAREA. 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 (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). Because of its flexible nature and softness, external contact with chaff would not 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 variable periods of time, depending on wave and wind action. Seabirds could 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 on 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 five million fibers). As an example, an adult herring gull weighs about 0.8 to 1.2 kg (Cornell Lab of Ornithology, 2008). As discussed in Section 3.7.4.1, silicon dioxide (silica) is chemically uncreative in the environment and the acute and chronic oral toxicity of silicon dioxide is low. 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 a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Other military 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 about 1.4 inches in diameter. These plastic expended materials sink in saltwater (Spargo, 2007), which reduces the likelihood of ingestion by birds. However, some of the material could remain at or near the surface if it were to fall directly on a dense *Sargassum* mat.

About 15,200 end-caps and pistons (13,100 chaff end-caps and pistons and 2,100 flare end-caps) would be released into the marine environment in the Study Area annually. The relative environmental concentration would be 4.5 pieces/nm^2/year, assuming even distribution in Areas 1, 8, 15, and 16, which encompass about 3,357 nm^2. Actual 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 identified include toxic plastic additives and toxic contaminants that could be adsorbed 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 piston ingested by seabirds is expected to be very low based on the low concentration (4.5 pieces/nm^2/year) and the fact that an extremely small percentage of the total would be potentially available to seabirds (that is, 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.

In summary, 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.

Bermuda Petrel

While the Bermuda petrel is very rare (worldwide population estimate of 250 birds [BirdLife International, 2007a]), available information suggests that low numbers of foraging birds are likely to occur with some regularity in portions of the Study Area. The highest potential for this species to occur exists along Gulf Stream frontal boundaries. As discussed above for other seabirds, it is possible that Bermuda petrels would be exposed to various stressors associated with the No Action Alternative, including vessel movements, aircraft overflights, NEPM, HE ordnance, and military expended materials.

Bermuda Petrel - Vessel Movements

Bermuda petrels may often feed at night to avoid predators and capture prey that surfaces to feed on plankton (Brinkley and Humann, 2001). Consequently, this species could be susceptible to interactions with lighted vessels at night. However, Navy and Marine Corp training activities attempt to simulate warlike conditions and, in an attempt to remain visually disguised, vessels typically do not use large deck lights or strobes. This reduces the potential for attraction and disorientation of nocturnal foraging seabirds. Furthermore, the concentrated food sources that attract seabirds to commercial fishing vessels are not present around Navy and Marine Corps vessels.

The probability of a Bermuda petrel colliding with a Navy or Marine Corps vessel is extremely low based on the low density of birds (worldwide population of 250 birds) and low density of Navy and Marine Corps vessels in the Study Area. Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of vessel collisions. The effects of vessel movements on the Bermuda petrel would be discountable because the effects are extremely unlikely to occur. Vessel movements under the No Action Alternative may affect the Bermuda petrel.

Bermuda Petrel - Aircraft Overflights

Despite their low density, Bermuda petrels would occasionally be exposed to elevated noise levels associated with aircraft overflights for short durations (seconds). Most of the exposures would be from relatively high altitude fixed-wing aircraft overflights. Exposure to helicopter noise is less likely because many of these operations occur relatively close to shore in Onslow Bay, where Bermuda petrels are not expected to occur.

As discussed above for other seabirds, if a Bermuda petrel were to respond to a noise exposure, the responses would be limited to short-term behavioral or physiological reactions, such as alert response, startle response, and/or temporary increase in heart rate and the general health of individual birds would not be compromised. Noise associated with aircraft overflights may affect the Bermuda petrel, but any effects would be insignificant.

Bermuda petrels are not expected to be exposed to an aircraft strike based on the low Bermuda petrel density and the widely dispersed and infrequent nature of the operations. A majority of the fixed-wing aircraft overflights in the Study Area occur at altitudes above 3,000 feet. Bermuda petrels are expected to spend a majority of their time near the sea surface. Therefore, Bermuda petrels would not be exposed to fixed-wing aircraft strikes. Most helicopter operations take place in the Mine Warfare Training Area, where Bermuda petrels are not expected to occur. Aircraft strikes under the No Action Alternative would have no effect on the Bermuda petrel.

Bermuda Petrel - Towed Mine Warfare Devices

Towed Mine Warfare devices would have no effect on Bermuda petrels under the No Action Alternative because use of these systems would primarily be used in the Underwater Detonation Area where Bermuda petrels are not expected to occur.

Bermuda Petrel – Non-explosive Practice Munitions

As discussed above for other seabirds, Bermuda petrels could be exposed to noise associated with weapons firing. However, only short-term behavioral or physiological responses such as alert response, startle response, and/or temporary increase in heart rate would be expected and the general health of individual birds would not be compromised. Weapons-firing noise under the No Action Alternative may affect the Bermuda petrel, but any effects would be insignificant.

Bermuda petrels are not expected to be exposed to direct NEPM strikes based on the low density of birds present. Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of NEPM strikes. NEPM strikes in the Navy Cherry Point Study Area would have no effect on the Bermuda petrel.

Bermuda Petrel – Underwater Detonations and High Explosive Ordnance

Underwater detonations associated with Mine Neutralization exercises would occur in the Underwater Detonation Area in Onslow Bay under the No Action Alternative. Bermuda petrels are not expected to occur in the Underwater Detonation Area based on its relatively nearshore location. Therefore, underwater detonations conducted for the No Action Alternative would have no effect on the Bermuda petrel.

Of the training areas where HE ordnance explosions would occur at or near the sea surface under the No Action Alternative (Table 2.2-7), Bermuda petrels are most likely to be present in Surface Grid 18 based on proximity to the western frontal boundary of the Gulf Stream (Figure 3.10-1). Under the No Action Alternative, 145 bomb explosions would occur annually in Surface Grid 18. Bermuda petrels may also occur in Surface Grids 16 and 17, where seven air-to-surface missiles would be fired per year. Portions of these surface grids are located along the extreme western boundary of the Gulf Stream. Bermuda petrels may also occur in Surface Grids 4, 5, 13, and 14, where 78 HE naval gunshell rounds would be fired annually, but these areas are located east of the Gulf Stream.

While the effects of HE ordnance on Bermuda petrels cannot be quantified, the likelihood of an exposure to cause injury appears to be remote based on the very low density of birds. If exposures were to occur, they would most likely be in Surface Grid 18 based on the number of bomb explosions, the relatively large ZOIs associated with bomb explosions, and the quality of foraging habitat (proximity to western boundary of the Gulf Stream). Based on the factors discussed above for other seabirds and the Bermuda petrel's low density, the effects of HE ordnance use in the Navy Cherry Point Study Area would be considered discountable because the effects are extremely unlikely to occur. HE ordnance use may affect the Bermuda petrel.

Bermuda Petrel – Military Expended Materials

As discussed for other seabirds, ordnance-related materials and marine markers would sink in relatively deep waters and would not present an ingestion risk. Target-related materials would be recovered after use or would rapidly sink after use. Copper guide wires from TOW missiles would sink and would not present an entanglement risk to seabirds. Therefore, ordnance-related materials, target-related materials, marine markers, and TOW missile guide wires would have no effect on the Bermuda petrel.

Bermuda petrels could be exposed to chaff fibers, chaff plastic end-caps or pistons, and self-protection flare end-caps. As discussed above for other seabirds, the effects of direct contact with chaff fibers, and inhalation and ingestion of chaff fibers would be insignificant. Bermuda petrels feed at the sea surface and could mistake plastic end-caps or pistons entrained in *Sargassum* as prey. This species is a member of the Procellariidae family, which as a group appears to be more susceptible to digestive tract blockages from plastic. However, the probability of a Bermuda petrel ingesting a plastic end-cap or piston is extremely low based on the low density of birds, the low concentration of end-caps and pistons (4.5 pieces/nm^2/year), and the fact that an extremely small percentage of the total would be potentially available for ingestion (*i.e.,* those that land on *Sargassum* mats and remain at the sea surface). Chaff fibers, end-caps, and pistons may affect the Bermuda petrel. The effects of chaff fiber ingestion would be insignificant and the effects of chaff end-cap and piston ingestion would be discountable.

The No Action Alternative would have no effect on critical habitat because none has been designated for the Bermuda petrel.

Piping Plover

Piping plovers have been documented adjacent to the Study Area on Onslow Beach and could forage in the Study Area in intertidal areas below the mean high tide line. This species is not expected to occur in open ocean waters of the Study Area. With the exception of amphibious exercises and use of land impact areas, the proposed training activities would take place greater than 1 mile offshore. Based on this species' use of shoreline habitats, potential exposure to stressors is limited to those associated with amphibious exercises and use of land range impact areas.

The MCB Camp Lejeune Environmental Assessment (DoN, 2009), which is incorporated into this EIS/OEIS by reference, analyzes the potential effects of amphibious and land-based training on piping plovers at MCB Camp Lejeune. Even though nesting activity has not been documented on MCB Camp Lejeune, the Marine Corps has implemented protective measures for migrating, breeding, and foraging piping plovers. Avoidance and minimization measures implemented on base to prevent or reduce impacts to piping plovers are described in the: MCB Camp Lejeune Integrated Natural Resources Management Plan; Range and Training Regulations, Standing Operating Procedures for Range Control (Base Order P3570.1B); the Environmental Handbook for Trainers; and a 2002 Biological Assessment and subsequent Biological Opinion from USFWS for proposed activities on Onslow Beach (USFWS, 2002). The Marine Corps concluded in the MCB Camp Lejeune Environmental Assessment (DoN, 2009) that the Preferred Alternative may affect, but is not likely to adversely affect the piping plover and will consult with USFWS in accordance with Section 7 of the ESA.

This Navy Cherry Point Range Complex EIS/OEIS does not analyze potential effects to the piping plover in further detail because all potential stressors associated with the proposed action are analyzed in the MCB Camp Lejeune Environmental Assessment (DoN, 2009) and will be addressed under the Marine Corps Section 7 consultation with USFWS.

Roseate Tern

Roseate terns are not expected to occur in the Navy Cherry Point Study Area except as occasional transient individuals. Roseate terns would not be exposed to one or more stressors associated with the No Action Alternative. Consequently, the No Action Alternative would have no effect on the roseate tern. The No Action Alternative would have no effect on critical habitat because none has been designated for the roseate tern.

3.10.3.2 Alternative 1

Vessel Movements

Vessel movements would increase by about six percent per year in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased potential for bird collisions and associated bird mortalities and injuries to occur compared to baseline conditions. If birds are affected by vessel movements under Alternative 1, the number of individuals affected would be small. Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of vessel collisions. 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 Bermuda petrel and roseate tern are analyzed below.

Aircraft Overflights

Alternative 1 would include a 10 percent increase in fixed-wing aircraft sorties per year and a 16 percent increase in helicopter sorties per year in the Study Area (Table 2.2-5). A majority of the new helicopter

sorties would occur over Onslow Bay. As a result, the potential for birds to be exposed to elevated noise levels would increase compared to baseline conditions, particularly in the Mine Warfare Training Area. The magnitude of individual exposures would not increase because Alternative 1 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to or less than the noise levels generated by the helicopters they would replace.

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. 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 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 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.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would decrease by 13 percent per year under Alternative 1. Similar to the No Action Alternative, the potential for a towed Mine Warfare device to strike a bird under Alternative 1 is extremely low because birds would likely see and hear the oncoming helicopter and flee the immediate area. Use of towed Mine Warfare devices 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, towed device use in territorial waters would have no significant impact on birds. In accordance with EO 12114, towed device use in non-territorial waters would not cause significant harm birds.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

Alternative 1 does not include establishment of Mine Warfare Training Areas where temporary mine shapes would be deployed.

Non-explosive Practice Munitions

The amount of NEPM used in the Study Area would increase under Alternative 1 (Tables 2.2-5 and 2.2-6). 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, if birds were affected the number would continue to be small. Mitigation measures,

which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of NEPM 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

The number and location of explosions that would occur under Alternative 1 would be the same as the No Action Alternative, with the exception of increases in air-to-surface MISSILEX (Tables 2.2-5 and 2.2-7). A total of eight additional explosions associated with air-to-surface MISSILEX would occur per year under Alternative 1 in Areas 16, 17, and 18. 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

The amount of chaff fibers and plastic end-caps and pistons entering the marine environment would increase in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased potential for birds to ingest chaff and plastic end-caps and pistons. However, the number of birds affected would continue to be small. 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.

Bermuda Petrel

As discussed above for other seabirds, increases in training operations under Alternative 1 (Table 2.2-5) would increase the potential for Bermuda petrels to be exposed to associated stressors. The probability of a Bermuda petrel being exposed to a vessel collision would continue to be extremely low based on the small increase in vessel operations (6%) and the low Bermuda petrel density. Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of vessel interactions. The effects would be insignificant or discountable. Vessel movements may affect the Bermuda petrel under Alternative 1, but the effects would be insignificant or discountable.

The effects of aircraft overflights under Alternative 1 are expected to be similar to the No Action Alternative. Fixed-wing aircraft would increase by ten percent, but would continue to operate at relatively high altitudes. Helicopter sorties would increase by 16 percent and a majority of helicopter operations would continue to occur in Mine Warfare Training Area, where Bermuda petrels are not expected to occur. The effects of aircraft noise would be insignificant (short-term behavioral response). Aircraft noise under Alternative 1 may affect the Bermuda petrel. Aircraft strikes under Alternative 1 would have no effect on the Bermuda petrel because most fixed-wing flights would be at high altitudes and most helicopter operations would take place in areas where this species is not expected to occur.

Towed Mine Warfare devices would have no effect on Bermuda petrels under Alternative 1 because use of these systems would primarily be used in the Underwater Detonation Area where Bermuda petrels are not expected to occur.

The increases in NEPM use under Alternative 1 (Tables 2.2-5 and 2.2-6) would not appreciably increase Bermuda petrel exposure to weapons firing noise or NEPM strikes. Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of ordnance strikes. Weapons-firing noise under Alternative 1 may affect the Bermuda petrel, but the effects would be insignificant (short-term behavioral response). NEPM strikes under Alternative 1 would have no effect on the Bermuda petrel because Bermuda petrel density is very low.

The increase in HE ordnance use associated air-to-surface MISSILEX (eight additional HE missiles per year, Table 2.2-7) would increase the potential for Bermuda petrels to be exposed to impacts from explosions. Nonetheless, the probability of a Bermuda petrel being exposed to impacts from explosions would continue to be extremely low based on the Bermuda petrel's low density and other factors discussed above for the No Action Alternative. HE ordnance use under Alternative 1 may affect the Bermuda petrel, but the effects would be considered discountable

The probability of a Bermuda petrel ingesting a chaff or flare plastic end-cap or piston would continue to be extremely low based on the low density of birds, the low concentration of end-caps and pistons (about five pieces/nm^2/year), and the fact that an extremely small percentage of the total would be potentially available for ingestion (*i.e.,* those that land on *Sargassum* mats and remain at the sea surface). The potential effects would be considered discountable because they are extremely unlikely to occur. Ingestion of expended materials under Alternative 1 may affect the Bermuda petrel, but the potential effects would be considered discountable because they are extremely unlikely to occur.

Alternative 1 would have no effect on critical habitat because none has been designated for the Bermuda petrel.

Piping Plover

As discussed for the No Action Alternative, this EIS/OEIS does not analyze potential effects to the piping plover in further detail because all potential stressors associated with the proposed action are analyzed in the MCB Camp Lejeune Environmental Assessment (DoN, 2009) and will be addressed under the Marine Corps Section 7 consultation with USFWS.

Roseate Tern

Roseate terns are not expected to occur in the Navy Cherry Point Study Area except as occasional transient individuals. Roseate terns would not be exposed to one or more stressors associated with Alternative 1. Consequently, Alternative 1 would have no effect on the roseate tern. Alternative 1 would have no effect on critical habitat because none has been designated for the roseate tern.

3.10.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements that would occur under Alternative 2 would be the same as Alternative 1 (Table 2.2-5). Therefore, the analysis presented above for Alternative 1 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 2 on the federally listed Bermuda petrel and roseate tern are analyzed below.

Aircraft Overflights

Alternative 2 would include a 7 percent increase in fixed-wing aircraft sorties per year and an 83 percent increase in helicopter sorties per year in the Study Area (Table 2.2-5). The majority of the new helicopter sorties would occur over Onslow Bay. As a result, the potential for birds to be exposed to elevated noise levels would increase compared to baseline conditions, particularly in the Mine Warfare Training Area. The magnitude of individual exposures would not increase because Alternative 2 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to or less than the noise levels generated by the helicopters they would replace.

Based on the increased operations under Alternative 2 more birds could be exposed to noise and/or the number of times an individual bird is exposed could increase. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions such as alert response, startle response, and/or 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 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.

The changes in aircraft overflights would also 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 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.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase from 220 to 576 per year (162%) under Alternative 2 (Table 2.2-5). Most of these sorties would occur in the proposed Mine Warfare Training Area, which would be established in Onslow Bay under Alternative 2 (Figure 2.2-1). Some towed devices sorties would continue to take place farther offshore in the CVOA North. Consequently, the potential for towed device/bird strikes would increase under Alternative 2. Similar to the No Action Alternative, the potential for a towed Mine Warfare device to strike a bird under Alternative 2 is extremely low because birds would likely see and hear the oncoming helicopter and flee the immediate area. Use of towed Mine Warfare devices 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, towed device use in territorial waters would have no significant impact on birds. In accordance with EO 12114, towed device use in non-territorial waters would not cause significant harm to birds.

Mine Warfare Training Area Establishment (Temporary Mine Shape Deployment/Recovery)

As discussed in Chapter 2, a littoral Mine Warfare Training Area would be designated in Onslow Bay under Alternative 2 (Figure 2.2-1). This section addresses potential effects on seabirds associated with establishing and maintaining this training area (*i.e.*, temporary mine shape deployment/recovery). The effects of conducting training exercises in this area are the same as those analyzed under aircraft overflights and towed mine warfare devices.

As discussed in Chapter 2, the mine shape assembly would include a concrete anchor, mooring line (steel cable or chain), and the mine shape. Up to 315 mine shapes would be temporarily placed in the training area. The entire assembly (mine shape, mooring line, and anchor) would be deployed concurrently from a boat and recovered following the exercise (typically within 7 to 30 days). If seabirds are present at the time of mine shape deployment/recovery they could be startled by the process and flee the immediate area. However, the effects would be negligible, short-term, and localized. Temporary mine shape deployment/recovery would have no significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, temporary mine shape deployment/recovery in territorial waters would have no significant impact on birds. Temporary mine shape deployment/recovery would not occur in non-territorial waters.

Non-explosive Practice Munitions

The amount of NEPM used in the Study Area under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Tables 2.2-5 and 2.2-6). As a result, the potential for bird/NEPM strikes and associated bird mortalities and injuries would increase. However, if birds were affected the number would continue to be small. Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of NEPM 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

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs, which would not be used in the Study Area under Alternative 2 (Tables 2.2-5 and 2.2-7). As such, the potential for seabirds to be exposed to impacts associated with explosions 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 military expended materials entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Tables 2.2-5 and 2.2-6). Military expended materials associated with increased non-explosive practice

bomb use would have no effect on seabirds because the materials rapidly sink to the sea floor. Therefore, the analysis of military expended materials presented above 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.

Bermuda Petrel

Vessel movements that would occur under Alternative 2 would be the same as Alternative 1 (Table 2.2-5). Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Vessel movements may affect the Bermuda petrel under Alternative 2, but the effects would be insignificant or discountable.

The effects of aircraft overflights under Alternative 2 are expected to be similar to the No Action Alternative. Fixed-wing aircraft would increase by 7 percent, but would continue to operate at relatively high altitudes. Helicopter sorties would increase by 83 percent and a majority of helicopter operations would continue to occur in the proposed Mine Warfare Training Area (Figure 2.2-1), where Bermuda petrels are not expected to occur. The effects of aircraft noise would be insignificant (short-term behavioral response). Aircraft noise under Alternative 2 may affect the Bermuda petrel. Aircraft strikes under Alternative 2 would have no effect on the Bermuda petrel because most fixed-wing flights would be at high altitudes and most helicopter operations would take place in areas where this species is not expected to occur.

The proposed increase in towed Mine Warfare device sorties under Alternative 2 (162%) would have no effect on the Bermuda petrel because the sorties would primarily occur in the Mine Warfare Training Area, where this species is not expected to occur. Likewise, deployment/recovery of temporary mine shapes would occur in the Mine Warfare Training Area under Alternative 2 and would have no effect on the Bermuda petrel.

The increases in NEPM use under Alternative 2 (Tables 2.2-5 and 2.2-6) would not appreciably increase Bermuda petrel exposure to weapons firing noise or NEPM strikes. Mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of ordnance strikes. Weapons firing noise under Alternative 2 may affect the Bermuda petrel, but the effects would be insignificant (short-term behavioral response). NEPM strikes under Alternative 2 would have no effect on the Bermuda petrel because Bermuda petrel density is very low.

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs, which would not be used in the Study Area under Alternative 2 (Tables 2.2-5 and 2.2-7). As such, the potential for Bermuda petrels to be exposed to impacts associated with explosions would decrease substantially under Alternative 2 compared to the No Action Alternative and Alternative 1. The probability of a Bermuda petrel being exposed to impacts from explosions would decrease under Alternative 2 and would continue to be extremely low based on the Bermuda petrel's low density and other factors discussed above for the No Action Alternative. The effects of HE ordnance use would be considered discountable. HE ordnance use under Alternative 2 may affect the Bermuda petrel.

The amount of military expended materials entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Tables 2.2-5 and 2.2-6). Military expended materials associated with increased non-explosive practice bomb use would have no effect on Bermuda petrels because the materials rapidly sink to the sea floor.

Therefore, the analysis of military expended materials presented above for Alternative 1 is applicable to Alternative 2. Military expended materials under Alternative 2 may affect the Bermuda petrel.

Alternative 2 would have no effect on critical habitat because none has been designated for the Bermuda petrel.

Piping Plover

As discussed for the No Action Alternative, this EIS/OEIS does not analyze potential effects to the piping plover in further detail because all potential stressors associated with the proposed action are analyzed in the MCB Camp Lejeune Environmental Assessment (DoN, 2009) and will be addressed under the Marine Corps Section 7 consultation with USFWS.

Roseate Tern

Roseate terns very rarely occur in the Study Area as transients and are not likely to be exposed to one or more stressors associated with the action. Consequently, Alternative 2 would have no effect on the roseate tern. Alternative 2 would have no effect on critical habitat because none has been designated for the roseate tern.

3.10.4 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 seabirds or migratory birds.

3.10.5 Summary of Environmental Effects

3.10.5.1 Endangered Species Act

Table 3.10-3 provides a summary of the Navy's determination of effect for the No Action Alternative, Alternative 1, and Alternative 2 (the Preferred Alternative) and federally listed birds that potentially occur in the Study Area. The alternatives may affect the Bermuda petrel. The alternatives would have no effect on the roseate tern. The Study Area does not contain designated critical habitat for any listed species. Consequently, the alternatives would have no effect on critical habitat. The Navy has completed informal consultation with USFWS for the Preferred Alternative in accordance with Section 7 of the ESA. The USFWS concurred with the Navy's determination that the Preferred Alternative may affect, but is not likely to adversely affect the Bermuda petrel and that the Preferred Alternative would have no effect on the roseate tern. Copies of correspondence with USFWS are provided in Appendix C.

3.10.5.2 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.

Table 3.10-3 Summary of the Navy's Determination of Effect for Federally Listed Birds Potentially Occurring in the Study Area for All Alternatives

Stressor	Bermuda Petrel	Roseate Tern
Vessel Movements		
Vessel Disturbance	May Affect	No Effect
Vessel Collisions	May Affect	No Effect
Aircraft Overflights		
Aircraft Disturbance	May Affect	No Effect
Aircraft Strikes	No Effect	No Effect
Towed Mine Warfare Devices		
Towed Device Strikes	No Effect	No Effect
Mine Warfare Training Area Establishment		
Temporary Mine Shape Deployment/Recovery	No Effect	No Effect
Non-explosive Practice Munitions		
Weapons Firing Disturbance	May Affect	No Effect
Strikes	No Effect	No Effect
Underwater Detonations and High Explosive Ordnance		
Underwater Detonation	No Effect	No Effect
High Explosive Ordnance	May Affect	No Effect
Military Expended Materials		
Ordnance-Related Materials	No Effect	No Effect
Target-Related Materials	No Effect	No Effect
TOW Missile Copper Guide Wire	No Effect	No Effect
Chaff	May Affect	No Effect
Self-Protection Flares	May Affect	No Effect
Marine Markers	No Effect	No Effect

3.10.5.3 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 in accordance with NEPA. Furthermore, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to seabirds and migratory birds in non-territorial waters in accordance with EO 12114.

Table 3.10-4 Summary of Environmental Effects of the Alternatives on Seabirds and Migratory Birds in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	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.	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. No long-term population-level effects.
Aircraft Overflights	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.	Short-term behavioral responses to overflights. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.
Towed Mine Warfare Devices	Extremely low potential for towed device strikes. No long-term population-level effects.	Extremely low potential for towed device strikes. No long-term population-level effects.
Mine Warfare Training Area Establishment	No effect.	No effect.
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.	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.
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.	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.
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.	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.
Impact Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.
Alternative 1		
Vessel Movements	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.
Aircraft Overflights	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to overflights. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.
Towed Mine Warfare Devices	Extremely low potential for towed device strikes. Slight decrease compared to No Action. No long-term population-level effects.	Extremely low potential for towed device strikes. Slight decrease compared to No Action. No long-term population-level effects.
Mine Warfare Training Area Establishment	No effect.	No effect.
Non-explosive Practice Munitions	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.

Table 3.10-4 Summary of Environmental Effects of the Alternatives on Seabirds and Migratory Birds in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
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. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. Slight increase compared to No Action. No long-term population-level effects.
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. Slight increase compared to No Action. No long-term population-level effects.	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. Slight increase compared to No Action. No long-term population-level effects.
Impact Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.
Alternative 2		
Vessel Movements	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.
Aircraft Overflights	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to overflights. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.
Towed Mine Warfare Devices	Extremely low potential for towed array strikes. Increase compared to No Action. No long-term population-level effects.	Extremely low potential for towed array strikes. Increase compared to No Action. No long-term population-level effects.
Mine Warfare Training Area Establishment	Minor, short-term, and localized disturbances associated with temporary mine shape deployment/recovery. No long-term population-level effects.	No effect.
Non-explosive Practice Munitions	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.
Underwater Detonations and High Explosive Ordnance Use	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. No change from No Action. No long-term population-level effects.	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. Substantial decrease compared to No Action because HE bombs would no longer be used. No long-term population-level effects.
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. Slight increase compared to No Action. No long-term population-level effects.	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. Slight increase compared to No Action. No long-term population-level effects.
Impact Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.

3.11 LAND USE

3.11.1 Introduction and Methods

Land use is the classification of either natural or human-modified activities occurring at a given location. As detailed in Section 1.5.1, no inland ranges or associated airspace will be analyzed in this EIS/OEIS. 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. Land use is typically limited in offshore operations to public access and safety issues, to include potential hazards inherent in flight operations, torpedo drops, 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 in order to prevent injury to people or damage to property (DoN, 2006).

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 (DoN, 2006).

3.11.1.1 Assessment Methods and Data Used

Historical Naval training and environmental studies contributed to the development of the land use section. Bathymetry data for classification of offshore areas were obtained from the National Oceanic and Atmospheric Administration (NOAA).

3.11.1.2 Warfare Areas and Associated Environmental Stressors

No potential stressors from the proposed activities on land use have been identified. Land-based installations and ranges are managed by Commander Naval Installations Command (CNIC). CNIC is responsible for preparing NEPA documentation for its installations when necessary. Therefore, installations are not included in the analysis for this EIS/OEIS. Other-Service land ranges are responsible for environmental compliance and analysis of their own ranges and therefore are not included in this EIS/OEIS. The geographic scope of this EIS/OEIS (Study Area) includes the 18,966 nm^2 of Special Use Airspace warning area; 18,617 nm^2 of offshore surface and subsurface operating area (OPAREA); and 12,529 nm^2 of deep ocean area greater than 100 fathoms (600 feet) (DoN, 2006). It does not include the separate and distinct Marine Corps Air Station (MCAS) Cherry Point Complex and Marine Corps Base (MCB) Camp Lejeune Range Complex. This EIS/OEIS will not address any land or inland ranges or their associated special use airspace.

3.11.2 Affected Environment

Offshore activities are military, commercial, and recreational. Although the FAA established warning areas for military operations, virtually all airspace and seaspace is available for co-use the majority of the time. Only hazardous activities are exclusive use, and those times are scheduled and broadcast through Notices-to-Mariners, issued by USCG and Notices-to-Airmen, issued by the FAA (DoN, 2006).

3.11.3 Environmental Consequences

3.11.3.1 No Action Alternative

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. Additionally, the scenic quality of the offshore area is not

affected by proposed activities. Therefore, the proposed activities associated with the No Action Alternative would have no impact on land use.

3.11.3.2 Alternative 1

Alternative 1 proposes increased operational training, expansion of warfare missions, accommodation of force structure changes, and enhancement of range complex capabilities. Proposed increases to Commercial Air Services, introduction of Maritime Security Surface Strike Group training, introduction of MH-60R/S training, and introduction of Organic Mine Countermeasures to the Mine Countermeasures mission, are not associated with land encroachment or land forms and soil. Land-based modes of transportation and utility systems are not associated with offshore events. Additionally, the scenic quality of the offshore area would not be affected by proposed activities. No changes to existing real estate use or agreements are proposed as a result of implementing Alternative 1. Therefore, the proposed activities associated with Alternative 1 would have no impact on land use.

3.11.3.3 Alternative 2 (Preferred Alternative)

Alternative 2 proposes increased operational training, expansion of warfare missions, accommodation of force structure changes, and enhancement of range complex capabilities beyond those proposed for Alternative 1. Proposed increases to Commercial Air Services, introduction of Maritime Security Surface Strike Group training, introduction of MH-60R/S training, and introduction of Organic Mine Countermeasures to the Mine Countermeasures mission, are not associated with land encroachment or land forms and soil. Land-based modes of transportation and utility systems are not associated with offshore events. Additionally, the scenic quality of the offshore area would not be affected by the proposed activities. No changes to existing real estate use or agreements are proposed as a result of implementing Alternative 2. Therefore, the proposed activities associated with Alternative 2 would have no impact on land use.

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 land use.

3.11.5 Summary of Environmental Effects (NEPA and EO 12114)

Table 3.11-1 summarizes the lack of impacts of the No Action Alternative, Alternative 1, or Alternative 2 to land use resources. There are no aspects of the proposed activities likely to act as stressors to land use; thus, there are no effects on land use under the requirements of NEPA or Executive Order 12114. Proposed activities in U.S. territory would have no impact on land use under the No Action Alternative, Alternative 1, or Alternative 2. Proposed activities in non-territorial waters would cause no harm on land use under the No Action Alternative, Alternative 1, or Alternative 2.

Table 3.11-1 Summary of Environmental Effects of the Alternatives on Land Use in the Navy Cherry Point Range Complex

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
No Stressors Identified	The No Action Alternative would not require land-based modes of transportation and utility systems. The scenic quality of the offshore area would not be affected by the proposed activities. No changes to existing real estate use or agreements are proposed as a result of implementing the No Action Alternative.	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.
Impact Conclusion	Implementation of the No Action Alternative would have no impact on land use in U.S. territory.	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.
Alternative 1		
No Stressors Identified	Alternative 1 would not require land-based modes of transportation and utility systems. The scenic quality of the offshore area would not be affected by the proposed activities. No changes to existing real estate use or agreements are proposed as a result of implementing Alternative 1.	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.
Impact Conclusion	Implementation of Alternative 1 would have no impact on land use in U.S. territory.	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.
Alternative 2		
No Stressors Identified	Alternative 2 would not require land-based modes of transportation and utility systems. The scenic quality of the offshore area would not be affected by the proposed activities. No changes to existing real estate use or agreements are proposed as a result of implementing Alternative 2.	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.
Impact Conclusion	Implementation of Alternative 2 would have no impact on land use in U.S. territory.	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.

3.12 CULTURAL RESOURCES

3.12.1 Introduction and Methods

Cultural resources are 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. There is a potential for prehistoric and historic archaeological resources to occur within the Navy Cherry Point Study Area. With respect to prehistoric resources in offshore waters at depths of less than approximately 300 feet (91 meters), archeological sites may be present from the Paleo-Indian Period when the sea levels were lower during the last ice age. However, it is likely these archaeological sites would be buried under sediments that have accumulated over time and would be effectively preserved in place. As a result, the only archaeological sites occurring throughout the Study Area would be historic shipwrecks. It should be noted that due to mechanical, chemical, and biological erosion and decay, it is likely that older shipwrecks are represented by non-organic materials (*e.g.,* metal, ballast stones, *etc.*) and are likely covered by sediments that have accumulated over time. No architectural resources occur in the Study Area and no sites associated with federally recognized American Indian tribes were identified for this project. For purposes of this document, shipwrecks are the only cultural resources considered in this assessment.

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 (National Park Service 2007); the Sunken Military Craft Act (10 USC 113, Title XIV); and OPNAVINST 5090.1B (Department of the Navy 1994). In accordance with the Sunken Military Craft Act, sunken military craft, such as shipwrecks and their associated contents (including human remains), are protected from unauthorized disturbance, removal or injury.

The Advisory Council on Historic Preservation 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 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 North Carolina State Historic Preservation Office (SHPO); 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, will be accomplished as part of the NEPA process for this EIS/OEIS. Onslow Beach, however, was excluded from the analysis on underwater cultural resources because MCB Camp Lejeune has already analyzed and consulted on that geographic area for underwater cultural resources.

3.12.1.1 Assessment Methods and Data Used

This Final EIS/OEIS evaluates Navy and Marine Corps training and testing effects on cultural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP). (The term "historic properties" is synonymous for NRHP-eligible or listed prehistoric, historic, or traditional cultural resources.) Cultural resources that have not been 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 that are:

(a) associated with events that have made a significant contribution to the broad patterns of American history; or
(b) associated with the lives of persons significant in the American past; or
(c) 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
(d) that have yielded, 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. However, very few of the shipwrecks within the Cherry Point OPAREA have been fully documented or evaluated for their NRHP significance, so for purposes of this EIS/OEIS, all unevaluated shipwrecks are considered potentially eligible for the NRHP.

Data Used

Information on the area's historic shipwrecks was obtained from the North Carolina SHPO; from the National Oceanic and Atmospheric Administration's (NOAA) on-line Automated Wreck and Obstruction Information System (AWOIS) (NOAA, 2007), from the National Register Information System (NRIS); from on-line maps and data; and from published sources, as cited. Information on underwater archaeological resources obtained from the North Carolina SHPO 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 document are estimates compiled from information obtained from these various sources. No comprehensive underwater surveys have been completed for the Study Area; however, data changes are made yearly as exploration systems become more sophisticated and 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.

3.12.1.2 Warfare Areas and Associated Environmental Stressors

Aspects of the proposed actions likely 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. Table 3.12-1 below presents operations associated with Mine Warfare operations, underwater detonations and high explosive ordnance, and Military Expended Materials that will be carried forward for detailed analysis in this EIS/OEIS.

3.12.2 Affected Environment

Thousands of submerged cultural resources, primarily shipwrecks, are located along the south Atlantic continental shelf. Early history of the coastal areas of the coastal states is closely linked to maritime activities because colonial settlement and commerce in these states were made possible by shipping. Shipwrecks occurred in these areas throughout the historic period, which may be considered as

beginning with the earliest European exploration of the area during the 16th century, and continuing until after World War (WW) II (prior to 1960).

Table 3.12-1 Warfare Areas and Potential Environmental Stressors on Cultural Resources

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Towed MIW Equipment	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)					
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓		
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)			✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)			✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)				✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA				✓
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA				✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA				
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA				
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)				
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)				✓
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)				✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA				✓
Air Intercept Control	W-122				
Electronic Combat (EC)					
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122				
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)				✓
Chaff Exercise- ship	Cherry Point OPAREA				✓
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)				✓
Strike Warfare (STW)					
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Area 18, 19, 20, 21)				✓

Table 3.12-1 Warfare Areas and Potential Environmental Stressors on Cultural Resources (Continued)

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Towed MIW Equipment	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Amphibious Warfare (AMW)					
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)				
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)			✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)				
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)				

Over the past four centuries, thousands of ships were wrecked along these coasts, earning those waters the nickname "The Graveyard of the Atlantic." Shipwrecks are not randomly located, but often are associated with prominent capes such as Cape Hatteras, Cape Lookout, and Cape Fear, and the attendant shoals such as Diamond, Lookout, and Frying Pan. Numerous wrecks are concentrated in the Cape Hatteras area where the intersection of cold northern currents and the northbound Gulf Stream forms shoals, and powerful currents, treacherous seas, and wind create shallow submerged shifting sandbars, creating hazards for mariners (see Figure 3.3-1).

Warfare, especially during WW II, contributed to wrecked vessels as well. Records of the North Carolina Underwater Archaeology Branch indicate that almost 3,000 wrecks occurred from north to south from the Northern Outer Banks area to New Inlet; of these, 87 can be identified by name, affiliation, or vessel type. Thirty-six of these vessels, including freighters and tankers and three German submarines, were lost during WW II. Other shipwrecks along the North Carolina coast include a wide variety water craft, from early 19th century Spanish merchant sailing ships, wood- and iron-sided steamers dating to the 1900s, freighters, whalers, gunboats, a steam battleship, and trawlers lost during WW II (Association of Underwater Explorers 2007; Koski-Karell 1995). The *USS Monitor*, *USS Huron*, and the 15 Civil War shipwrecks in southeastern North Carolina are all listed on the NRHP.

The Global Maritime Wrecks Database (Veridian, 2001) was used to identify the potential for shipwrecks to exist within the Cherry Point OPAREA. Approximately 174 locations indicating the location of metal obstructions and/or submerged wrecks were identified in the overall Cherry Point OPAREA; of these, about 80 can be identified by name and vessel type (Veridian, 2001). The majority

of the identified vessels are from the United States and Great Britain. Only about half of the 80 named vessels have accurate locations; the rest of the locations are approximate and may vary by one to three miles. Locations of the confirmed shipwrecks as well as other possible obstructions/shipwrecks are shown in Figure 3.12-1.

Only one known historic property is located in the Cherry Point OPAREA: the *USS Monitor*, an ironclad Civil War gunship which sank during a storm on December 31, 1862. Sixteen of the 62 member crew were lost with the ship (Naval Historical Center, 2008). The *USS Monitor* was listed on the NRHP on October 11, 1974 (National Register Information System, 2008) and was designated a National Historic Landmark on June 23, 1986 (National Park Service, 2008). The *USS Monitor* was designated the *Monitor* National Marine Sanctuary in 1973 and is managed by the National Oceanic and Atmospheric Administration (USS Monitor Center, 2008).

As a result of German submarine activity during WW II, many ships were torpedoed and sunk in the Cherry Point OPAREA. At least nineteen ships within the Cherry Point OPAREA are associated with loss of life and include the *Caribsea*, the *City of Atlanta*, the *Empire Gem*, the *Naeco*, the *U-352*, and the *W.E. Hutton* (NC Wreck Diving, 2008a, 2008c, 2008f, 2008g, 2008h; AUE, 2008). Another six ships were lost during WW II and may also be associated with loss of life and include the *E.M. Clark*, the *Esso Nashville*, and the *Lancing* (NC Wreck Diving 2008b, 2008d, 2008e). As these shipwrecks may contain human remains, they are considered war grave sites.

A literature review was undertaken for the three potential Bottom Impact areas (UNDET, MIW, and the Amphibious Landing training areas) in the Cherry Point OPAREA (Southeastern Archaeological Research, Inc. [SEARCH] 2009). Review of available databases identified two known wreck sites (*Suloide* and *W.E. Hutton*) and one obstruction within the UNDET area. Three known wreck sites (*Nutfield*, *Pulaski*, and *Seaman*) and one obstruction have been recorded in the MIW area (SEARCH 2009: 24). One wreck site (unnamed), two archaeological sites, and one obstruction are located in the Amphibious Landing area. Application of the predictive model indicates that all Potential Bottom Impact Areas have a high potential to contain submerged cultural resources. Of the three areas, only UNDET is considered a slightly lower probability area to contain 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 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.

3.12.3 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 National Register;

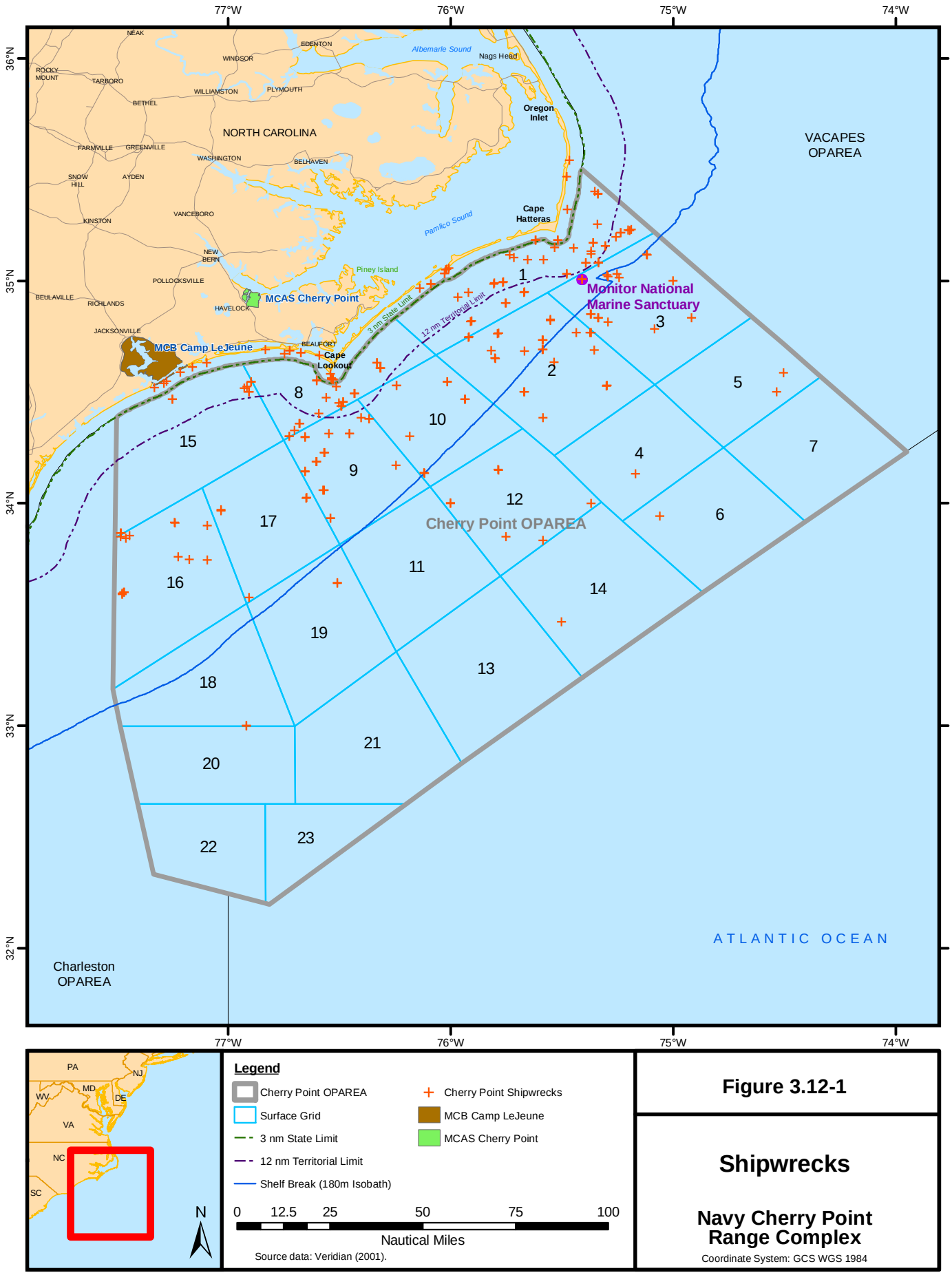


Figure 3.12-1

Shipwrecks

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

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 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 proposed action, 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 Cherry Point OPAREA, 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 high explosive (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.

3.12.3.1 No Action Alternative

Two MIW training activities have the potential to affect shipwrecks: Mine Countermeasures Exercise (MCM) and Mine Neutralization. MCM events generally involve a helicopter with minesweeping and mine hunting gear using one of several systems. Typically the helicopter would fly within 75 feet of the water while towing the appropriate system, which may be towed on the surface or down to a depth of 150 feet or less.

MCM systems include AN/AQS-20 and AN/AQS-24A, which are helicopter-towed sonar systems. Other minesweeping systems include the MK-103 (mechanical mine sweeping system) and the MK-105 (used to counter magnetic influencing mines). Under the No Action Alternative, a total of 220 MCM sorties typically occur yearly in Onslow Bay. Four shipwrecks occur in the Mine Warfare training area that could be affected by minesweeping systems. For example, if operators are unaware of the locations of shipwrecks in the OPAREA, the towed system and attachment cable could inadvertently encounter, snag, and damage a shipwreck situated in relatively shallow water and/or at low tide (*possible adverse effect* under Section 106).

Mine Neutralization activities occur in Onslow Bay that may also have an effect on shipwrecks. Typically, 20 explosive mine neutralization (MINEX) events occur yearly, all within the UNDET Area (Figure 2.2-1). Eight known shipwrecks have been identified in this area. Explosive Ordnance Disposal (EOD) units use underwater explosive charges to destroy or neutralize simulated mines in this area, and may involve detonation of explosive charges equivalent to up to 20-lbs of TNT. Because of the properties that allow water to rapidly transmit shock waves, demolition of mines could damage cultural sites in the general vicinity. The amount of damage would depend on a number of factors such as size of the charge, distance from the wreck, and topography of the ocean bottom (*possible adverse effect* under Section 106).

Use of other high explosives (HE) includes Hellfire and TOW missiles and 5-inch HE rounds (from FIREX with IMPASS events). All these HE munitions are designed to detonate at or close to the

surface of the water. BOMBEX and FIREX (with IMPASS) training operations would take place in deep water (Figure 2.2-3) and the actual explosions would not affect the ocean bottom or shipwrecks laying on the ocean floor. Therefore, use of HE munitions in the Cherry Point OPAREA would not affect shipwrecks (*no historic properties affected* under Section 106).

Sections 3.1 and 3.2 discuss bathymetry, sediments, and Military Expended Materials (MEM) resulting from Navy and Marine Corps training in the Cherry Point OPAREA. MEM, such as material resulting from bombing and surface-to-surface gunnery exercises, can be deposited on the ocean bottom in the vicinity of shipwrecks. However, even if bomb fragments sink to the ocean bottom, it is unlikely they would come into contact with a wreck. If they should sink in the vicinity of a wreck, the expended materials would not affect the historic characteristics of the shipwreck, and eventually all would be covered by sediments. Thus, these operations and their resulting MEM would not affect shipwrecks (*no historic properties affected* under Section 106).

Under the No Action Alternative, training operations and major range events would continue at current levels, but because avoidance of known shipwreck locations is conducted during current training, no significant impacts (negligible to minor impacts) to cultural resources within the Cherry Point OPAREA would be expected (*no historic properties affected* under Section 106). On-going MIW towed devices and EOD activities would have the advantage of past experience with known locations of shipwrecks, so operators should be able to avoid damage to cultural resources in these areas. Required preplanning and implementation of described mitigation measures (especially avoidance) would help reduce the potential for impacts.

3.12.3.2 Alternative 1

Under Alternative 1, MCM activities would decrease from 220 sorties per year to 192 per year. These exercises would include use of a variety of MIW towed systems: AQS-20, AQS-24, MK-103, MK-105, and OASIS. The locations for using these systems would be Onslow Bay and CVOA North for this alternative (Figure 2.2-1). No simulated mines would be deployed. If helicopter operators are unaware of the locations of shipwrecks in the Cherry Point OPAREA, the towed system and attachment cable could inadvertently encounter, snag, and damage a shipwreck situated in relatively shallow water and/or at low tide (*possible adverse effect* under Section 106).

Typically, the 20 explosive mine neutralization events which occur yearly in the No Action Alternative would continue. All EOD training with actual explosive charges would be performed in Onslow Bay (UNDET Area), which is pre-approved for detonations. Eight documented shipwrecks located in the UNDET Area as depicted in Figure 3.12-1. As described under the No Action Alternative, EOD units that use underwater explosive charges to neutralize simulated mines have the potential to damage cultural sites in the general vicinity. Damage would vary, based on sea bottom topography and proximity to the shipwreck (*possible adverse effect* under Section 106).

Additionally, the non-explosive mine neutralization activities (RAMICS and AMNS) also would increase from no events per year to 18 events. AMNS and RAMICS systems would use non-explosive ordnance to cause the mine to surface or destroy mines. With AMNS, the target location is determined, and then an expendable, self-propelled neutralizer device locates the target and renders it inoperable. RAMICS is a targeting, fire control, and gun system that fires a supercavitating projectile[25] at a near surface moored mine.

[25] A marine propeller which has special blade sections so that at sufficiently high speed, the whole back of each blade becomes enveloped by a smooth sheet of bubbles, which greatly reduces the viscous drag of the water.

Use of HE munitions would increase compared to the No Action Alternative. This increase would be due to an increase from eight to 16 HE missiles used. However, all HE munitions would be detonated in deep water areas within the Cherry Point OPAREA. As determined for the No Action Alternative, use of HE munitions in the Cherry Point OPAREA would not affect shipwrecks under Alternative 1 (*no historic properties affected* under Section 106).

As with the No Action Alternative, MEM such as shells and mine fragments expended during the proposed operations under Alternative 1 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 characteristics of the shipwreck. Eventually, the expended materials would provide a substrate for benthic colonization and would likely be covered by shifting sediments. Therefore, MEM resulting from Alternative 1 training operations would not have an affect on shipwrecks (*no historic properties affected* under Section 106).

Preplanning and implementation of described mitigation measures (especially avoidance of known shipwreck locations during training) would result in no significant impacts (negligible to minor impacts) to shipwrecks in Onslow Bay or the Cherry Point OPAREA (*no historic properties affected* under Section 106).

3.12.3.3 Alternative 2 (Preferred Alternative)

The same types of MCM activities described above for Alternative 1 would be employed for Alternative 2, except that training areas would be temporarily populated with up to 105 mineshapes during each of three major exercises. As described in Chapter 2 and Section 3.1, mooring lines to hold mine shapes in place would be temporarily anchored by concrete blocks in the Mine Warfare (MIW) Training Area. Under the preferred alternative, the number of training events would increase from 220 from the No Action Alternative to 576 (see Table 2.2-5). These training operations would occur in the proposed MIW Training Area and CVOA North (see Figure 2.2-1). At least 11 shipwrecks occur in the Onslow Bay area. Because the number of known shipwrecks is small, deploying mineshape near or on a shipwreck is highly unlikely (*no historic properties affected* under Section 106).

There are a few shipwrecks in the areas where the proposed MIW towed devices would operate (three know shipwrecks in the MIW Training Area). If helicopter operators are unaware of the locations of shipwrecks in the Cherry Point OPAREA, the towed system and attachment cable could inadvertently encounter, snag, and damage a shipwreck situated in relatively shallow water and/or at low tide (*possible adverse effect* under Section 106).

The number of EOD explosive training would be the same as the No Action Alternative and Alternative 1. All these events would be performed in the UNDET Area, and if possible confined to a small area where the UNDET Area overlaps the proposed MIW Training Area (Figure 2.2-2). EOD units that use underwater explosive charges to neutralize simulated mines have the potential to damage cultural sites in the general vicinity. Damage would vary, based on sea bottom topography and proximity to the shipwreck (*possible adverse effect* under Section 106).

Use of HE munitions would decrease as compared to the No Action Alternative due to the cessation of HE bombs. The number of Hellfire and TOW missiles and 5-inch rounds would increase slightly compared to the No Action Alternative. All HE munitions would be detonated in deepwater. As determined for the No Action Alternative, use of HE munitions in the Cherry Point OPAREA would not effect shipwrecks under Alternative 2 (*no historic properties affected* under Section 106).

Preplanning and implementation of described mitigation measures (especially avoidance of known shipwreck locations during training) would cause no significant impacts (negligible to minor impacts) for shipwrecks in Onslow Bay or the Cherry Point OPAREA (*no historic properties affected* under Section 106).

3.12.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant effects to historic properties.

3.12.5 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 Alternative 2 (the Preferred Alternative). 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 operations. Mine warfare activities would be limited to the identified areas in Onslow Bay and shallow areas in Cherry Point OPAREA. Table 3.12-2 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 3.12-2 Summary of Environmental Effects of the Alternatives on Cultural Resources in the Navy Cherry Point Range Complex Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Mine Warfare Deployment/Recovery	Localized disturbance to sea bottom; limited potential to strike a cultural resource or strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
MIW Towed Equipment	Limited potential for a towed array to disturb a shipwreck.	Limited potential for a towed array to disturb a shipwreck.
Underwater Detonations and Explosive Ordnance	Localized disturbance sea bottom; limited potential for explosions to occur at the location of a shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
Military Expended Materials	Localized accumulation of expended materials on sea bottom; limited potential for expended materials to accumulate at the location of a 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 1		
Mine Warfare Deployment/Recovery	Limited potential for a towed array to disturb a shipwreck.	Limited potential for a towed array to disturb a shipwreck.
MIW Towed Equipment	Limited potential for a towed array to disturb a shipwreck.	Limited potential for a towed array to disturb a shipwreck.
Underwater Detonations and Explosive Ordnance	Localized disturbance sea bottom; limited potential for explosions to occur at the location of a shipwreck.	Localized disturbance sea bottom; limited potential for explosions to occur at the location of a shipwreck.
Military Expended Materials	Localized accumulation of expended materials on sea bottom; limited potential for expended materials to accumulate at the location of a 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 3.12-2 Summary of Environmental Effects of the Alternatives on Cultural Resources in the Navy Cherry Point Range Complex Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Mine Warfare Deployment/Recovery	Localized disturbance sea bottom; limited potential to strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
MIW Towed Equipment	Limited potential for a towed array to disturb a shipwreck.	Limited potential for a towed array to disturb a shipwreck.
Underwater Detonations and Explosive Ordnance	Localized disturbance sea bottom; limited potential for explosions to occur at the location of a shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
Military Expended Materials	Localized accumulation of expended materials on sea bottom; limited potential for expended materials to accumulate at the location of a 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).

3.13 TRANSPORTATION

3.13.1 Introduction and Methods

Traffic issues refer to transportation and circulation of vehicles within an organized framework. This discussion addresses the marine and air traffic within the vicinity of the Navy Cherry Point Study Area. Military and civilian use of the offshore sea and air areas is compatible, with Navy ships accounting for three percent of the total ship presence out to 200 nm (Center for Naval Analysis [CNA], 2001). Where naval vessels and aircraft conduct operations that are not compatible (*e.g.,* hazardous weapons firing), they are confined to Operating Areas (OPAREA) away from shipping lanes and inside Special Use Airspace (SUA). Hazardous operations are communicated to all vessels and operators by use of Notice-to-Mariners (NOTMAR), issued by the U.S. Coast Guard (USCG), and Notice-to-Airmen (NOTAM), issued by the Federal Aviation Administration (FAA).

Ocean Traffic. Ocean traffic is the transit of commercial, private, or military vessels at sea, including submarines. Ocean traffic 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 traffic involving recreational boating, sport fishing, commercial fishing, and activity by naval vessels. In most cases, the factors that govern shipping or boating traffic 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 (EEZ) are sea zones that were established by the Third United Nations Convention on the Law of the Sea in 1982. Part V, Article 55 of the Convention establishes that the EEZ 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 EEZs extend 200 nautical miles from the coastal baseline (the baseline usually follows the low-tide water line). Within the EEZ, the coastal nation has sole exploration 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 EEZ was established by Presidential Proclamation 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 nautical miles. 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 a critical phase of flight, either take-off or landing, and flight under Instrument Flight Rules (IFR), particularly flight 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 in order 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.
- Class A extends from 18,000 feet MSL up to and including 60,000 feet MSL and includes designated airways for commercial aviation operations at those altitudes.
- Class B airspace extends from the ground to 10,000 feet 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 the need to restrict or limit non-participating aircraft. SUA is established under procedures outlined in 14 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 (MOA), 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 Navy Cherry Point 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 nautical miles 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 the 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 activities, 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.

3.13.1.1 Assessment Methods and Data Used

CNA (2001, 2004, 2006) studies were used to look at non-Navy ship traffic in the vicinity of the Navy Cherry Point Range Complex. In 2001 the Chief of Naval Operations (CNO-N45) initiated a study that, among other things, sought to determine the contribution of the Navy to coastal ship traffic. This study

utilized the Historical Temporal Shipping (HITS) database[26] and daily listings of Navy ship traffic. Regarding "traffic" issues, the 2001 CNA study concluded that the Navy ships were a small fraction of the coastal ship presence (1/30th) and comparisons of naval and commercial traffic is difficult due to naval traffic being "patchy" in both time and space while commercial traffic is more uniform.

The 2004 CNA study concentrated more on the Navy OPAREAs and due to the difficulties in estimating small commercial vessels and recreational boats, the CNA was asked to establish a methodology for estimating the small boat and craft traffic in a given ocean area. Additionally, the HITS data used in the 2001 study had been developed in 1993 and had not been updated, so using sporadic vessel position data, the 2004 study developed a tool for comparing relative densities of large vessels, by vessel type, region, and time to compare Navy and non-Navy traffic levels (CNA, 2004).

The 2006 CNA study concentrated more on information concerning Navy and non-Navy vessel traffic and speed patterns due to increasing concerns regarding proposed speed restrictions. The study concluded that estimates of vessel speed could be calculated from positional data and that while Navy ships were capable of transiting at higher speeds than most large commercial vessels, they generally do not do so (CNA, 2006).

Information regarding personal watercraft was obtained in part from the United States Coast Guard (USCG). 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 USCG focuses on personal water craft and boating. 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 sites that are commonly used (Davison, 2007; DEMA, 2006). Dive locations identified in this document were established through the use of a survey of state dive charter company websites, Veridian Corporation's 2001 Global Maritime Wrecks Database, and state tourism and parks and recreation information.

3.13.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to transportation are assessed in terms of anticipated levels of 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 3.13-1. These stressors were identified by conducting a detailed analysis of the warfare areas, and specific activities included in the Alternatives.

[26] The Historical Temporal Shipping (HITS) data is a 1993 database, developed by the Naval Oceanographic Office, which describes the number of ships expected in each region of the ocean for five types of ships: fishing, merchant, tanker, large tanker, and supertanker. While ship types other than those included in the HITS data also may transit the site, the selected ship types are expected to be representative of major commercial shipping in the region. Traffic density was determined for this study by isolating 1-degree latitude by 1-degree longitude boxes. For each box, ship-hour estimates were divided by box area. This calculation is useful comparing relative densities between East Coast Navy OPAREAs and ship types (CNA, 2001).

Table 3.13-1 Summary of Potential Stressors to Transportation Resources[27]

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Military Expended Materials	Inert Mine Shape Deployment/Recovery
Mine Warfare (MIW)					
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)	✓	✓	✓	
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)			✓	
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)			✓	
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓	✓		
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA	✓		✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA	✓	✓		
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA	✓	✓		
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)		✓		
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)				
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)				
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓	
Air Intercept Control	W-122		✓		
Electronic Combat (EC)					
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122		✓		
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	
Chaff Exercise- ship	Cherry Point OPAREA		✓	✓	
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	
Strike Warfare (STW)					
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Area 18, 19, 20, 21)	✓	✓	✓	
Amphibious Warfare					
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)		✓	✓	

[27] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations; see Table 2.2-4 and Appendix D.

Table 3.13-1 Summary of Potential Stressors to Transportation Resources (Continued)

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Military Expended Materials	Inert Mine Shape Deployment/Recovery
Amphibious Warfare (Continued)					
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)	✓	✓	✓	
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	

3.13.2 Affected Environment

3.13.2.1 Ocean Traffic

Military

The Cherry Point OPAREA sea space covers 18,617 square nautical miles (nm²) and lies off the east coast of North and South Carolina. Both the sea space and undersea space begin 3 nautical miles (nm) from the shoreline and extends seaward 103 nm. The area is separated into 23 surface areas. Subsurface transit lanes are designated in subsurface areas of grids 20 and 21. However, submarine operations are included in both an ESGEX and COMPTUEX (see Appendix D for details of these exercises). During these exercises the submarine will operate submerged anywhere within the Cherry Point OPAREA beyond the 20 fathom isobath (approximately 40 m). Subsurface operations in the submarine operating areas must be authorized by the Submarine Exercise Area Coordinator, Commander, Submarine Force, U.S. Fleet Forces (DoN, 2006).

Fleet Area Control and Surveillance Facility (FACSFAC) Virginia Capes (VACAPES), located at Naval Air Station (NAS) Oceana, VA, is the principal controlling authority for the Navy Cherry Point Range Complex. FASFAC VACAPES controls special use airspace, (Warning Area [W]-122), surface, and subsurface operating areas. Units are required to obtain clearance for all hazardous or exclusive operations within the OPAREA. FACSFAC is in essence an air traffic control facility that coordinates closely with the FAA to ensure control of SUA that consists of warning areas and restricted areas, military operating areas, air traffic control assigned airspace, and surface/subsurface operating areas. FACSFAC VACAPES has responsibility for the following activities and procedures:

- Coordinate DoD usage of oceanic airspace east of the warning areas to the Azores and the Gulf of Mexico.
- Schedule, coordinate, and provide range control for surface and airborne missile firing exercises.
- Coordinate, schedule, and oversee associated commercial and military aircraft services support.
- Act as Regional Airspace Coordinator for DoN activities and the FAA.
- Provide full air traffic control services by direct interface with FAA and military/civil approach controls.

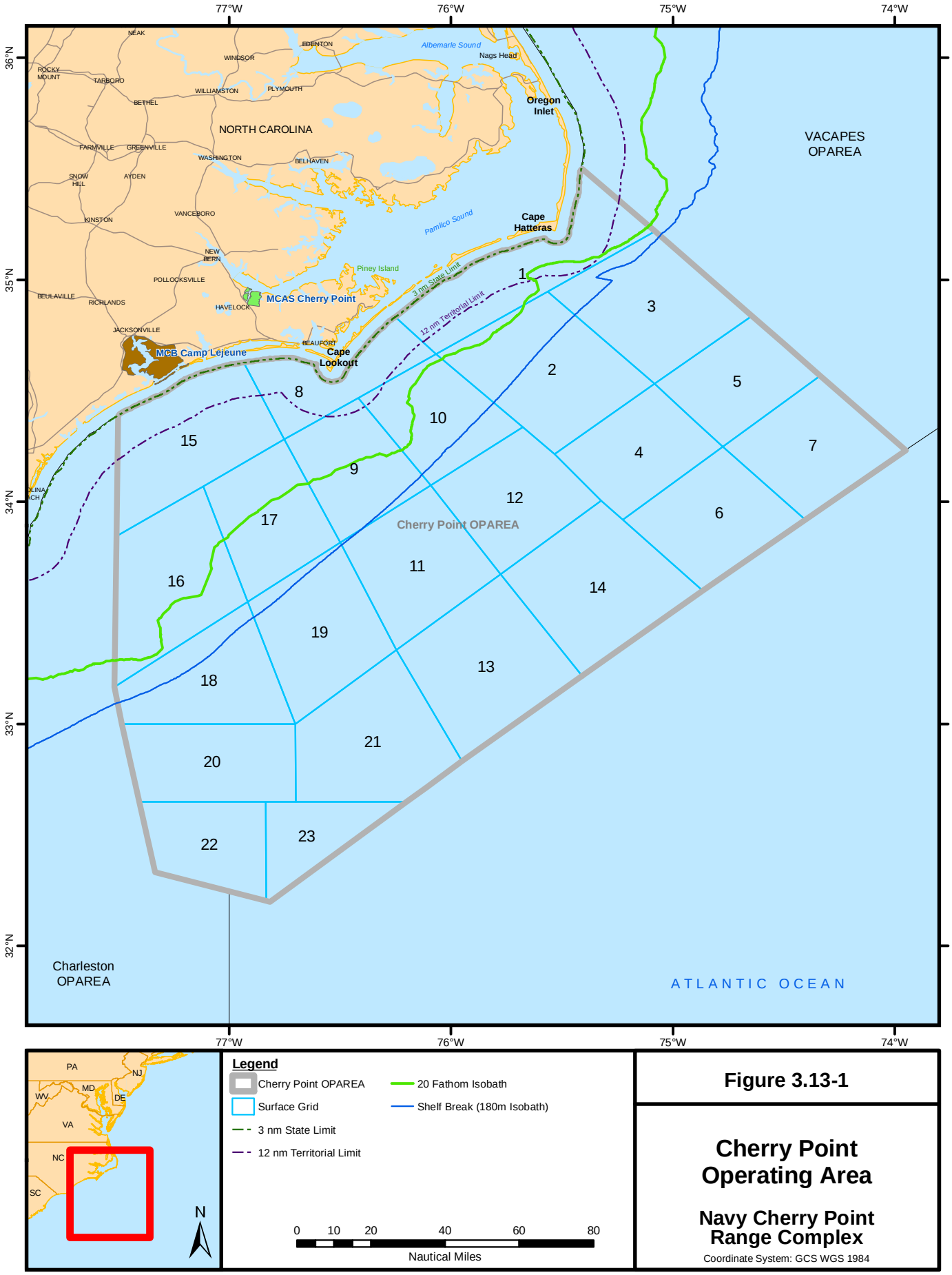


Figure 3.13-1

Cherry Point Operating Area

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

- Coordinate operations with search and rescue, anti-immigration interdiction defense operations, federal drug interdiction teams, Maritime Homeland Security Operations, and Trusted Agent for Southeast Air Defense Sector and Northeast Air Defense Sector.

FACSFAC VACAPES has authority to coordinate services and firing notices, issue weekly target and OPAREA schedules, and prescribe necessary additional regulations governing matters within the Navy Cherry Point Range Complex. They provide the U.S. Fleet Forces with surveillance and functional area support services to include scheduling, monitoring, and controlling DoD air, surface and subsurface units operating in the Study Area for the Navy Cherry Point EIS/OEIS. As a designated Air Traffic Control (ATC) facility, FACSFAC VACAPES is required to provide air traffic separation consistent with FAA guidelines to ensure the safe, efficient, expeditious flow of air traffic. Radar surveillance and radio communications assists in providing area containment and ATC separation between high-performance military aircraft and the high volume of commercial aircraft transiting the numerous jet routes along the Atlantic coast.

Military aircraft originating from NAS Oceana are controlled by FACSFAC VACAPES upon entering Navy Cherry Point Range Complex airspace. Aircraft transiting from other areas are under control of the appropriate Air Route Traffic Control Center prior to transiting into Navy Cherry Point Range Complex airspace. Clearance is provided to the appropriate Air Route Traffic Control Center for those aircraft transiting the Navy Cherry Point Study Area airspace using a grid system.

The Atlantic Fleet Exercise Coordination Center (AFECC) is a component of FACSFAC VACAPES responsible for performing as the single point of contact for scheduling and coordinating all fleet training exercises. The AFECC coordinates and schedules airspace, sea space, targets, electronic warfare services, and other assets for all large scale exercises. AFECC is responsible for the coordination of operational area assignments, ranges, airspace, mobile sea range assets, fixed and mobile targets, Large Area Tracking Range, electronic attack, and commercial air services. AFECC coordinates with all DoD, government and civilian agencies to ensure compliance with all requirements and regulations for the safe use of ranges, assets, and services.

Civilian

The east coast of the U.S. is heavily traveled by marine vessels, with several commercial ports occurring near Navy OPAREAs. Recreational boats range throughout the coastal waters, depending on season and weather conditions. North Carolina has 362,784 registered recreational boats and is ranked 11th nationwide (NMMA, 2007; USCG, 2005). There are 185 water access areas throughout the State of North Carolina (NCWRC, 2008).

Travel between the most popular cruising destinations in the Study Area does not require traversing the Navy Cherry Point Range Complex; however, larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore. In particular, sailboats in the 75-foot and larger class, and cruising vessels transiting ocean passages (*e.g.,* from some North Carolina ports to the Bahamas or Bermuda) might favor courses through the vicinity of Cherry Point OPAREA. Registered boats of 25 feet or greater, however, represent less than one percent of total U.S. recreational boats (NMMA, 2007).

Commercial shipping lanes do traverse the Navy Cherry Point Range Complex but are controlled by the use of directional shipping lanes for large vessels (cargo, container ships, and tanker) (Figure 3.13-2). 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.

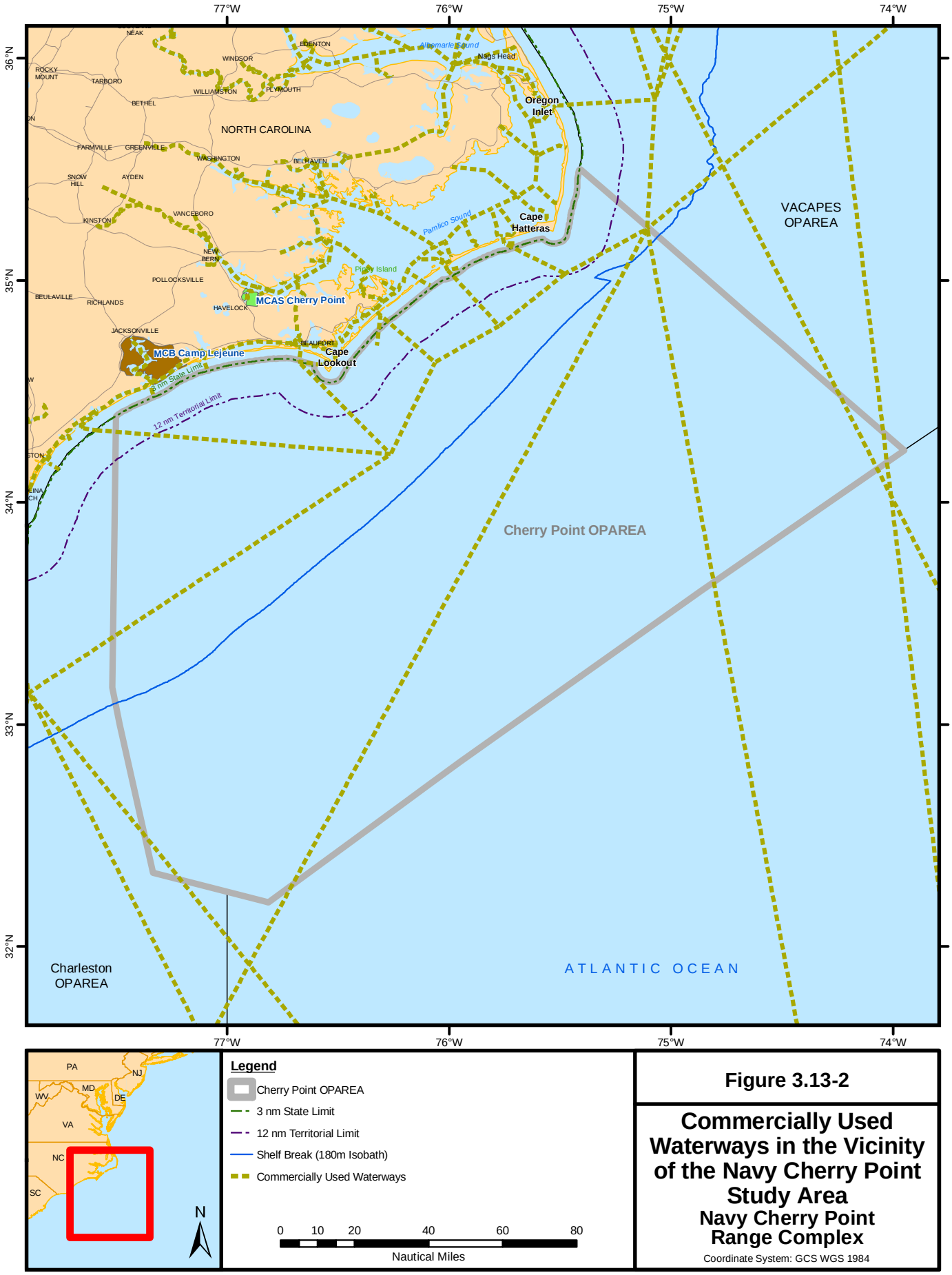


Figure 3.13-2

Commercially Used Waterways in the Vicinity of the Navy Cherry Point Study Area

Navy Cherry Point Range Complex

Coordinate System: GCS WGS 1984

Recreational dive vessels travel to shipwrecks that provide habitat suitable for development of artificial reefs, and are popular destinations for divers. Divers frequent the Cape Hatteras offshore area due to its volume of artificial reefs provided by shipwrecks (Divehatteras.com). Cape Lookout and Oregon Inlet also offer many opportunities for wreck diving, with some wrecks extending as far as 75 miles offshore (NOAA, [date unknown]). Within the Cherry Point OPAREA, about 89 shipwrecks are located offshore of North Carolina (Veridian, 2001).

3.13.2.2 Air Traffic

Requests to schedule the airspace and hazardous events (those involving firing or dropping ordnance) are coordinated directly with FACSFAC VACAPES. The FACSFAC VACAPES operations schedule is published weekly and lists assigned radio frequencies and area assignment times for events controlled by FACSFAC VACAPES or which involve commercial aircraft. Full and specific guidelines, procedures, and restrictions are provided in FACSFAC VACAPES Instruction 3120.1 Series.

Military

The only special use airspace associated with the Navy Cherry Point Range Complex is Warning Area 122 (W-122). Warning Area W-122's dimensions are approximately 185 nautical miles (north-south) and 100 nautical miles (east-west) and its shape basically follows the same outline as the Cherry Point OPAREA. W-122 is divided into 23 air areas that go from the surface to an unlimited altitude in most of the air areas and are consistently labeled the same as the 23 surface areas. Air areas 1, 8, and 15 are used by both commercial and military aircraft and the military is not given exclusive use of these areas. The WHISKEY and X-RAY corridors are used to provide routing and clearance limits for aircraft arriving or departing the W-122 airspace.

Civilian

Close coordination between military and civilian air traffic control facilities enables effective, real-time, joint use of the Navy Cherry Point Range Complex warning area. Under these procedures, regardless of the schedule for the use of a military warning area, civilian aircraft may use warning area airspace, until a military aircraft is actually en route to that area. FACSFAC VACAPES has the responsibility to ensure civilian air carrier transit of SUA does not conflict with DoD operations and training.

3.13.2.3 Range Safety Procedures

Through naval operating instructions, range safety precautions and regulations are implemented by in Commander, in Chief, U.S. Atlantic Fleet (CINCLANTFLT) Instruction 3120.26, "Atlantic Fleet Operating Areas and Warning Areas," apply in the Cherry Point OPAREA. Additionally FACSFAC VACAPES has implemented safety restrictions that are imposed specifically for the Cherry Point OPAREA. The following general rules apply to area clearances within Cherry Point OPAREA:

- Dropping any ordnance, live or inert, or live fire is considered a hazardous event. All hazardous or exclusive operations and exercises conducted in the Cherry Point OPAREA require clearance from FACSFAC VACAPES.
- The firing or dropping of ordnance must be scheduled with FACSFAC VACAPES. Firing exercises are not authorized without prior FACSFAC VACAPES approval.
- Small arms (munitions .50 caliber and under) qualifications on ships do not require FACSFAC VACAPES approval. The unit conducting small arms fire is responsible for clearing their area.
- Non-hazardous/concurrent air, surface and subsurface operations, such as independent steaming exercise transits, navigation drills, deck landing qualifications, and helicopter operations do not require a specific clearance/message request.
- Flare drops are considered a non-hazardous event, but all airborne/surface units must contact FACSFAC VACAPES prior to dropping flares to prevent errant search-and-rescue reporting.

- Publications of NOTMARs and NOTAMs by the USCG and FAA. The Navy provides information about potentially hazardous activities planned for the Navy Cherry Point Range Complex (DoN, 2006).

3.13.3 Environmental Consequences

The traffic analysis addresses ocean and air traffic in the Navy Cherry Point Range Complex. The principal issue is the potential for existing or proposed military air or vessel traffic to affect existing transportation and circulation conditions. Impacts on traffic are assessed with respect to the potential for disruption of transportation pattern and systems, and changes in existing levels of transportation safety.

Impacts to air traffic might occur if an alternative would result an increase of flights that cannot be accommodated within established operational procedures and flight patterns. Impacts could also occur if an alternative would require airspace modifications or an increase in air traffic that could result in an increase in the potential for collision between military and non-participating civilian flight operations.

Impacts on 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 Navy Cherry Point Range Complex. However, the need to use alternative routes during the time of exclusion does not constitute a serious disruption.

3.13.3.1 No Action Alternative

Both military and non-military entities have been sharing the use of the airspace and ocean surface that encompasses the Navy Cherry Point Range Complex for many 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. Activities under the No Action Alternative include activities that are and have been routinely conducted in the area for decades. Ongoing, continuing operations identified in this EIS/OEIS will continue to use the existing offshore OPAREA and Warning Area. 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 hazard to other vessels).

Currently the Navy uses the Cherry Point OPAREA for 900 steaming days per year. There are 8,016 annual fixed-wing and 698 helicopter sorties in the OPAREA annually. None of the alternatives include proposed airspace modifications and would not change the existing relationship of the Navy's special use airspace with federal airways, uncharted visual flight routes, and airport related air traffic operations.

FACSFAC VACAPES is the principal controlling authority for activities within the Navy Cherry Point Range Complex. Through close coordination with the FAA, FACSFAC VACAPES ensures 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 proposed activities likely to impact transportation activities stem from vessel movements, aircraft overflights, military expended materials, and the associated training activities; however, conflicts in the Navy Cherry Point Range Complex are handled through a single point of contact system that ensures the needs of both the military and civilian sectors are met. Military activities are either scheduled or announced ahead of execution or take place in an area that is designated for the exclusive use of military activities.

Military expended materials can interfere with transportation activities through training activities that are currently conducted in the Study Area which would remain and continue to have no impact upon the transportation activities in the Study Area due to the limited amount of materials (See Section 3.1 and 3.2 for a more detailed analysis of military expended materials).

Mine warfare deployment/recovery can impact transportation activities due to mine countermeasures and neutralization exercises that are currently conducted in the Study Area which would remain and continue to have no impact upon the transportation activities in the Study Area. These exercises are limited in nature and occur primarily in the Onslow Bay area of the Cherry Point OPAREA (Figure 2.2-2) and the nearshore waters in Onslow Bay. This training only occurs during major exercises and comprises a few helicopter mine hunting and sweeping events.

The proposed activities associated with the No Action Alternative have no impact on transportation resources. Implementation of the No Action Alternative would have no impact on transportation resources in U.S. Territory. Further, implementation of the No Action Alternative would not cause harm to transportation resources in non-territorial waters.

3.13.3.2 Alternative 1

The Navy can accomplish the proposed activities associated with Alternative 1 without modifications or need for additional designated 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 procedure; 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.

The introduction of Organic Mine Countermeasures (OMCM) operations and the associated components and operations would result in additional restrictions to civilian traffic during operational periods. The addition of OMCM to the current Mine Countermeasures Exercises conducted in the Cherry Point OPAREA will likely result in an additional three times per year that civilians would be restricted from operational areas during periods of training. The areas affected are primarily in the UNDET area and Onslow Bay (Figure 2.2-2).

The potential impacts to transportation assets associated with Alternative 1 would otherwise be similar to those described for the No Action Alternative. Implementation of Alternative 1 would have no impact on transportation resources in U.S. Territory. Further, implementation of Alternative 1 would not cause harm to transportation resources in non-territorial waters.

3.13.3.3 Alternative 2 (Preferred Alternative)

The Navy can accomplish the proposed activities associated with Alternative 2 without modifications or need for additional designated ocean or airspace. The proposed operations would not require either: (1) a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure; or (2) a VFR 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. Operations involving steaming days would increase by approximately 5.5 percent if this alternative were implemented, the fixed wing sorties would increase by approximately 8 percent, and the helicopter sorties are anticipated to increase by approximately 71 percent.

The Proposed Action in Alternative 2 includes an increase of operations in the Onslow Bay with the establishment of the Mine Warfare Training Area (Figure 2.2-2). Implementation of Alternative 2 would have no impact on transportation resources in U.S. Territory. Further, implementation of Alternative 2 would not cause harm to transportation resources in non-territorial waters.

3.13.4 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.

3.13.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.13-2, the environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on transportation would have no impact.

Table 3.13-2 Summary of Environmental Effects of the Alternatives on Transportation in the Navy Cherry Point Study Area

Alternative and Stressor	NEPA (U.S. Territory)	EO 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		
Inert Mine Shape Deployment/Recovery		
Impact Conclusion	Implementation the No Action Alternative would have no impact on transportation resources in 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		
Inert Mine Shape Deployment/Recovery		
Impact Conclusion	Implementation Alternative 1 would have no impact on transportation resources in U.S. Territory.	Implementation of Alternative 1 would not cause harm to transportation resources in non-territorial waters.
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		
Inert Mine Shape Deployment/Recovery		
Impact Conclusion	Implementation Alternative 2 would have no impact on transportation resources in U.S. Territory.	Implementation of Alternative 2 would not cause harm to transportation resources in non-territorial waters.

3.14 DEMOGRAPHICS

3.14.1 Introduction and Methods

Demographic statistics are assessed through identification and evaluation of socioeconomic factors such as population characteristics, which may include population, age, education, disabilities, poverty levels, and race and ethnicity. The Study Area for demographics is the coastal counties of the state of North Carolina.

3.14.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the U.S. Census Bureau (USCB), state and local governmental agencies, and local organizations, as shown in the references section.

3.14.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to demographics are assessed in terms of their direct impacts on the local economy and related impacts on other socioeconomic resources (for example, housing). The level of these impacts can vary depending on the location of the proposed action. If implementation of an action results in the creation of 10 jobs, it is likely that in an urban setting the addition of 10 employment positions would go unnoticed, but may have impacts in a more rural region. If potential stressors would result in substantial shifts in population trends, or adversely affect regional spending and earning patterns, they would result in more of 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.

3.14.2 Affected Environment

Population Characteristics

The North Carolina population increased by 10.1 percent during the period April 1, 2000 to July 1, 2006 while the population of the United States experienced a 6.5 percent increase (USCB, 2007). In the United States there were 355,866 Navy and Marine Corps personnel in active duty military installations in 2002 (the latest year reported by the USCB) compared with a total United States population of 288,125,973 (in 2002). North Carolina had 43,522 military and 7,281 civilian personnel affiliated with the Navy and Marine Corps (USCB, 2003; 2006) while the North Carolina 2002 population was 8,313,494.

Age Structure

The latest year for which data is available is 2005. During that period 7 percent of North Carolina's population was under the age of 5, 24.7 percent were under the age of 18, and 12.1 percent were 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, 2007).

Race and Ethnicity

Table 3.14-1 shows a comparison of the race and ethnicity of the State of North Carolina and the United States. The percentages exceed 100 due to individuals' reporting in more than one category (i.e., "white" and "white, not Hispanic")

Table 3.14-1 North Carolina Race and Ethnicity

Race/Ethnicity	North Carolina (%)	United States (%)
White	74.1	80.2
Black	21.8	12.8
American Indian & Alaska Native	1.3	1.0
Asian	1.8	4.3
Native Hawaiian & Other Pacific Islander	0.1	0.2
Persons Reporting 2 or More Races	1.0	1.5
Hispanic or Latino Origin	6.4	14.4
White, Not Hispanic	68.3	66.9

NOTE: All numbers are percentages from 2005
Source: USCB, 2007

Poverty Level

North Carolina reported 13.8 percent of the population below the poverty level in 2004 while the United States reported 12.7 percent (USCB, 2007).

Education

In the year 2000, the percentage of households in North Carolina that spoke a primary language other than English was 8.0 percent. During that same time, the United States' percentage of homes with a primary language other than English was 17.9 percent. In North Carolina, 78.1 percent of the population graduated from high school and 22.5 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 (USCB, 2007).

3.14.3 Environmental Consequences

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 result if the proposed action or alternative resulted in a substantial shift in population trends, spending and earning patterns, or community resources (notably housing and education).

3.14.3.1 No Action Alternative

Implementation of the No Action Alternative would not result in a change in the demographics within the Study Area of the coastal counties of the State of North Carolina. 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.

3.14.3.2 Alternative 1

Although Alternative 1 introduces new training activities and proposes an increase to some existing training in the offshore training areas, Alternative 1 would not require basing or relocation of additional personnel within the Study Area. Therefore, implementation of Alternative would not result in impacts to demographics.

3.14.3.3 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.

3.14.4 Unavoidable Significant Environmental Impacts

Based upon the proceeding analysis, there are no unavoidable environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.14.5 Summary of Environmental Impacts (NEPA and EO 12114)

Table 3.14-2 summarizes the fact that there are no aspects of the proposed actions likely to act as stressors to demographics; thus, there are no effects on demographics under the requirements of the National Environmental Policy Act. Proposed activities in U.S. territory would have no impact on demographics under the No Action Alternative, Alternative 1, or Alternative 2. Non-territorial waters are outside the Study Area for demographics; therefore, there are no impacts on demographics under the requirements of EO 12114.

Table 3.14-2 Summary of Environmental Impacts of the Alternatives on Demographics in the Navy Cherry Point Study Area

Alternative and Stressor	NEPA (U.S. Territory)	EO 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 are no impacts to demographics under EO 12114.
Impact Conclusion	Implementation of the No Action Alternative would have no impact on demographics in U.S. territory.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no impacts to demographics under EO 12114.
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 are no impacts to demographics under EO 12114.
Impact Conclusion	Implementation of Alternative 1 would have no impact on demographics in U.S. territory.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no impacts to demographics under EO 12114.
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 are no impacts to demographics under EO 12114.
Impact Conclusion	Implementation of Alternative 2 would have no impact on demographics in U.S. territory.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no impacts to demographics under EO 12114.

3.15 REGIONAL ECONOMY

3.15.1 Introduction and Methods

Regional economy is assessed through the evaluation of economic factors associated with offshore naval and Marine Corps activities as indicated in Chapter 2 including industry, commercial fishing, tourism, and recreational fishing. The Study Area for assessment of the regional economy is the State of North Carolina offshore training areas as indicated in Chapter 2.

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), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), state and local governmental agencies, and local organizations, as shown in the reference section. Data was collected on commercial fisheries landings, types of fishing gear used, and fishing effort. NMFS collects data regarding national fisheries, target species, landed tonnage, and gear types.

3.15.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to the regional economy are assessed in terms of their direct effects on the local economy and related effects on other socioeconomic resources (for example, earnings, income, and transportation). 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 3.15-1 depicts aspects of the proposed action that are likely to act as stressors to the regional economy resulting from the offshore operations. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the Alternatives.

Table 3.15-1 Summary of Potential Stressors to Regional Economy Resources

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Military Expended Materials	Inert Mine Shape Deployment/Recovery
Mine Warfare (MIW)					
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)	✓	✓	✓	
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)			✓	
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10, 15, 16, 17)			✓	

Table 3.15-1 Summary of Potential Stressors to Regional Economy Resources (Continued)

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Military Expended Materials	Inert Mine Shape Deployment/Recovery
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓	✓		
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA	✓		✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA	✓	✓		
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA	✓	✓		
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)		✓		
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)				
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)				
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓	
Air Intercept Control	W-122		✓		
Electronic Combat (EC)					
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122		✓		
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	
Chaff Exercise- ship	Cherry Point OPAREA		✓	✓	
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	
Strike Warfare (STW)					
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19, 20, 21)	✓	✓	✓	
Amphibious Warfare (AMW)					
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)		✓	✓	
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)	✓	✓	✓	
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	

3.15.2 Affected Environment

3.15.2.1 Industry

The 2002 U.S. Census indicates that the greatest number of establishments in the U.S. was in the retail trade industry. The state of North Carolina reflected that trend with the retail trade industry leading the states with the greatest number of retail establishments (35,851). The commercial fishing industry was indicated in the category of "Other Services (except Public Administration)." The fishing industry is the industry most likely to be affected by the alternatives analyzed in this EIS/OEIS. Of the top ten industries for North Carolina, "Other Services" (of which fishing is a sub-section) ranked 5th with 13,826 (USCB, 2002).

The U.S. cruise industry has experienced steady growth in numbers of passengers with an average, annual growth from 1990-2007 of 7.4 percent (CLIA, 2008a). 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 cruise line and port operations. North Carolina realized a total income of $109 million in 2007 (CLIA, 2008b).

3.15.2.2 Commercial Fishing

The Mid-Atlantic Fishery Management Council is responsible for management of fisheries in federal waters off the mid-Atlantic coast. North Carolina is one of the states with voting representation on the Council[28]. The Mid-Atlantic Fishery Management Council develops Fishery Management Plans to aid in the process of managing and conserving fisheries. Fishery management practices are in effect for several fisheries and regulate both commercial and recreational fishing.

The objectives of the Fishery Management Plans vary, but are generally geared toward ensuring the long-term sustainability of the subject fish species and meeting specific management goals. Fishery Management Plans 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 Mid-Atlantic Fishery Management Council developed six Fishery Management Plans to promote the long-term health and stability of the managed fisheries (MAFMC, 2007). These Fishery Management Plans include the following fisheries:

- Atlantic mackerel, squid, and butterfish
- Bluefish
- Dogfish
- Atlantic surfclam and ocean quahog
- Summer flounder, scup, and black sea bass
- Tilefish

Additional Fishery Management Plans are in place for certain highly migratory species and are applicable in federal waters off the North Carolina coast (NMFS, 2007a):

- Atlantic Swordfish
- Atlantic Tuna
- Atlantic Sharks
- Atlantic Billfish

[28] Other members of the Council include New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. North Carolina is the only State with membership in two of the eight regional management councils.

Both the Mid-Atlantic Fishery Management Council and the South Atlantic Fishery Management Council manage fisheries in federal waters off the coast of North Carolina. The South Atlantic Fishery Management Council is headquartered in Charleston, South Carolina and currently manages the following nine fisheries, all of which apply to North Carolina and all of which have Fishery Management Plans in place.

- South Atlantic Snapper/Grouper
- Coastal Migratory Pelagics (Mackerels)
- Shrimp Fishery
- Spiny Lobster
- Golden Crab
- Coral, coral reefs, and live/hard bottom habitat
- *Sargassum*
- Dolphin/Wahoo
- Habitat

These Fishery Management Plans are in addition to, and supplemented by the Mid-Atlantic Fishery Management Council. The South Atlantic Fishery Management Council meets four times a year, once in each member state (North Carolina, South Carolina, Georgia, and East Florida to Key West). The Council is a regional representative of the fishing industry that takes input from state and federal agencies, universities and members of the public. They are advised by Advisory Panels, Stock Assessment Panels, and Scientific and Statistical Committees whose goal is the management and conservation of fish stocks within the 200 mile federal limit of the Atlantic off the coast of member states (SAFMC, 2007).

3.15.2.3 State Landings

The NMFS and State of North Carolina incorporates commercial landing data into the NMFS Statistics and Economics Division databases and State of North Carolina databases from comprehensive surveys of all coastal states landings through a system of cooperative state and federal collection systems. The data includes 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 (NMFS, 2007b). The Fisheries Statistics Division collects 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. The latest year data are available for North Carolina is 2005. 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.

Table 3.15-2 North Carolina Commercial Landings (2003-2007), All Species

Year	Pounds	Dollars
2003	139,423,516	87,112,849
2004	134,107,316	79,705,177
2005	79,628,690	64,889,275
2006	68,758,033	70,120,027
2007	62,903,307	82,284,514
TOTAL	484,820,862	384,111,842

Source: NCDMF, 2008a.

Over the five-year period ending in 2007, commercial landings ranged between a high of 139,423,516 pounds in 2003 and a low of 62,903,307 pounds in 2007 (Table 3.15-2). Over the same

period, the ten non-shellfish species that generated the most poundage of harvest were approximately 48 percent of the total annual landings. Landings of these species (Bluefish; Atlantic Croaker; Flukes and Summer Flounder; Menhaden; Striped [Liza] Mullet; Spot; Yellow Fin Tuna; Weakfish; and Sea Basses) averaged about 46,496,607 pounds annually. Shellfish comprised 39 percent of the total 96,964,172 annual average of North Carolina East Coast commercial landings, with an average 37,848,592 annual pounds during the period 2003-2007. Shellfish included in the harvest were Quahog or Bivalve Clams; Blue, Blue Peeler, Blue Soft, Florida Stone Claw, and Horseshoe Crab; Octopus; Eastern Oyster; Bay and Sea Scallop; Shellfish, Brown, Marine [other], Pink and White Shrimp; Snails (Conchs); Northern Shortfin Squid; Squid; and Snapping Turtle (NCDMF, 2008a; NMFS, 2008c).

The North Carolina annual commercial harvest experienced large fluctuations that resulted in a decrease in production and revenue from 2003-2007. Revenues dropped from $87,112,849 in 2003 to $82,284,514 in 2007. Due to large annual fluctuations in the harvest, the five-year average was 96,964,172 pounds while the five-year average revenue was $76,822,368 (NCDMF, 2008a).

The major ports that report commercial fishery landings for the state of North Carolina include: Beaufort-Morehead City, Engelhard-Swanquarter, Oriental-Vandemere, Sneads Ferry-Swansboro, and Wanchese-Stumpy Point. In 2007 Beaufort-Morehead City reported 6.6 million pounds of commercial harvest with revenue of $10.9 million. Engelhard-Swanquarter reported 6.4 million pounds of commercial harvest with a revenue of $9.5 million in 2007. Oriental-Vandemere had a 2007 commercial harvest of 4.8 million pounds and revenue of $7.9 million; Sneads Ferry-Swansboro reported 2.4 million pounds in 2007 and revenue of $5.4 million. Wanchese-Stumpy Point reported 22.4 million pounds and revenue of $20.6 million in 2007 (NMFS, 2008a).

North Carolina fish harvest in the 0-3 miles from shore in 2007 was 12,845,000 pounds ($12,118,000) and the shellfish harvest was 31,844,000 pounds ($39,101,000). The 3-200 miles from shore fish harvest was 17,592,000 pounds ($21,184,000) and the shellfish harvest was 619,000 pounds ($1,996,000). Neither fish nor shellfish had a reportable harvest on the High Seas (NMFS, 2008c).

3.15.2.4 Fishing Gear

The principal gear used to harvest fish and shellfish landed on the North Carolina coast are pots and traps, otter trawl, and gill nets. Between 2001 and 2005, almost 37 percent of the commercial harvest landed in the state was captured using pots and traps, while otter trawl and gill nets were used to capture 26 and 12 percent, respectively (Table 3.15-3).

3.15.2.5 Tourism

In 2005, 45 million visitors to North Carolina contributed $15 billion to the state economy (North Carolina Department of Commerce, 2007). Tourism is more important to Dare County than to any other county in North Carolina, with half of all jobs in the county directly dependent on tourist spending. Half of all lodging sales occur in this area in the months of June, July, and August (Palmquist *et al*., 2002). Only 5 percent of domestic visitors to the coastal regions of the state polled in a visitor profile survey cited boating or sailing as the reason for their visit, but nearly 10 percent visited to hunt or fish. Spring and summer months accounted for the highest rate of visitation to this area, with 61 percent of coastal visits occurring during this time (North Carolina Division of Tourism, Film and Sports Development, 2005).

Table 3.15-3 2003-2007 Average Annual Commercial Landings by Gear Type – North Carolina

Gear type	Revenue	Percent of Total
Pots & Traps	$24,523,665	32
Otter Trawl	21,370,484	28
Gill Nets	9,518,384	12
Hand Lines	3,757,364	5
Seines	1,729,902	2
Troll Lines	2,900,104	4
By Hand	3,757,364	5
Pound Nets	1,370,243	2
Rakes	1,346,204	2
Dredge	1,626,514	2
Tongs & Grabs	560,635	1
Bag Nets	270,495	1
Spears	187,701	1
Other Gear Types	347,139	1
Total All Gear	76,390,450	

NOTES: Numbers may not total exactly due to rounding. Source: NMFS, 2008d.

3.15.2.6 Recreational Fishing

The North Carolina Division of Marine Fisheries' *Annual Fisheries Bulleting*, *2007 Commercial and Recreational Statistics* provides the 2007 recreational fisheries harvest statistics. The recreational fishery harvest and effort statistics are received from the Marine Recreational Fisheries Statistics Survey that 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. Additionally, through surveys, the number of boat trips and catch per trip are compiled to contribute to the total catch conclusions (NCDMF, 2008b). In 2007, a total of 6,883,754 recreational trips were conducted from the beach/bank, charter boat, manmade, private boat, and headboats. There were 725,898 fishing licenses sold during 2007. Finfish harvested in 2007 totaled 301,181 pounds and shellfish totaled 131,971 pounds. The total recreational harvest was 23,052,903 pounds (NCDMF, 2008b).

Through state brochures, the state of North Carolina reports that 37 percent of the recreational anglers lived outside the state of North Carolina, 35 percent of the saltwater fishing trips were taken via private or rental boat, and 61 percent of the recreational fishing was conducted from the shore. Four percent of the saltwater fishing trips were taken by charter boat. Ten percent were in federal waters, 65 percent were in state waters, and 25 percent were inland. The top ten harvested species were (in order of greatest harvest) Spot, Bluefish, Mullet Genus, Atlantic Croaker, Spotted Seatrout, Atlantic Menhaden, Pigfish, Dolphin, Spanish Mackerel, and Southern Kingfish (NMFS, 2007b).

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 fish. Fishermen focusing on areas of bottom relief not only catch reef-associated fish, but also coastal pelagic species that may be attracted to the habitat. A detailed discussion of fishing habitat can be found in Appendix F (Essential Fish Habitat).

3.15.3 Environmental Consequences

3.15.3.1 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.

3.15.3.2 Alternative 1

The assessment of impacts to industry, commercial fishing, fishing gear, tourism, or recreational fishing with implementation of Alternative 1 is similar as those described in Section 3.15.3.1. The proposal to increase Commercial Air Services Support for Fleet Opposition Force and Electronic Warfare Threat Training, conduct Maritime Security Surface Strike Group Training, conduct the MH-60R/S training missions, introduce organic mine countermeasures, the airborne mine neutralization system, the rapid airborne mine clearance system, the organic airborne and surface influence sweep, the airborne laser mine detection system, AN/AQS-20A, and MAEWR in the Navy Cherry Point Range Complex, would result in a very small increase of helicopter sorties (7 percent), a 5.5 percent increase in steaming days, a 10 percent increase in fixed-wing overflights, a 22 percent increase in mine warfare devices towed through water by helicopters, and the introduction of temporary mine shapes. Minor increases in military expended materials are proposed under Alternative 1 (see Table 2.2-5).

The increase of operations is not anticipated to result in impacts to the regional economy as the operations would occur in areas where current military training exists and commercial and recreational activities are already restricted or notified of naval activity before the activity takes place. If the Navy selected Alternative 1 for implementation, naval activities in U.S. territory would have no impact to the regional economy under Alternative 1. Navy activities in non-territorial waters would not cause harm to the regional economy under Alternative 1.

3.15.3.3 Alternative 2 (Preferred Alternative)

The assessment of impacts to industry, commercial fishing, fishing gear, tourism, or recreational fishing with implementation of Alternative 2 is the same as those described in Sections 3.15.3.1 and 3.15.3.2. The proposed action in Alternative 2 is similar to that of Alternative 1, except for increased Mine Warfare (MIW) training in the MIW Training Area to be established in Onslow Bay (Figure 2.2-2).

This increase is not anticipated to result in impacts to the regional economy as it will occur in areas where current military training exists and commercial and recreational activities are already restricted. Increases in training activities would result in temporary disruptions to civilian activities in the Study Area; however, this type of temporary disruption is included in the discussion of the No Action Alternative as this region has been a Marine Forces Atlantic concentration area since World War II (see Section 2.2.7.1 for more extensive discussion). Section 3.18 provides an extensive discussion of the scheduling system requirements and communication procedures for the range complex that provides for interactive, real-time information. The information would minimize most conflicts among users of the area and ensures close coordination between military and civilian users of the area. With this information, civilian users could then use alternative areas reducing economic impacts, if any.

This increase results in a 75 percent increase in helicopter operations from that proposed in the No Action Alternative. Fixed wing overflights are proposed to increase 12 percent over that proposed in the No Action Alternative and a 267 percent increase in temporary mine warfare devices towed through water by helicopters over that proposed in the No Action Alternative would be expected. Military expended materials will increase slightly more than was proposed under Alternative 1 (see Table 2.2-5).

The proposed location for the use of temporary mine warfare devices was, in part, selected upon the avoidance of shipping lanes, popular dive, shipwrecks, and recreational fishing sites. If the range were to be in conflict with civilian activities, training would be cancelled or delayed until the range is clear.

Navy activities in U.S. territory would have no impact to regional economy under Alternative 2. Navy activities in non-territorial waters would not cause harm to the regional economy under Alternative 2.

3.15.4 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 the regional economy.

3.15.5 Summary of Environmental Impacts (NEPA and EO 12114)

Table 3.15-4 shows a summary of the environmental impacts of the alternatives on the regional economy. Navy activities in territorial waters would have no impact to regional economy under the No Action Alternative, Alternative 1, or Alternative 2. Navy activities in non-territorial waters would not cause harm to the regional economy under the No Action Alternative, Alternative 1, or Alternative 2.

Table 3.15-4 Summary of Environmental Effects of the Alternatives on the Regional Economy in the Navy Cherry Point Range Complex

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movement (Disturbance)	Mine warfare, surface warfare, air warfare, electronic combat, strike warfare, and amphibious warfare currently conducted in the Range Complex would remain.	Mine warfare, surface warfare, air warfare, electronic combat, strike warfare, and amphibious warfare currently conducted in the Range Complex would remain.
Aircraft Overflights (Disturbance)		
Military Expended Materials		
Mine Warfare Deployment/Recovery		
Impact Conclusion	Implementation of the No Action Alternative would have no impact on the regional economy in territorial waters.	Implementation of the No Action Alternative would not cause harm to the regional economy in non-territorial waters.
Alternative 1		
Vessel Movement (Disturbance)	Mine warfare, surface warfare, air warfare, electronic combat, strike warfare, and amphibious warfare currently conducted in the Range Complex would remain. There would be an increase of operations and military expended materials as well as the introduction of temporary mine shape deployment and recovery.	Mine warfare, surface warfare, air warfare, electronic combat, strike warfare, and amphibious warfare currently conducted in the Range Complex would remain. There would be an increase of operations and military expended materials as well as the introduction of temporary mine shape deployment and recovery.
Aircraft Overflights (Disturbance)		
Military Expended Materials		
Mine Warfare Deployment/Recovery		
Impact Conclusion	Implementation of the Alternative 1 would have no impact on the regional economy in territorial waters.	Implementation of the Alternative 1 would not cause harm to the regional economy in non-territorial waters.

Table 3.15-4 Summary of Environmental Effects of the Alternatives on the Regional Economy in the Navy Cherry Point Range Complex (Continued)

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel Movement (Disturbance)	Mine warfare, surface warfare, air warfare, electronic combat, strike warfare, and amphibious warfare currently conducted in the Range Complex would remain. There would be an increase of operations and military expended materials as well as the introduction of temporary mine shape deployment and recovery. Designation of a mine warfare training area in the Cherry Point OPAREA and nearshore waters of Onslow Bay would occur.	Mine warfare, surface warfare, air warfare, electronic combat, strike warfare, and amphibious warfare currently conducted in the Range Complex would remain. There would be an increase of operations and military expended materials as well as the introduction of temporary mine shape deployment and recovery. Designation of a mine warfare training area in the Cherry Point OPAREA and nearshore waters of Onslow Bay would occur.
Aircraft Overflights (Disturbance)		
Military Expended Materials		
Mine Warfare Deployment/Recovery		
Impact Conclusion	Implementation of the Alternative 2 would have no impact on the regional economy in U.S. territory.	Implementation of the Alternative 2 would not cause harm to the regional economy in non-territorial waters.

3.16 RECREATION

3.16.1 Introduction and Methods

The recreation section refers to non-commercial activities that occur in the Study Area. Commercial recreation activities are addressed in the regional economy section of this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). Offshore areas of the east coast are in use by both military and civilian interests. These activities are compatible with Navy ships, accounting for three percent of the total ship presence out to 200 nautical miles (nm) (CNA, 2001). Where naval vessels and aircraft are conducting operations that are not compatible (*e.g.,* hazardous weapons firing), they are confined to operating areas (OPAREA) away from shipping lanes and inside Special Use Airspace (SUA). Hazardous operations are communicated to all vessels and operators by use of Notices to Mariners (NOTMAR), issued by the United States Coast Guard (USCG), and Notices to Airmen (NOTAMs), 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 https://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 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, and divers in advance of ongoing military activities that may temporarily relocate civilian/recreational activities. To minimize potential military/civilian interactions, the Navy will continue to publish NOTMARs on a weekly basis (DoN, 2006).

3.16.1.1 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.

3.16.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to recreation are assessed in terms of anticipated levels of disruption or improvement of current levels of access to recreational areas. Table 3.16-1 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 3.16-1 Summary of Potential Stressors to Recreation Resources

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Military Expended Materials	Inert Mine Shape Deployment/Recovery
Mine Warfare (MIW)					
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North	✓	✓	✓	✓
Mine Neutralization	Onslow Bay UNDET Area	✓	✓	✓	✓
Surface Warfare (SUW)					
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)	✓	✓	✓	
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)			✓	
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10,, 15, 16, 17)			✓	
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓	✓		
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA	✓		✓	
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA	✓	✓		
MSO to include VBSS/MIO- Helo	Cherry Point OPAREA	✓	✓		
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)		✓		
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)				
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)				
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓	✓	
Air Intercept Control	W-122		✓		
Electronic Combat (EC)					
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122		✓		
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	
Chaff Exercise- ship	Cherry Point OPAREA		✓	✓	
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)		✓	✓	
Strike Warfare (STW)					
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Areas 18, 19,20, 21)	✓	✓	✓	

Table 3.16-1 Summary of Potential Stressors to Recreation (Continued)

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Military Expended Materials	Inert Mine Shape Deployment/Recovery
Amphibious Warfare (AMW)					
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)		✓	✓	
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)	✓	✓	✓	
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓	✓	

3.16.2 Affected Environment

The Navy Cherry Point Study Area does not include land; therefore, all civilian recreational activities in the Study Area are conducted from boats. The most common activities include fishing, diving, whale watching, sailing, and cruising. In 2005, 7.8 million residents participated in marine recreational fishing in the Atlantic Ocean (NMFS, 2007a). These visitors took more than 52 million trips and caught a total of almost 243 million fish. Of that total, approximately 13 percent came from the Study Area for the Navy Cherry Point EIS/OEIS. Almost 30 percent of the total Atlantic catch came on saltwater trips that fished primarily in the state territorial seas, and 60 percent came on trips that fished primarily in inland waters (this is an estimate that does not include the High Sea). In 2007, a total of 6,883,754 recreational trips were conducted from the beach/bank, charter boat, manmade, private boat, and headboats. (NCDMF, 2008).

Recreational Boating and Diving. Offshore recreational activities comprise game and sport fishing, charter boat fishing, sport diving, whale watching, sailing, power cruising, and other recreational boating activities. North Carolina ranks 11th in the nation for the number of recreational boats registered in the state (USCG, 2005), with 362,784 boats registered (NMMA, 2007). Recreational boats range throughout the North Carolina coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations in the Study Area does not require traversing the Navy Cherry Point Range Complex; however, larger recreational vessels such as sailboats and motor cruisers in the 50-foot and larger class may travel considerable distances offshore. In particular, sailboats in the 75-foot and larger class, and cruising vessels transiting ocean passages (*e.g.,* from some North Carolina ports to the Bahamas or Bermuda), might favor courses through the vicinity of the Navy

Cherry Point Range Complex. Registered boats of 25 feet or greater, however, represent less than 1 percent of total U.S. recreational boats (NMMA, 2007).

Shipwrecks provide habitat suitable for development of artificial reefs, and are popular destinations for divers. Within the Navy Cherry Point Range Complex, about 89 shipwrecks are located offshore of North Carolina (Veridian, 2001).

Recreational Fishing. Table 3.16-2 provides North Carolina fish catch recreational landings for years 2002-2006.

Table 3.16-2 North Carolina Recreational Landings & Trip Estimates

YEAR	Number Harvested	Pounds Harvested	Number Released	Beach/Bank	Boat[1]
2003	13,179,590	22,009,304	14,052,622	2,102,022	4,631,442
2004	14,313,977	25,351,659	18,211,838	2,195,631	4,831,487
2005	12,738,334	22,077,464	16,027,278	2,148,335	4,586,941
2006	11,955,977	24,877,848	20,683,498	2,227,317	4,958,464
2007	14,683,722	23,052,903	19,714,623	1,984,484	4,819,518

Notes:

1. *Boat includes charter, manmade and private. Headboat estimates were not available for all years; therefore were excluded from this report.*

Source: NCDMF, 2008.

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. None of the top ten United States ports are in the Study Area for this EIS/OEIS; the largest of the ports are in Florida, California, or New York. The top ten embarkation points in the United States in 2007 were Miami, Port Canaveral, Port Everglades, Galveston, Los Angeles, New York, Tampa, Long Beach, Seattle, and Honolulu (CLIA, 2008b). In 2007, 54.3 percent of the North American cruise passengers lived in Florida, California, Texas, New York, Massachusetts, and Pennsylvania. North Carolina ranked 12th in the nation for annual passengers which were 2.14 percent (218,785) of the national total (CLIA, 2008a).

3.16.3 Environmental Consequences

The recreational resource analysis addresses recreational activities in the Navy Cherry Point Range Complex. The principal issue is the potential for existing or proposed military ocean or air activities to affect existing recreational activities. Impacts on recreational activities are assessed with respect to the potential for disruption 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 Navy Cherry Point Range Complex; however, the need to use alternative recreational areas during the time of the temporary exclusion does not constitute a serious disruption.

3.16.3.1 No Action Alternative

Civilian recreational activities conducted in the Cherry Point OPAREA include sport fishing/diving, sailing, and other tourist-related activities. Restrictions of civilian ocean and air traffic are minimized by temporary clearance procedures for safety purposes that do not adversely affect these recreational

activities because restriction from these areas is temporary. The Navy has performed military operations in this region in the past and has not precluded fishing or recreational use in the Cherry Point OPAREA, even during peak fishing seasons.

Vessel Movements. Conflicts between civilian and military vessels 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. Approximately 30 percent (1,685,122) of recreational angler trips occur within a few miles of shore, and approximately 72 percent (4,435,452) of angler trips occur in the vicinity of the Cherry Point OPAREA (NMFS, 2007b). Recreational boaters and divers' activities tend to occur closer to the shore although larger vessels do travel in the vicinity of the Cherry Point OPAREA. These activities are compatible. Navy ships account for three percent of the total ship presence out to 200 nm (CNA, 2001). Operational activities are required to avoid recreational boaters in the range.

Aircraft Overflights. Aircraft overflights and their associated training activities are confined to designated special use airspace designed for that purpose. Training operations are communicated to the public by use of NOTAMs Navy aircraft training activities are typically at altitudes over 10,000 feet in specified areas within the Study Area. Most recreational activities are fairly close to shore and would not be disturbed by aircraft presence or noise.

Military Expended Materials. Military expended materials interfering with recreational activities that are currently conducted in the Study Area would remain and continue to have no impact upon the 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).

Mine Warfare Deployment/Recovery. Mine warfare deployment/recovery impacts to 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 upon the recreational activity in the Study Area. These exercises are limited in nature and occur in the Cherry Point OPAREA (15B) and the nearshore waters in Onslow Bay. This training only occurs during major exercises and comprises a few helicopter mine hunting and sweeping events or as a tabletop exercise.

The No Action Alternative does not have an impact on recreational activities as they are currently executed because the Navy's policy of avoidance ensures that conflicts between military and recreational activities are minimized. Navy activities in U.S. territory would have no impact on recreational interests under the No Action Alternative. Navy activities in non-territorial waters would not cause harm to recreational interests under the No Action Alternative.

3.16.3.2 Alternative 1

The proposed increase in training operations, force structure changes, and enhanced range capabilities related to sea and ocean space (as detailed in Chapter 2) do not impact use of the Navy Cherry Point Range Complex in areas analyzed in this EIS/OEIS. The assessment of impacts to recreation with implementation of Alternative 1 is the same as those described in Section 3.16.3.1. The increase of operations 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. If the Navy selected Alternative 1 for implementation, naval activities in U.S. territory would have no impact to recreation under Alternative 1. Navy activities in non-territorial waters would not cause harm to the recreation under Alternative 1.

3.16.3.3 Alternative 2 (Preferred Alternative)

The impacts to recreation under Alternative 2 is similar to those in the No Action Alternative and Alternative 1 with the following exceptions: high explosive bombs would not be used under this

alternative; there would be an increase in Non-explosive Practice Munitions; there would be an increase in Mine Warfare training in Onslow Bay due to the establishment of the Mine Warfare Training Area (Figure 2.2-1).

These increases are not anticipated to result in impacts to recreation in the Study Area as it will occur in areas where current military training exists and commercial and recreational activities are already restricted. Navy activities in U.S. territory would have no impact to recreation under Alternative 2. Navy activities in non-territorial waters would not cause harm to recreation under Alternative 2.

3.16.4 Unavoidable Significant Environmental Impacts

This analysis has determined that there would be 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 Impacts (NEPA and EO 12114)

As summarized in Table 3.16-3 the environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 on recreation would have no impact and would not cause harm. Navy activities in U.S. territory would have no 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 3.16-3 Summary of Environmental Effects of the Alternatives on Recreation in the Navy Cherry Point Range Complex

Alternative and Stressor	NEPA (U.S. Territory)	EO 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 Cherry Point OPAREA, 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 Cherry Point OPAREA, 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		
Inert Mine Shape Deployment/Recovery		
Impact Conclusion	Implementation of the No Action Alternative would have no impact on the recreation in U.S. territory.	Implementation of the No Action Alternative would not cause harm to the recreation in non-territorial waters.
Alternative 1		
Vessel Movements	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 OPAREA.	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 OPAREA.
Aircraft Overflights		
Military Expended Materials		
Inert Mine Shape Deployment/Recovery		
Impact Conclusion	Implementation of Alternative 1 would have no impact on the recreation in U.S. territory.	Implementation of Alternative 1 would not cause harm to the recreation in non-territorial waters.
Alternative 2		
Vessel Movements	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 OPAREA.	Mine warfare, surface warfare, air warfare, electronic combat, strike warfare, and amphibious warfare currently conducted in the Range Complex would remain.
Aircraft Overflights		
Military Expended Materials		
Inert Mine Shape Deployment/Recovery		
Impact Conclusion	Implementation of Alternative 2 would have no impact on the recreation in U.S. territory.	Implementation of Alternative 2 would not cause harm to the recreation in non-territorial waters.

3.17 ENVIRONMENTAL JUSTICE

3.17.1 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 United States Environmental Protection Agency (USEPA) and Council on Environmental Quality (CEQ) emphasize the importance of incorporating environmental justice review in the analyses conducted by federal agencies under the National Environmental Policy Act (NEPA) of 1969 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 Environmental Impact Statement/Overseas Environmental Impact Statement (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 (23 September 2004). This policy provides instructions for naval personnel to identify and assess stressors to and disproportionately high and adverse impacts upon 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.

3.17.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the U.S. Census Bureau and state and local governmental agencies and local organizations, as shown in Chapter 7 (References) 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 resulted 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.

3.17.1.2 Warfare Areas and Associated Environmental Stressors

The CEQ's Environmental Justice Guidance under NEPA identifies factors that are 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 will be an effect on the natural or physical environment that adversely affects a minority population, low-income population, or Indian tribe. Such impacts may include ecological, cultural, human health, economic, or social impacts when those impacts are interrelated to impacts to the natural or physical environment. Other factors to be considered if adverse impacts are projected include: (1) whether they will appreciably exceed those same impacts to the general population or other appropriate comparison group, and (2) whether these populations have been 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 EIS 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.

3.17.2 Affected Environment

The affected environment is primarily open water and the State of North Carolina. Populations that could be impacted would be fisherman and recreational users of the open water areas who are most likely to live in the coastal areas adjacent to the proposed action. The average number of children under the age of five is seven percent, which is consistent with the United States which reports that 6.8 percent of the total population is under the age of five. The North Carolina poverty level is 13.8 percent which is consistent with the United States 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 32.4 percent of the North Carolina total population which is consistent with the United States total of 34.2. North Carolina's educational attainment of High School and Bachelor's degrees was approximately four percent lower than that of the United States[29]. The major industry in North Carolina is retail trade and fishing is ranked fifth in the top ten industries in the State.

3.17.3 Environmental Consequences

Environmental impacts related to Environmental Justice or Protection of Children could occur if they would disproportionately affect minorities, low-income populations, or children.

3.17.3.1 No Action Alternative

The No Action Alternative would comprise the continuation of current Navy and Marine Corps training. Because current operations 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 industry in North Carolina ranks fifth in the State and is 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. Navy

[29] North Carolina reported 78.1 percent of the population attained a high school diploma and 22.5 percent of the population attained Bachelor's degrees. The United States reported 80.4 percent of the population attained a high school diploma and 24.4 percent of the population attained Bachelor's degrees (USCB, 2007).

activities in U.S. territory would have no impact upon environmental justice under the No Action Alternative. Likewise, Navy activities in non-territorial waters would not cause harm to environmental justice under the No Action Alternative.

3.17.3.2 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.

3.17.3.3 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.

3.17.4 Unavoidable Significant Environmental Effects

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.

3.17.5 Summary of Environmental Effects (NEPA and EO 12114)

Table 3.17-1 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 actions 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 actions 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 3.17-1 Summary of Environmental Effects of the Alternatives in the Navy Cherry Point 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 the environmental justice or protection of children within the Study Area.	Implementation of the No Action Alternative would not cause harm to the 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 the environmental justice or protection of children within the Study Area.	Implementation of Alternative 1 would not cause harm to the 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 the environmental justice or protection of children within the Study Area.	Implementation of Alternative 2 would not cause harm to the environmental justice or protection of children within the Study Area.

3.18 PUBLIC HEALTH AND SAFETY

3.18.1 Introduction and Methods

Public health and safety issues include potential hazards inherent in vessel movements, flight operations, mine warfare, munitions use, firing of weapons, underwater detonations, and expended materials. The Navy and Marine Corps observe every possible precaution in the planning and execution of all training activities to prevent injury to people.

3.18.1.1 Assessment Methods and Data Used

All current and proposed training operations were examined for the possibility of civilians or uninvolved military personnel being placed in a hazardous environment associated with Navy and Marine Corps training that could cause personal injury. Current Navy and Marine Corps safety procedures were assessed for their protection of the public from the hazardous training operations proposed in the alternatives.

3.18.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to public health and safety were assessed based on the potential for Navy and Marine Corps training operations to injure or otherwise harm civilians or uninvolved military personnel. Impacts could result from physical injury caused directly by hazardous operations, or as an indirect result of materials expended from a training event.

Stressors that potentially could impact public health and safety are identified in Table 3.18-1. These include disturbance from and collisions with surface and subsurface ships; noise and strikes associated with aircraft use; mine warfare training activities, including the deployment and recovery of mine shapes; the use of non-explosive practice munitions (NEPM); the use of bombs, missiles, and other explosive ordnance; and the release of military expended material (MEM).

Electromagnetic radiation (EMR) is produced by radar, navigational aids, and electronic warfare (EW) systems. Lasers, which are used in range-finding and targeting systems, have the potential to damage living tissue, particularly in the eye. Exposure is not a concern due to the specific guidelines that are in place to avoid potential public health and safety impacts from lasers and EMR.

Amplification on some of the effects that relate to public health and safety is provided in other sections of this chapter as follows:

- Hazardous materials and hazardous wastes, including military expended materials, are addressed in Section 3.2;
- Water quality impacts are considered in Section 3.3;
- Effects on air quality are evaluated in Section 3.4; and
- Noise that is transmitted through the air is evaluated in Section 3.5.

3.18.2 Affected Environment

Military, commercial, institutional, and recreational activities take place in the Navy Cherry Point Study Area. Although the Federal Aviation Administration (FAA) established warning areas for military aircraft operations, most of the airspace and seaspace in the range complex is available for use by all civilian and military users. Only hazardous activities require exclusive use of an area, and periods of these activities are scheduled in advance by the Navy and broadcast through U.S. Coast Guard (USCG) notices to mariners (NOTMAR) and FAA notices to airmen (NOTAM).

The public typically accesses the offshore ocean areas within the study area for recreational purposes such as sport fishing, sailing, boating, and diving. In addition, substantial numbers of civilians are on

the water within the range complex as they engage in activities such as commercial fishing or shipping to and from major ports.

As described below, the Navy has standard operating procedures (SOP) in place to ensure public health and safety, regardless of whether operations are occurring in U.S. territorial waters or international waters. In addition to the preventive measures described below, during all training events or exercises, weapons delivery events are delayed or cancelled if range areas are not clear. Prior to issuing a "Green Range," Navy personnel must ensure that the hazard footprint of the ordnance being fired is clear of non-participating surface vessels, divers, and aircraft.

Table 3.18-1 Summary of Potential Stressors to Public Health and Safety[30]

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Towed Mine Warfare (MIW) Devices	Inert Mine Shape Deployment/Recovery	Weapons Firing/ Non-explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Materials
Mine Warfare (MIW)								
Mine Countermeasures Exercise (MCM)	Onslow Bay MIW Training Area and CVOA North		✓	✓	✓	✓		
Mine Neutralization	Onslow Bay UNDET Area	✓			✓	✓	✓	✓
Surface Warfare (SUW)								
Bombing Exercise (BOMBEX A-S))	W-122 (Area 18)		✓			✓	✓	✓
Missile Exercise (MISSILEX) (Air-to-Surface)	W-122 (Area 16 and 17)		✓			✓	✓	✓
Gunnery Exercise (GUNEX) (Air-to-Surface)	W-122 (Area 1, 2, 3, 8, 9, 10,, 15, 16, 17)		✓			✓	✓	✓
GUNEX (Surface-to-Surface) Ship	Cherry Point OPAREA	✓				✓	✓	✓
GUNEX (Surface-to-Surface) USMC small arms training	Cherry Point OPAREA	✓				✓	✓	✓
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Cherry Point OPAREA	✓						
MSO to include VBSS/MIO-Helo	Cherry Point OPAREA	✓	✓					
Air Warfare (AW)								
Air Combat Maneuver (ACM)	W-122 (Areas 1, 8, 15, & 16)		✓					
GUNEX (Air-to-Air)	W-122 (Areas 9, 10, 11, & 12)		✓			✓		✓

[30] For detailed information on the numbers and types of ordnance, specific weapons platforms, types of targets used and location of operations, see Table 2.2-4 and Appendix D.

Table 3.18-1 Summary of Potential Stressors to Public Health and Safety (Continued)

Warfare Area and Operation	Training Area(s)	Vessel Movements	Aircraft Overflights	Towed Mine Warfare (MIW) Devices	Inert Mine Shape Deployment/Recovery	Weapons Firing/ Non-explosive Ordnance Use	Underwater Detonations and Explosive Ordnance	Military Expended Materials
Air Warfare (AW) (Continued)								
MISSILEX (Air-to-Air)	W-122 (Areas 1, 2, 3, 8, 9, 10, 11, 12, 15, 16, & 17)		✓			✓	✓	✓
MISSILEX (Surface-to-Air)	Cherry Point OPAREA	✓	✓					✓
Air Intercept Control	W-122		✓					
Electronic Combat (EC)								
Electronic Combat Operations (EC OPS)	Cherry Point OPAREA and W-122	✓	✓					
Chaff Exercise- aircraft	W-122 (mostly Areas 1, 8, 15, &16)		✓					✓
Chaff Exercise- ship	Cherry Point OPAREA	✓						✓
Flare Exercise	W-122 (mostly Areas 1, 8, 15, &16)		✓					✓
Strike Warfare (STW)								
HARM Missile Exercise (HARMEX) (Air-to-Surface)	W-122 (Area 18, 19, 20, 21)		✓			✓	✓	✓
Amphibious Warfare								
Firing Exercise (FIREX) (Land)	Firing point: Cherry Point OPAREA (Area 15B) Impact area: MCB Camp Lejeune (Area G-10)					✓	✓	✓
FIREX –Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Cherry Point OPAREA (Area 4/5, 13/14)	✓				✓	✓	✓
Amphibious Assaults	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓					✓
Amphibious Raids	Onslow Bay (Area 15B and littoral area between there and Onslow Beach)	✓	✓					✓

3.18.2.1 Cherry Point OPAREA Sea Space and Associated Special Use Airspace

The Cherry Point OPAREA sea space covers 18,617 nm^2 and lies off the east coast of North and South Carolina. The OPAREA is separated into 23 surface areas that begin 3 nm from the shoreline and extend seaward 103 nm (Figure 2.1-1). Areas 2 through 7 and 11 through 14 are primary areas designated for surface ship operations.

W-122 is associated with this sea space and roughly follows the same outline as the OPAREA (Figure 2.1-1). The dimensions of W-122 are approximately 185 nm (north-south) and 100 nm (east-west). W-122 is also divided into 23 air areas that go from the surface to unlimited altitude in most of the air areas, and correspond to the surface areas. Air areas 1, 8, and 15 are concurrent use only, where

participating aircraft share the airspace with commercial traffic and are not given exclusive use of the airspace. The WHISKEY and X-RAY corridors are established to provide routing/clearance limits for aircraft arriving or departing W-122 airspace (Figure 3.13-1).

3.18.2.2 Undersea Space

Undersea space lies directly below the surface OPAREA, but submarine operations are normally conducted in the subsurface areas of surface area 7, Submarine Operating Area (SUBOA) SIERRA.

3.18.2.3 Land Area and Associated Special Use Airspace

There is no land area in the Navy Cherry Point Range Complex.

3.18.2.4 Other Special Use Airspace

No other special use airspace (SUA) is located in the Navy Cherry Point Range Complex.

3.18.2.5 Range Safety Procedures

General Safety Procedures

All Navy range safety precautions and regulations (e.g. CINCLANTFLT Instruction 3120.26) apply in the Cherry Point OPAREA.

FACSFAC Virginia Capes (VACAPES), located at Naval Air Station (NAS) Oceana, is the principal controlling authority for the Navy Cherry Point Range Complex. FACSFAC VACAPES controls SUA, which consists of warning areas and restricted areas, military operating areas (MOA), air traffic control assigned airspace (ATCAA), and surface/subsurface operating areas. FACSFAC VACAPES imposes additional safety requirements, which may be waived by the FACSFAC VACAPES Commanding Officer (CO), as the situation dictates.

The following general rules apply to area clearances within Navy Cherry Point Range Complex:

- Dropping any ordnance, (NEPM or HE) is considered a hazardous event. All hazardous or exclusive operations and exercises conducted require clearance from FACSFAC VACAPES.
- The firing or dropping of ordnance must be scheduled with FACSFAC VACAPES. Firing exercises are not authorized without prior FACSFAC VACAPES approval.
- Small arms (munitions .50 caliber and under) qualifications on ships do not require FACSFAC VACAPES approval. The unit conducting small arms fire is responsible for clearing its area.
- Non-hazardous/concurrent air, surface, and subsurface operations, such as Independent Steaming Exercise transits, navigation drills, Deck Landing Qualifications, and helicopter operations do not require a specific clearance/message request.
- Flare drops are considered a non-hazardous event, but all airborne/surface units must contact FACSFAC VACAPES prior to dropping flares to prevent errant search-and-rescue reporting.
- Range safety procedures for other ranges and training facilities are documented in the respective range manuals and instructions for each range.

Range Inspection Procedures

Within the Cherry Point OPAREA and warning areas, all units conducting firing or other hazardous activity must comply Navy regulations (Section 8, Chapter 1 of CINCLANTFLTINST 3120.26) and all Fleet exercise publications. FACSFAC VACAPES promulgates NOTAMs and NOTMARs as applicable. The officer conducting the exercise (OCE) may not authorize firing or jettisoning of aerial targets unless the area is confirmed to be clear of nonparticipating civilian and military units.

Scheduling Authority

The scheduling authority for aviation operations and hazardous surface and subsurface events within the Navy Cherry Point Range Complex is FACSFAC VACAPES.

Staffing

Typical personnel staffing of FACSFAC VACAPES consists of:

- Nine officers, 138 enlisted naval personnel, and five civilians. This workforce supports multiple missions, including management of VACAPES Range Complex training areas assigned to FACSFAC VACAPES.
- Five contractors staffing the Atlantic Fleet Exercise Coordination Center (AFECC).
- Three contractors staffing the commercial air services group.
- Four contractors supporting the FACSFAC scheduling software.

3.18.3 Range Management Procedures

3.18.3.1 Range Control Procedures

The following is a brief synopsis of procedures that must be followed to safely operate in the Cherry Point range complex. Official Navy regulations (FACSFACVACAPESINST 3120.1) provide much more specific procedures and guidelines. Range users must be knowledgeable of current procedures and should coordinate with FACSFAC VACAPES for procedures in effect before using the range.

All units operating within this range complex are required to maintain positive two-way radio communications with FACSFAC VACAPES on its primary HF and Link Coordination circuits, and Fleet Satellite High Communications (SATHICOM). Upon clearance, units may conduct operations, both tactical and live-fire, at the discretion of the CO and without positive control from FACSFAC VACAPES.

Two-way Air-to-Ground (A-G) radios, both high frequency (HF) and Link Coordination radios, provide the primary communications link between the FACSFAC VACAPES and range participants. There are two primary and one secondary HF radio frequencies. A two-way point-to-point frequency is used to communicate aircraft-to-aircraft for deconfliction purposes.

3.18.3.2 Airspace Controlling Procedures

As a designated Air Traffic Control (ATC) facility, FACSFAC VACAPES is required to provide air traffic separation consistent with FAA guidelines to ensure the safe, efficient, and expeditious flow of air traffic. Radar surveillance and radio communications provide ATC separation between high performance military aircraft and the high volume of commercial aircraft transiting the numerous jet routes off the east coast.

3.18.3.3 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 clearance for all hazardous or exclusive operations. Commander, Submarine Force, U.S. Atlantic Fleet (COMSUBLANT) is the Submarine exercise Area Coordinator (SEAC) for the Submarine Operating area (SUBOA).

3.18.3.4 Range Scheduling Procedures

Requests to schedule the airspace, surface and subsurface training areas, and hazardous events (those involving firing or dropping ordnance) are coordinated directly with FACSFAC VACAPES. Requests for training must be received by FACSFAC VACAPES via Naval Message Format, phone, fax or e-mail, the week prior to the week in which the event is requested. The FACSFAC VACAPES operations

schedule is published weekly, and lists assigned radio frequencies and area assignment times for events controlled by FACSFAC VACAPES or which involve commercial aircraft. Full and specific guidelines, procedures, and restrictions are provided in official Navy regulations (FACSFAC VACAPES Instruction 3120.1 Series).

3.18.3.5 Range Coordination Procedures

Close coordination between military and civilian air traffic control facility (ATCF) enables effective real-time shared use of the warning areas. Under this procedure, regardless of the schedule for the use of a military warning area, civilian aircraft may use warning area airspace until a military aircraft is actually enroute to that area. It is the responsibility of FACSFAC VACAPES to ensure civilian air carrier transit of the SUA is deconflicted with military training use of the airspace. All necessary procedures are thoroughly described in official Navy regulations (FACSFACVACAPESINST 3120.1J).

AFECC coordinates schedules for W-122, Cherry Point Operating Area, R-5306A/C, BT-9 and 11, NEUSE ATCAA, and HATTERAS "F" MOA.

3.18.3.6 Links to Other Ranges

FACSFAC VACAPES for the Navy Cherry Point Range Complex maintains several agreements with the Marine Corps Air Station (MCAS) Cherry Point Range Complex, as well as the Marine Corps Base (MCB) Camp Lejeune Range Complex. All three of these range complexes are in proximity to each other and must work closely together to achieve the required close coordination to execute operations. The VACAPES Range Complex to the north, especially Navy and Air Force Dare County Bombing Ranges, may be used in conjunction with operations within the Navy Cherry Point Range Complex, and some operations may extend south into the Jacksonville Range Complex or other Service ranges.

Terminal control of aircraft transiting and operating in, out, and between each of the training areas adds another layer of close coordination between air control authorities.

3.18.4 Scheduling

The Navy Ranges Required Capabilities Document (RCD) (DoN, 2006) specifies that the scheduling system for a range complex allow potential users access to an interactive system with a web-enabled database of descriptive range resource information for the entire Navy Range infrastructure and the ability to schedule required range periods remotely at least two weeks in advance. This scheduling system should also be interfaced with the training requirements for aircraft, surface and subsurface combatants, ground, and support forces.

- A pre-event module should identify available ranges that possess the specific resources required to support the required training event, identify competing requests for the same range, generate a confirmation to advise the requesting unit that the event is scheduled or unavailable and whether required resources are available or not, and be flexible to late cancellations that may make the range available to other users that are automatically notified.
- A real time event module should allow the range controller to enter all event-related data.
- A post event module should generate a post event completion report to the user that includes data collected by each module and automatically generate a single Navy-wide standardized range utilization report.

FACSFAC VACAPES utilizes the Navy Scheduling System (NAVSKED) computer system for scheduling. The current NAVSKED program:

- Schedules via military message, fax, or e-mail;
- Provides conflict analysis allowing schedulers to organize and prioritize requests;

- Generates an updated daily, weekly, bi-weekly, or modified schedule in the form of a military message that is electronically distributed to all users; and
- Provides various report processing.

The Training Range Information Management System (TRIMS) is also used to collect, store, and provide internet accessible additional information that documents range usage. This information includes dates, times, range name, unit name, type of unit (aircraft/ship), number of sorties, and type and quantity of ordnance.

3.18.5 Communications

3.18.5.1 Exercise Control and Coordination (EC&C) Circuits

Exercise Control and Coordination (EC&C) circuits provide two-way communications among Range Operations (RO) personnel. Most EC&C communication is done by telephone or e-mail.

3.18.5.2 Operational Communication Circuits

Operational Communication circuits provide encrypted and unencrypted two-way voice communications between range personnel and range event participants.

Two-way radio communications equipment includes both HF and Fleet Satellite High Communications (SATHICOM) radios. There are two primary HF radio frequencies and one secondary HF radio frequency, in addition to the SATHICOM frequency.

Identification Friend or Foe (IFF), normally used in conjunction with radar systems, provides an easy method to receive an identification signal from a range user, thereby providing a more exact location for safety and later debrief of operations.

3.18.5.3 Datalink Circuits

Datalink circuits provide encrypted and unencrypted two-way data communications between range personnel and range event participants, and may also support communications between or among range systems.

Link-11 and Link-16 are available to support this requirement. Link-16, a generation beyond Link-11, provides a secure, jam-resistant, high capacity data link communications system for command, control, and intelligence, and critical joint interpretability and situation awareness information. Link-16 is DoD's primary tactical data link for command, control, and intelligence, providing critical joint interpretability and situation awareness information.

3.18.6 Environmental Consequences

Public safety impacts are considered significant if the general public is substantially endangered as a result of Navy activities on the ranges. 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 range activities. Activities in the Navy Cherry Point Range Complex would be conducted in accordance with Navy regulations (FACSFAC VACAPES Instruction 3120). 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, ownership, access control, scheduling, public notification of events, frequency of events, duration of events, range safety procedures, operational control of training events, and safety history.

3.18.6.1 No Action Alternative

Public Safety

Under the No Action Alternative, training activities would continue to be conducted in the Cherry Point 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 high-explosive, wholly inert, and non-explosive practice munitions.

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 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 (for example, MISSILEXs), special sea and air surveillance measures would be taken to search for, detect, and clear the area for 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 over-fly 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 220 helicopter sorties annually within the Cherry Point OPAREA that would involve towing surface sleds and submerged equipment, such as AN/AQS-24A and AN/AQS-20, through simulated threat minefields with the goal of clearing a safe channel through the minefield for the passage of friendly ships. Upon deployment, MH-53 and MH-60S helicopters fly at low altitudes into the training area with one of the Organic Mine Countermeasures (OMCM) mine hunting systems in-tow. If the aircraft encountered a commercial or recreational vessel, the aircrew either would stop forward progress or maneuvers 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). This document 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 Cherry Point 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.

FACSFAC VACAPES would continue to use its ATC function, and to work with the FAA, to provide separation between military aircraft and civilian aircraft in the study area. The scheduling and coordination activities of FACSFAC VACAPES with agencies such as the USCG and interdiction teams for illegal immigrants and drugs would continue to ensure that neither agents nor the individuals they were assisting or seeking would be endangered by training activities. Continued implementation of the Severe Weather Avoidance Plan (SWAP) would continue to enhance civilian aviation during inclement weather.

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 MEM are typically small (such as the 19-inch-long, 3-inch-diameter MK-25 marker), 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.

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 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 Navy Cherry Point 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 Navy Cherry Point Study Area is addressed in Section 3.2. While the release 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 United States. EW systems emit EMR similar to that from cell phones, hand-held radios, commercial radio stations, and television stations. Standard operating procedures 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 Navy Cherry Point Study Area, where these high-energy light sources are used for precision range finding and by target-designation systems for guided munitions. In accordance with OPNAVINST 5100.27B and MCO 5104.1c both dated 2 May 2008, there is a comprehensive Navy Laser Hazards Control Program. 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.

Summary

In accordance with the 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.

3.18.6.2 Alternative 1

Under Alternative 1, training and RDT&E operations would be increased or modified to the minimal extent possible 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 accommodate recent force structure changes with the introduction of the new MH-60S Seahawk Multi-Mission Helicopter, training areas would be established, including limited capability to support Organic Mine Countermeasures (OMCM).

As summarized in Table 2.2-5 and detailed in Table 2.2-4, 2.2-6, and 2.2-7, the increased training tempo of Alternative 1 would result in more steaming hours by vessels, more sorties flown by fixed-wing aircraft and helicopters, more use of explosive munitions and NEPM, more underwater detonations, and more deployment of expendable materials. All 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.

Increased use of the MH-60S and training to support OMCM 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 OMCM 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 the live fire mine countermeasures platforms (RAMICS, AMNS, and MK-103) only in designated as live-fire areas (Area 15).

As a result of these measures, there would not be measurable changes in accidents, injuries, or illnesses compared to the No Action Alternative.

In accordance with the 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.

3.18.6.3 Alternative 2 (Preferred Alternative)

Training events proposed under Alternative 2 would have all the components of Alternative 1, but with additional increases in many operations (except for a decrease in the use of high-explosive bombs) and the designation of additional mine warfare training areas. The safety procedures implemented under this alternative would be the same as those described for the No Action Alternative and Alternative 1, and would be equally effective in protecting public health and safety. Therefore, for the types of operations that would have been included in the other alternatives, Alternative 2 would not result in any measurable changes in accidents, injuries, or illnesses.

As summarized in Tables 2.2-5 and 2.2-7, Alternative 2 would eliminate the use high-explosive bombs, including MK-84 bombs (944.8 pounds net explosive weight [NEW]), MK-82 bombs (192.2 pounds NEW), and MK-83 bombs (415.8 pounds NEW). However, these changes would not result in any reductions in risk to public health and safety. Because of the Navy's strict implementation of safety measures, current use of these high-explosive bombs has not resulted in any civilian deaths or injuries, and their elimination under Alternative 2 would not change this safety record.

Alternative 2 would establish a littoral Mine Warfare (MIW) Training Area in the Cherry Point OPAREA and in nearshore waters in Onslow Bay (see Figure 2.2-1). Safety measures that would be implemented for the establishment and use of these training areas 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 the live fire mine countermeasures platforms (RAMICS, AMNS, and MK-103) only in designated as live-fire areas (Area 15).

As a result of these measures, there would not be measurable changes in accidents, injuries, or illnesses compared to the No Action Alternative.

In accordance with the 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.

3.18.7 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 public health and safety.

3.18.8 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.18-2, 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 3.18-2 Summary of Environmental Effects of the Alternatives on Public Health and Safety in the Navy Cherry Point Study Area

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	**Executive Order 12114 (Non-Territorial Waters, >12 nm)**
No Action		
Vessel movements (disturbance and collisions)	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 (disturbance and strikes)	USMC is responsible for scheduling restricted airspace; Pilots are responsible for their own aircraft; FACSFAC VACAPES schedules aircraft in W-122 for exclusive use only; Civilian air traffic is very limited in warning areas and commercial flights are pre-planned; Use of NOTAMs would provide 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.	USMC is responsible for scheduling restricted airspace; Pilots are responsible for their own aircraft; FACSFAC VACAPES schedules aircraft in W-122 for exclusive use only; Civilian air traffic is very limited in warning areas and commercial flights are pre-planned; Use of NOTAMs would provide 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.
Mine warfare deployment and recovery	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.
Non-explosive practice munitions (NEPM)	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.
Underwater detonations and high-explosive ordnance	SOPs are in place to ensure ranges are clear before ordnance deliveries and detonations begin.	SOPs are in place to ensure ranges are clear before ordnance deliveries and detonations begin.
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.
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.
Impact conclusion	No significant impact to public health and safety.	No harm to public health and safety.

Table 3.18-2 Summary of Environmental Effects of the Alternatives on Public Health and Safety in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 1		
Vessel movements (disturbance and collisions)	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 (disturbance and strikes)	USMC is responsible for scheduling restricted airspace; Pilots are responsible for their own aircraft; FACSFAC VACAPES schedules aircraft in W-122 for exclusive use only; Civilian air traffic is very limited in warning areas and commercial flights are pre-planned; Use of NOTAMs would provide 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.	USMC is responsible for scheduling restricted airspace; Pilots are responsible for their own aircraft; FACSFAC VACAPES schedules aircraft in W-122 for exclusive use only; Civilian air traffic is very limited in warning areas and commercial flights are pre-planned; Use of NOTAMs would provide 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,
Mine warfare deployment and recovery	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.
NEPM	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.
Underwater detonations and high-explosive ordnance	SOPs are in place to ensure ranges are clear before ordnance deliveries and detonations begin.	SOPs are in place to ensure ranges are clear before ordnance deliveries and detonations begin.
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.
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.
Impact conclusion	No significant impact to public health and safety.	No harm to public health and safety.

Table 3.18-2 Summary of Environmental Effects of the Alternatives on Public Health and Safety in the Navy Cherry Point Study Area (Continued)

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (Territorial Waters, 0 to 12 nm)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel movements (disturbance and collisions)	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 (disturbance and strikes)	USMC is responsible for scheduling restricted airspace; Pilots are responsible for their own aircraft; FACSFAC VACAPES schedules aircraft in W-122 for exclusive use only; Civilian air traffic is very limited in warning areas and commercial flights are pre-planned; Use of NOTAMs would provide 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.	USMC is responsible for scheduling restricted airspace; Pilots are responsible for their own aircraft; FACSFAC VACAPES schedules aircraft in W-122 for exclusive use only; Civilian air traffic is very limited in warning areas and commercial flights are pre-planned; Use of NOTAMs would provide 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.
Mine warfare deployment and recovery	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.
NEPM	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.
Underwater detonations and high-explosive ordnance	SOPs are in place to ensure ranges are clear before ordnance deliveries and detonations begin.	SOPs are in place to ensure ranges are clear before ordnance deliveries and detonations begin.
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.
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.
Impact conclusion	No significant impact to public health and safety.	No harm to public health and safety.

3.19 SUMMARY OF ATLANTIC FLEET ACTIVE SONAR TRAINING AND AGGREGATE IMPACTS IN THE NAVY CHERRY POINT RANGE COMPLEX

The Navy Cherry Point 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 Final 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 Navy Cherry Point Range Complex can be comprehensively evaluated under NEPA and EO 12114. The reader should refer to the Final 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 16, 2009 and the annual Incidental Take Statement was subsequently issued.

The Final 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 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 Final 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 Final 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.

3.19.1 Summary of Sonar Activities in the Navy Cherry Point Range Complex

3.19.1.1 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 3.19-1 identifies the active acoustic systems acoustically modeled in the Final 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 2.2 and Appendix C in the Final AFAST EIS/OEIS for more information on sonar systems used during Atlantic fleet training.

Table 3.19-1 Acoustic Systems Modeled in the AFAST EIS/OEIS

Systems That Were Modeled			
System	***Frequency***	***Associated Platform***	***System Description***
AN/SQS-53	3.5kHz	DDG and CG hull-mounted sonar	ASW search, detection, & localization; utilized 70% in search mode and 30% track mode
AN/AQS-13 or AN/AQS-22	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)
Explosive source sonobuoy (AN/SSQ-110A)	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

Table 3.19-1 Acoustic Systems Modeled in the AFAST EIS/OEIS (Continued)

Systems That Were Modeled			
System	***Frequency***	***Associated Platform***	***System Description***
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 every 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 fired countermeasure (NAE)	MF	Submarine deployed countermeasure	Expendable acoustic countermeasure (20 mins per use)

3.19.1.2 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, the Navy grouped similar events to form representative scenarios for analysis in the Final AFAST EIS/OEIS. Specific active sonar events are described in more detail in Appendix C of the Final AFAST EIS/OEIS. Note that specific exercise names and other details occasionally change as required to meet the current operational needs. Table 3.19-2 summarizes the active sonar scenarios that typically occur in the Navy Cherry Point Range Complex and seaward. Refer to Section 2.3 and Appendix C in the Final AFAST EIS/OEIS for more detail on Atlantic fleet sonar training events. In the Navy Cherry Point Range Complex, all ASW training would occur beyond 12 nm from shore.

3.19.2 Summary of Environmental Consequences for AFAST

In the following sections, a summary of the environmental consequences due to sonar activities in the Navy Cherry Point 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 Navy Cherry Point Range Complex under the selected 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 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.

Table 3.19-2 Summary of Active Sonar Activities in the Cherry Point OPAREAs 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.	91	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 3 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 MK-1, MK-2, MK-3, or MK-4 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
ULT- Helicopter ASW	One helicopter conducting ASW training using dipping sonar or sonobuoys	25	2 to 4 hours	20 nm x 30 nm	Helicopter dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopter dipping up to two hours (10 pings per five-minute dip)	MFA sonar exposure
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	Up to four 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 material and direct strike
					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

Table 3.19-2 Summary of Active Sonar Activities in the Cherry Point OPAREAs and Seaward (Continued)

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.	14	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 RDT&E event could vary	MFA 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.	111	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 material and direct strike
					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 (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
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 material

Table 3.19-2 Summary of Active Sonar Activities in the Cherry Point OPAREAs and Seaward (Continued)

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
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	1.4	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 MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					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
Coordinated ULT- Group Sail	An exercise with two DDGs with embarked helicopters, and one submarine.	4	Two to three days	30 nm x 30 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	Two-three ships pinging for several hours	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopter dipping up to six hours (10 pings per five-minute dip)	MFA sonar exposure
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One submarine pinging up to two times	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material

Table 3.19-2 Summary of Active Sonar Activities in the Cherry Point OPAREAs and Seaward (Continued)

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)	One helicopter dropping up to four 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
					Vessel movement	Three ships maneuvering	Vessel strike
Strike Group Training- ESG COMPTUEX and CSG COMPTUEX and similar RDT&E	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.	1.4 training events and similar RDT&E	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
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					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 material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material 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

Table 3.19-2 Summary of Active Sonar Activities in the Cherry Point OPAREAs and Seaward (Continued)

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
					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
Strike Group training- JTFEX	Final fleet exercise prior to deployment of the CSG and ESG. Serves as a ready-to-deploy certification for all units. Four DDGs, two FFGs, one helicopter, one MPA, and three submarines.	0.6	10 days	60 nm x 80 nm up to 180 nm x 180 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	Six ships (CG, DDG, FFG) pinging up to 25 hours each	MFA sonar exposure
					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
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	Three submarines pinging twice 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 MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	One MPA and/or one helicopter dropping three to 10 sonobuoys for a total of up to 174 sonobuoys over duration of event	MFA sonar , direct shrike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					Explosive source sonobuoy (AN/SSQ-110A)	Two MPA dropping up to 14 AN/SSQ-110A sonobuoys	Explosive byproducts, pressure wave exposure, impulsive sound exposure, direct strike, and expended material
					Receiver (ADAR) sonobuoy (AN/SSQ-101)	Up to 5 AN/SSQ-101 sonobuoys	Direct Strike and expended material

Table 3.19-2 Summary of Active Sonar Activities in the Cherry Point OPAREAs and Seaward (Continued)

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
					Vessel movement	Nine ships (CG, DDG, FFG, or submarine) maneuvering	Vessel strike
Surface Ship Sonar Maintenance	Pier side and at-sea maintenance to sonar system.	82	.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.	14	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 Cherry Point OPAREAs and seaward of the Cherry Point OPAREAs. 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 Cherry Point OPAREAs.*

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

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 due to sonar activities.

3.19.2.1 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 3.19-3.

Table 3.19-3 Material Expended During Sonar Activities in the Navy Cherry Point Range Complex

Device	Description	Expended Material	Number Expended per Year*
Sonobuoys	A sonobuoy is an expendable device 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 (90-4—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: 4,620 • Tonal sonobuoys: 983 • Explosive source sonobuoys: 192 • Receiver sonobuoys: 68
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	• 45 ADCs

Table 3.19-3 Material Expended During Sonar Activities in the Navy Cherry Point Range Complex (Continued)

Device	Description	Expended Material	Number Expended per Year*
MATT	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	• 116 EMATTs

**The quantity shown is an estimate of the portion of overall AFAST expended material anticipated to be used in the Navy Cherry Point Range Complex or seaward of the Navy Cherry Point Range Complex.*

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 be 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 EIS/OEIS. Under all alternatives presented in this EIS/OEIS, when the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, 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.

3.19.2.2 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 3.19-3. 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 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 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.

3.19.2.3 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 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 will be no significant impacts to water quality in territorial waters. In addition, there will 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 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 EIS/OEIS 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.

3.19.2.4 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 will not be significant to the population as a whole. In addition, the explosions will 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 will not be operating in the shallow waters where sea grasses are present. In addition, *Sargassum* mats are easily identified and will be avoided wherever possible.

Under the AFAST selected alternative, therefore, there will be no significant impacts to marine communities in territorial waters. In addition, there will 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 EIS/OEIS 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.

3.19.2.5 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 3.19-1 is the curve resulting from the risk function inputs for odontocetes (except harbor porpoises) and pinnipeds. Figure 3.19-2 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.

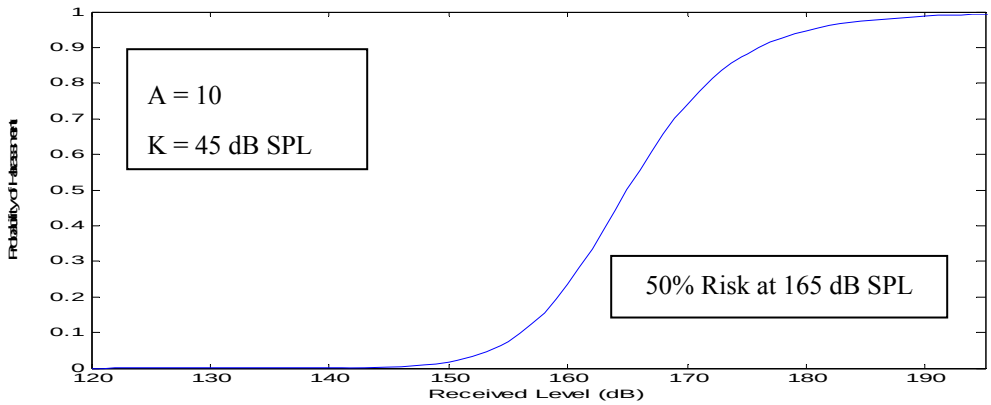


Figure 3.19-1 Risk Function Curve for Odontocetes (except harbor porpoises) (toothed whales) and Pinnipeds

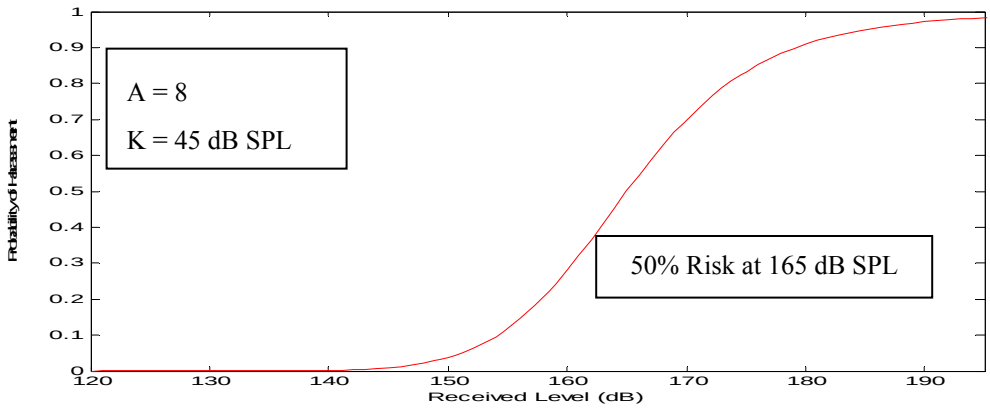


Figure 3.19-2 Risk Function Curve for Mysticetes (Baleen Whales)

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 3.19-3 depicts the ranges of effects that correspond to MMPA harassment levels.

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 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 Navy Cherry Point 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 3.19-4). 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

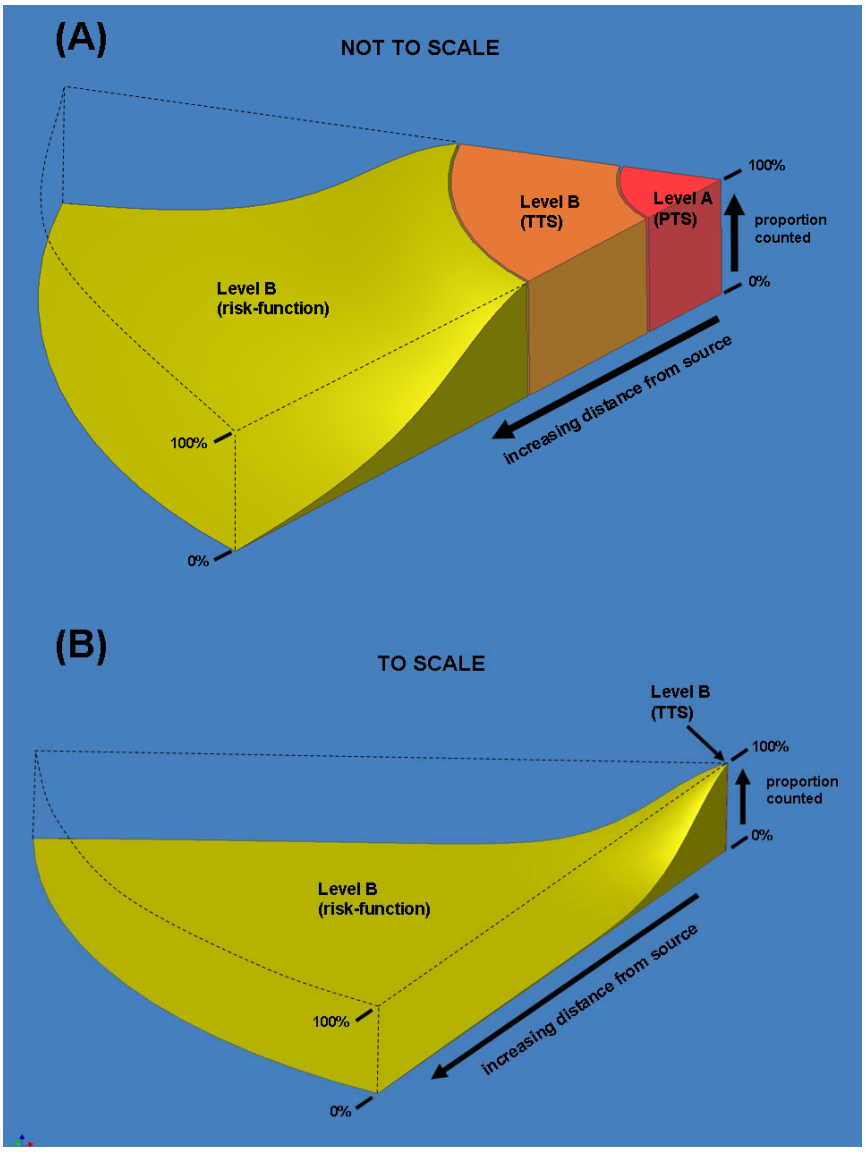


Figure 3.19-3 Range to Effects for the Most Powerful Active Sonar, AN/SQS-53

(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 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 Navy Cherry Point Range Complex.

Due to the above reasons, quantitative exposure estimates should be used in conjunction with a qualitative analysis to assess potential impacts.

Table 3.19-4
Estimated Annual Takes of Marine Mammals
In Navy Cherry Point Range Complex
Under the AFAST Selected Alternative

Species	Mortality	PTS	TTS	Risk-Function (Behavioral)
Atlantic spotted dolphin	0	3	551	41887
Bottlenose dolphin	0	7	738	66340
Clymene dolphin	0	1	87	7401
Common dolphin	0	0	1	111
***Kogia* spp.**	0	0	8	703
Pantropical spotted dolphin	0	2	183	15491
Pilot whales* **	0	1	134	12249
Risso's dolphin	0	1	100	8639
Rough-toothed dolphin	0	0	4	334
Sperm whale **	0	0	4	317
Striped dolphin	0	0	1	61
Beaked whale	0	0	5	423
Fin whale **	0	0	0	0
Humpback whale **	0	0*	6	686
Minke whale	0	0	0	36
North Atlantic right whale **	0	0	0*	30

* Indicates an exposure greater than or equal to 0.05, therefore, is considered a "may affect" for ESA-listed species.
** Denotes species listed in accordance with the Endangered Species Act
*** Pilot whales include both short- and long-finned pilot whales along the East Coast

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 Framework* (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 3.7.3.2 of the Navy Cherry Point Range Complex 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 has completed consultation 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. The Navy has completed consultation with NMFS in accordance with the MMPA for marine mammals located in the AFAST Study Area.

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 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 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.

3.19.2.6 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 Navy Cherry Point Range Complex EIS/OEIS (Section 3.8).

Table 3.19-5 shows that no acoustic exposures resulting in a physiological effect are anticipated in the Navy Cherry Point Study Area. In the case of single explosions, behavioral effects are expected to be limited to short-term startle effects.

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 3.8.3.1 of the Navy Cherry Point Range Complex EIS/OEIS, although the potential for vessel strike exists, 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.

Table 3.19-5 Estimated Sea Turtle Acoustic Exposures from Explosive Source Sonobuoys

Species	Mortality	PTS	TTS
Loggerhead sea turtle	0	0*	0*
Kemp's ridley sea turtle**	0	0	0
Leatherback sea turtle	0	0	0
Hardshell sea turtles***	0	0	0*

* 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

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 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 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.

3.19.2.7 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 3.19.2.1), Hazardous Material and Hazardous Waste (Section 3.19.2.2), and Water Resources (Section 3.19.2.3), 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 have indicated 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

The potential impacts to EFH and fish due to range complex activities (other than sonar activities) are presented in Section 3.9 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 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.

3.19.2.8 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 DEIS/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

The potential impacts to sea birds due to range complex activities (other than sonar activities) are presented in Section 3.10 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 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.

3.19.2.9 Cultural Resources

Summary of Environmental Consequences Due to AFAST

The 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

The potential impacts to cultural resources due to range complex activities (other than sonar activities) are presented in Section 3.12 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 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.

3.19.2.10 Transportation

Summary of Environmental Consequences Due to AFAST

The 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

The potential impacts to transportation due to range complex activities (other than sonar activities) are presented in Section 3.13 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 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.

3.19.2.11 Regional Economy

Summary of Environmental Consequences Due to AFAST

The 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

The potential impacts to regional economy due to range complex activities (other than sonar activities) are presented in Section 3.15 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 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.

3.19.2.12 Recreation

Summary of Environmental Consequences Due to AFAST

The 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, 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

The potential impacts to recreation due to range complex activities (other than sonar activities) are presented in Section 3.16 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 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.

3.19.3 Mitigation Measures for Atlantic Fleet Active Sonar Activities

The AFAST FEIS/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 FEIS/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 FEIS/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.

3.19.3.1 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.

3.19.3.2 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 (DoN) alternatives, including the Proposed Action ("Proposed Action") for the Navy Cherry Point Range Complex Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (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	The EIS portion of this document 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 OEIS aspects of this document satisfy this requirement. The Proposed Action would not result in significant harm to the environment.
Clean Air Act (CAA) (42 USC §§7401 *et seq*.)	DoN USEPA North Carolina DENR	The General Conformity Rule is not applicable where the Proposed Action occurs in areas in attainment
Clean Water Act (CWA) (33 USC §§1344, *et seq*.)	USEPA	No permit under the CWA, whether under Section 401, 402, or 404 (b) (1), is required
Coastal Zone Management Act (CZMA) (16 CFR §§1451, *et seq*.)	North Carolina DENR	The Navy has determined that the Proposed Action is consistent to the maximum extent practicable and has prepared a Coastal Consistency Determination (CCD) in accordance with the CZMA (Appendix G).
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 Summary of Environmental Compliance for the Proposed Action (Continued)

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 USFWS on the potential that the Proposed Action may affect listed species. Consultation with NMFS is ongoing.
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 also requested a Letter of Authorization from the NMFS regarding effects on marine mammals.
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 offshore environment of NC. Review of agency actions under Section 304 is not required.
National Historic Preservation Act (NHPA) (16 USC§§ 470. *et seq*.)	DoN North Carolina State Historic Preservation Office	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 these species. This EIS/OEIS satisfies the requirement of EO 13112 with regard to the Proposed Action.
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.
Migratory Bird Treaty Act (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

4.2 REQUIRED PERMITS AND APPROVALS

All required permits and approvals have been obtained. The decisions and supporting data can be found in the appendices.

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. Part 1453) as extending, "to the outer limit of State title and ownership under the Submerged Lands Act" (i.e., 3 nautical miles [nm] from the shoreline). The coastal zone extends inland only to the extent necessary to control the shoreline. Excluded from the coastal zone are lands the use of which is by law subject solely to the discretion of, or which is held in trust by, the federal government (16 U.S.C. Part 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. Regulatory information relating to CZMA may also be found in Appendix K.

In accordance with the CZMA, the Navy has reviewed the enforceable policies for North Carolina's CMP. Based on the limitations discussed in this EIS, the enforceable policies of North Carolina's CMP, and pursuant to 15 CFR § 930.39, the Navy has prepared a Consistency Determination for the State of North Carolina. North Carolina Department of Environmental and Natural Resources concurred with the Navy's determination on March 30, 2009. All agency correspondence is contained in Appendix G.

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 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, is committed to furthering understanding of these creatures and developing ways to lessen or eliminate the impacts that 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 the general welfare of the public. The Navy is committed to sustainable range management, including co-use of the Navy Cherry Point Range Complex with the general public and commercial interests. This commitment to co-use enhances the long-term productivity of the range areas surrounding Navy Cherry Point 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 those resources would 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. There are several culturally significant shipwrecks in the area proposed for training activities; however, these sites are well-documented and the Navy makes every effort to avoid these areas whenever possible. 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 (concrete, metal, sand, fuel, *etc.*) would not occur. Energy typically associated with construction activities would not be expended and irretrievably 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, total fuel use would 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 Navy Cherry Point 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, and power supply. Although the required electricity demands of increased intensity of range complex usage would be met by the existing electrical generation infrastructure within the Navy Cherry Point 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 onboard each vessel. 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 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 are beneficial because they decrease the use of fossil fuels. With respect to operational activities, 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 will emerge, or will become more cost effective or user-friendly, and will further reduce the Navy's 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 Cherry Point OPAREAs are the single largest airborne noise source. Noise levels in excess of 90 dBA can occur. Sustainable range management practices are in place that protect and conserve natural and cultural resources, as well as and preserve access to training areas for current 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 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 3.12.

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CHAPTER 5 :MITIGATION MEASURES

5.1 INTRODUCTION

Effective training in the Cherry Point 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 document, 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 special mitigation measures associated with vessel transit during North Atlantic right whale migration. Section 5.7 presents measures for specific training events. Section 5.8 presents coordination and reporting requirements. Section 5.9 provides alternative mitigation that was considered but eliminated. Section 5.10 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 AFAST EIS/OEIS (DoN, 2008a) and are presented in sections 5.7.14 and 5.7.15.

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 here, the Navy believes that a comprehensive approach to mitigation for the Navy Cherry Point 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 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 Record of Decision as well as in documents that result from other regulatory processes (*e.g.*, ESA Biological Opinion).

The final suite of measures developed in Navy's application for a Marine Mammal Protection Act (MMPA) Letter of Authorization (LOA) is analyzed in this final EIS/OEIS. In addition to the National Environmental Policy Act (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. In order 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 this Final EIS/OEIS. If additional mitigation or monitoring measures are required, they will be included in the Record of Decision.

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 (see Figure 5.3-1). Although the ICMP is intended to apply to all Navy training, use of MFA Sonar in training and research, development, testing, and evaluation (RDT&E) will comprise a major component of the overall program.

The ICMP will establish the overarching structure and coordination that will facilitate the collection and synthesis of monitoring data from Navy training and research and development projects. The Program will compile data from range-specific monitoring efforts as well as research and development (R&D) studies that are fully or partially Navy-funded. Monitoring methods across the ranges will include methods such as vessel and aerial surveys, tagging, and passive acoustic monitoring.

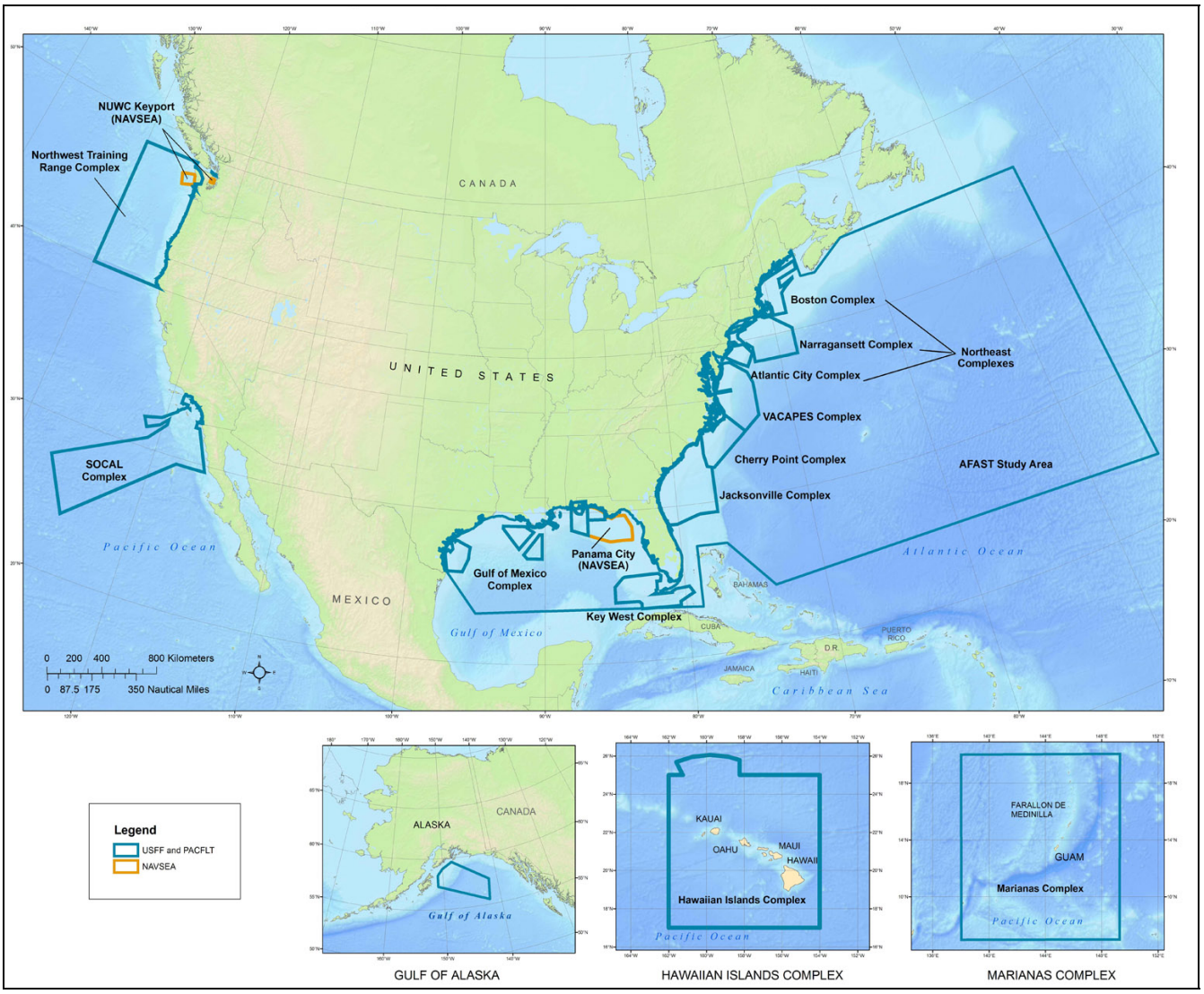


Figure 5.3-1 Navy-Wide Area Map of Areas Where Data Collection is Expected to Occur

The primary objectives of the ICMP are to:

- Monitor Navy training exercises, particularly those involving active sonar and underwater detonations, for compliance with the terms and conditions of ESA Section 7 consultations and/or MMPA authorizations;
- Minimize exposure of protected species to sound levels from active sonar or sound pressure levels from underwater detonations currently considered to result in harassment;
- Collect data to support estimating the number of individuals exposed to sound levels above current regulatory thresholds;
- Assess the efficacy of the Navy's current marine species mitigation;
- Assess the practicality and effectiveness of potential future mitigation tools and techniques;
- Document trends in species distribution and abundance in Navy training areas through focused longitudinal monitoring efforts; and
- Add to the knowledge base on potential behavioral and physiological effects to marine species from active sonar and underwater detonations.

The ICMP will provide a comprehensive structure and serve as the basis for establishing monitoring plans for individual range complexes and specific training activities as well as geographically based longitudinal monitoring programs at select locations. Specific training exercise plans will focus on short-term monitoring and mitigation for individual training activities. Each training event will be evaluated to determine if it represents an appropriate monitoring opportunity within the ICMP framework. Due to the scale (spatial, temporal, and operational) of various training activities, not every event will present optimum opportunity for concentrated monitoring and, as a result, various levels of effort and resources will be associated with individual exercises. The overall approach of the ICMP is to target the majority of available monitoring resources on a limited number of opportunities with best potential for high quality data collection rather than attempting to apply a thin blanket of monitoring over the entirety of Navy training.

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.

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 ICMP will evaluate the range of potential monitoring techniques that can be tailored to any Navy range or exercise and the appropriate species of concern. 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.

Because data concerning physiological and behavioral effects, as well as long-term modifications of habitat use, are extremely limited at this time, the ICMP will also incorporate several geographically fixed longitudinal monitoring sites to assess potential effects to marine mammals, both at the individual and population level. One example of this geographically fixed monitoring approach is the program recently initiated for the proposed Undersea Warfare Training Range (USWTR) in the Atlantic. The Navy contracted with a consortium of researchers from Duke University, the University of North Carolina at Wilmington, the University of St. Andrews, and the NMFS Northeast Fisheries Science Center to conduct a pilot study analysis and subsequently develop a survey and monitoring plan that prescribes the recommended approach for data collection, including surveys (aerial/shipboard, frequency, spatial extent, *etc*.), passive acoustic monitoring, photo identification and data analysis (standard line-transect, spatial modeling, *etc*.) necessary to establish a fine-scale seasonal baseline of protected species distribution and abundance.

This baseline study will provide the foundation for establishing a monitoring program designed to provide meaningful data on potential long term effects to marine species that may be chronically exposed to training activities on the USWTR. The baseline data collection portion of the program began in June 2007 at the Onslow Bay alternative site and includes coordinated aerial, shipboard, and passive acoustic surveys as well as deployment of HARPs to supplement the traditional visual surveys. A similar program is currently being initiated at the Jacksonville preferred site. Similar efforts may be developed for other Navy ranges to support the overall ICMP objectives.

In addition to the specific monitoring initiative outlined above, the ICMP framework proposes to continue or initiate studies of behavioral response, abundance, distribution, habitat utilization, *etc*. for species of concern using a variety of methods, which may include visual surveys, passive and acoustic monitoring, radar, and data logging tags (to record data on acoustics, diving and foraging behavior, and movements). This work will help to build the collective knowledgebase on the geographic and temporal extent of key habitats and provide baseline information to account for natural perturbations such as El Niño or La Niña events as well as establish baseline information to determine the spatial and temporal extent of reactions to Navy operations, or indirect effects from changes in prey availability and distribution. Both the Office of Naval Research and Chief of Naval Operations are heavily involved in supporting a variety of ongoing research efforts (summarized below), including the recent BRS-07 conducted at AUTEC during the summer of 2007.

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 explosive training activities.

5.3.2 Monitoring Summary

The monitoring methods proposed for use during training events in the Navy Cherry Point Range Complex include a combination of individual elements designed to allow a comprehensive assessment include:

(1) Vessel and aerial surveys

(i) Visual surveillance of 1 event per year. If possible, the event surveyed will be one involving multiple detonations. Due to the limited number of events conducted in the Cherry Point Range Complex, there is a potential that it may be impossible to coordinate required surveys to take place during the limited opportunities presented. In any case, any missed annual survey requirement will roll into the subsequent year ensuring that the appropriate number of surveys occurs over the 5-year period of effectiveness of the MMPA regulation. Likewise, additional surveys may be scheduled in any year where additional opportunities arise, with the number of surveys during the 5-year regulations not to exceed 5.

(ii) For surveyed training events, aerial or vessel surveys will be used 1– 2 days prior to, during if reasonably safe, and 1–5 days post detonation. The variation in the number of days after allows for the detection of animals that gradually return to an area, if they indeed do change their distribution in response to underwater detonation events.

(iii) Surveys will include any specified exclusion zone around a particular detonation point plus 2000 yards beyond the exclusion zone. For vessel-based surveys a passive acoustic system (hydrophone or towed array) could be used to determine if marine mammals are in the area before and/or after a detonation event. Depending on animals sighted, it may be possible to conduct focal surveys of animals outside of the exclusion zone (detonations could be delayed if marine mammals are observed within the exclusion zone) to record behavioral responses to the detonations.

(iv) When conducting a particular survey, the survey team will collect:

(A) species identification and group size;

(B) location and relative distance from the detonation site;

(C) the behavior of marine mammals including standard environmental and oceanographic parameters;

(D) date, time and visual conditions associated with each observation;

(E) direction of travel relative to the detonation site; and

(F) duration of the observation.

(2) Passive acoustic monitoring

(i) When practicable, a towed hydrophone array should be used whenever shipboard surveys are being conducted. The towed array would be deployed during daylight hours for each of the days the ship is at sea.

(ii) A towed hydrophone array is towed from the boat and can detect and localize marine mammals that vocalize and would be used to supplement the ship-based systematic line-transect surveys (particularly for species such as beaked whales that are rarely seen).

(iii) The array would need to detect low frequency vocalizations (< 1,000 Hz) for baleen whales and relatively high frequency vocalizations (up to 30 kHz) for odontocetes such as sperm whales. The use of two simultaneously deployed arrays can also allow more accurate localization and determination of diving patterns.

(3) Marine mammal observers on Navy platforms as follows:

(i) To the extent practicable, marine mammal observers (MMOs) will be placed on a Navy platform.

(ii) Qualifications must include expertise in species identification of regional marine mammal species and experience collecting behavioral data. Experience as a NMFS marine mammal observer is preferred, but not required. Navy biologists and contracted biologists will be used; contracted MMOs must have appropriate security clearance to board Navy platforms.

(iii) MMOs will not be placed aboard Navy platforms for every Navy training event or major exercise, but during specifically identified opportunities deemed appropriate for data collection efforts. The events selected for MMO participation will take into account safety, logistics, and operational concerns.

(iv) MMOs will observe from the same height above water as the lookouts.

(v) The MMOs will not be part of the Navy's formal reporting chain of command during their data collection efforts; Navy lookouts will continue to serve as the primary reporting means within the Navy chain of command for marine mammal sightings. The only exception is that if an animal is observed within the shutdown zone that has not been observed by the lookout, the MMO will inform the lookout of the sighting for the lookout to take the appropriate action through the chain of command.

(vi) The MMOs will collect species identification, behavior, direction of travel relative to the Navy platform, and distance first observed. All MMO sighting will be conducted according to a standard operating procedure.

The Navy would submit a report annually on September 1 describing the implementation and results (through June 1 of the same year) of the monitoring required above. Standard marine species sighting forms would be provided by the Navy and data collection methods will be standardized across ranges to allow for comparison in different geographic locations.

Navy Cherry Point Range Complex Comprehensive Report – The Navy will submit to NMFS a draft report that summarizes all of the marine mammal observations and data gathered during explosive exercises through June 1, 2012. This report will be submitted to NMFS at the end of the fourth year of the rule (November 2012).

The Navy will respond to NMFS comments on the draft comprehensive report if submitted within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

To implement the aforementioned monitoring measures, the Navy is developing an ICMP for marine species in order 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 MFA sonar in training, testing, and RDT&E will comprise a major component of the overall program.

The ICMP will establish the overarching structure and coordination that will facilitate the collection and synthesis of monitoring data from Navy training and research and development projects. The Program will compile data from range-specific monitoring efforts as well as R&D studies that are fully or partially Navy funded. Monitoring methods across the ranges will include methods such as vessel and aerial surveys, tagging, and passive acoustic monitoring. 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 explosives training activities.

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 monitoring pursuant to the Navy Cherry Point Range Complex rule as well as monitoring results from other Navy rules and LOAs. The Monitoring Workshop participants would provide their individual 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.

5.3.3 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 Navy Cherry Point Monitoring Plan Report

The Navy will submit a report annually on September 1 describing the implementation and results (through June 1 of the same year) of the Navy Cherry Point Monitoring Plan, described above. Data collection methods will be standardized across range complexes to allow for comparison in different geographic locations. Although additional information will also be gathered, the MMOs collecting marine mammal data pursuant to the Navy Cherry Point Monitoring Plan shall, at a minimum, provide the same marine mammal observation data required in the MFAS/HFAS major Training Exercises section of the Annual Navy Cherry Point Exercise Report referenced below. The Navy Cherry Point Monitoring Plan Report may be provided to NMFS within a larger report that includes the required Monitoring Plan Reports from multiple Range Complexes.

Annual Navy Cherry Point Exercise Report

The Navy will submit an Annual Navy Cherry Point Exercise Report on September 1 of every year. This report 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 Navy Cherry Point 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.*, FFG, DDG, or 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.
- (xiii) Mitigation Implementation—whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was.
- (xiv) If source in use (x) is hull-mounted, true bearing of animal from ship, true direction of ship's travel, and estimation of animal's motion relative to ship (opening, closing, parallel)
- (xv) 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.

5.3.4 Adaptive Management

The regulations under which the Navy's LOA 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 the mitigation 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.

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 monitoring pursuant to the Navy Cherry Point Range Complex rule as well as monitoring results from other Navy rules and LOAs. The Monitoring Workshop participants would provide their individual 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, 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 and the Navy OPAREA Density Estimates (NODE) reports (DoN, 2007b). Furthermore, research cruises by the 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, through 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.

For the past few years, the Navy has implemented marine mammal spotter training for its bridge lookout personnel on ships and submarines. This training has been revamped and updated as the Marine Species Awareness Training (MSAT) and is provided to all applicable units. The lookout training program incorporates MSAT, which addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information, including more detailed information for spotting 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 (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 Eyes" (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 1,500 ft (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 APPLICABLE TO VESSEL TRANSIT DURING NORTH ATLANTIC RIGHT WHALE MIGRATION

The mid-Atlantic is defined broadly to include ports south and east of Block Island Sound southward to South Carolina. The procedure described below would be established as mitigation measures for Navy vessel transits during North Atlantic right whale migratory seasons near ports located off the western North Atlantic, offshore of the eastern United States. The mitigation measures would apply to all Navy vessel transits, including those vessels that would transit to and from East Coast ports and operating areas (OPAREAs). Seasonal migration of North Atlantic right whales is generally described by NMFS as occuring from October 15th through April 30th, when right whales migrate between feeding grounds farther north and calving grounds farther south. The Navy mitigation measures have been established in accordance with rolling dates identified by NMFS consistent with these seasonal patterns.

NMFS has identifed ports located in the western Atlantic Ocean, offshore of the southeastern United States, where vessel transit during North Atlantic right whale migration is of highest concern for potential ship strike. Navy vessels are required to use extreme caution and operate at a slow, safe speed consistent with mission and safety during the months indicated in Table 5.6-1 and within a 20 nm (37 km) arc (except as noted) of the specified reference points.

During the indicated months, Navy vessels would practice increased vigilance with respect to avoidance of vessel-whale interactions along the mid-Atlantic coast, including transits to and from any mid-Atlantic ports not specifically identified above. All surface(d) units transiting within 56 km (30 nm) of the coast in the mid-Atlantic would ensure at least two watchstanders are posted, including at least one lookout that has completed required MSAT training. Furthermore, Navy vessels would not knowingly approach any whale head on and would maneuver to keep at least 500 yards (457 m) away from any observed whale, consistent with vessel safety.

Table 5.6-1
North Atlantic Right Whale Migration Port References

Region	Months	Port Reference Points
South and East of Block Island	Sep–Oct and Mar–Apr	20 nm seaward of line between 41-4.49N 071-51.15W and 41-18.58N 070-50.23W
New York / New Jersey	Sep–Oct and Feb-Apr	40-30.64N 073-57.76W
Delaware Bay (Philadelphia)	Oct–Dec and Feb–Mar	38-52.13N 075-1.93W
Chesapeake Bay (Hampton Roads and Baltimore)	Nov-Dec and Feb–Apr	37-1.11N 075-57.56W
North Carolina	Dec–Apr	34-41.54N 076-40.20W
South Carolina	Oct–Apr	33-11.84N 079-8.99W 32-43.39N 079-48.72W

5.7 MEASURES FOR SPECIFIC 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.

5.7.1 Surface-to-Surface Gunnery (up to and including 5-inch explosive rounds)

1. Lookouts will 4visually survey for floating weeds, algal mats, and *Sargassum* rafts, which may be inhabited by immature sea turtles, in the target area. Intended target area shall not be within 600 yards (548 m) of known or observed floating weeds, algal mats, *Sargassum* rafts, or coral reefs.
2. If applicable, target-towing vessels shall maintain a trained lookout for marine mammals and sea turtles. If a marine mammal or sea turtle is sighted in the vicinity, the tow vessel will immediately notify the firing vessel, which will suspend the exercise until the area is clear.
3. A 600 yard (548 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.

5.7.2 Surface-to-Surface Gunnery (up to and including 5-inch non-explosive rounds)

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 target area shall not be within 200 yards (182 m) of known or observed floating weeds, algal mats, *Sargassum* rafts, or coral reefs.
2. A 200 yard (182 m) radius buffer zone will be established around the intended target.
3. 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.
4. If applicable, target-towing vessels shall maintain a trained lookout for marine mammals and sea turtles. If a marine mammal or sea turtle is sighted in the vicinity, the tow vessel will immediately notify the firing vessel, which will suspend the exercise until the area is clear.
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.

5.7.3 Firing Exercise (FIREX) Using the Integrated Maritime Portable Acoustic Scoring System (IMPASS) (5-in. explosive rounds)

Note: This exercise is also known as Firing Exercise II (FIREX II) and Naval Surface Fire Support (NSFS).

1. FIREX using IMPASS will only be conducted in Areas 4, 5, 13 or 14 of the Navy Cherry Point Range Complex.
2. Pre-exercise monitoring of the target area will be conducted with “Big Eyes” prior to the event, during deployment of the IMPASS sonobuoy array, and during return to the firing position. Ships will maintain a lookout dedicated to visually searching for marine mammals and sea turtles 180° along the ship track line and 360° at each buoy drop-off location.
3. “Big Eyes” on the ship will be used to monitor a 600 yd (548 m) buffer zone around the target area for marine mammals/sea turtles during naval-gunfire events. 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.

4. Ships will not fire on the target if any marine mammals or sea turtles are detected within or approaching the 600 yd (548 m) buffer until the area is cleared. If marine mammals or sea turtles are present, operations would be suspended. Visual observation will occur for approximately 45 minutes, or until the animal has been observed to have cleared the area and is heading away from the buffer zone.
5. Post-exercise monitoring of the entire effect range will take place with "Big Eyes" and the naked eye during the retrieval of the IMPASS sonobuoy array following each firing exercise.
6. FIREX with IMPASS will take place during daylight hours only.
7. FIREX with IMPASS will only be used in Beaufort Sea State three (3)[31] or less due to equipment limitations.
8. The visibility must be such that the fall of shot is visible from the firing ship during the exercise.
9. No firing will occur if marine mammals are detected within 70 yd (64 m) of the vessel.

5.7.4 Small Arms Training – (such as 9 mm, .45 cal pistol, 12GA Shotgun, 5.56 mm, 7.62 mm, and .50 cal)

1. Lookouts will visually survey for floating weeds, algal mats, *Sargassum* rafts, marine mammals, and sea turtles. Weapons will not be fired in the direction of known or observed floating weeds, algal mats, *Sargassum* rafts, marine mammals, sea turtles or coral reefs.

5.7.5 Air-to-Surface At-Sea Bombing Exercises (500-lbs to 2,000-lbs explosive bombs)

1. This activity occurs in W-122, Area 18 in the Navy Cherry Point Range Complex.
2. 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 will be made by flying at 1,500 ft 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.
3. A buffer zone of 5,100-yd (4,663 m) radius will be established around the intended target zone. The exercises will be conducted only if the buffer zone is clear of sighted marine mammals and sea turtles.
4. If surface vessels are involved, lookouts will survey for *Sargassum* rafts. Ordnance shall not be targeted to impact within 5,100 yards (4663 m) of known or observed *Sargassum* rafts or coral reefs.
5. At-sea BOMBEXs using live ordnance will occur during daylight hours only.

5.7.6 Air-to-Surface At-Sea Bombing Exercises (non-explosive munitions)

1. If surface vessels are involved, trained lookouts will survey for *Sargassum* rafts, which may be inhabited by immature sea turtles, and for sea turtles and marine mammals. Ordnance shall not be targeted to impact within 1,000 yds (914 m) of known or observed *Sargassum* Rafts, sea turtles, marine mammals or coral reefs.

[31] The Beaufort Scale of Wind Force was developed as a means for sailors to gauge wind speeds through visual observations of the sea state. The scale runs from 0 for calm to force 12 for Hurricane. In addition, this specific measure results from technological limitations of the sonobouy array in higher sea states and is not intended as a measure for minimizing potential effects on the marine environment.

2. A 1,000 yd (914 m) radius buffer zone will 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 will 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.

5.7.7 Air-to-Surface Gunnery (such as .50 cal, 20 mm and 25 mm explosive or non-explosive rounds)

1. If surface vessels are involved, lookouts will visually survey for *Sargassum* rafts, which may be inhabited by immature sea turtles, in the target area. Impact should not occur within 200 yds (182 m) of known or observed floating weeds, algal mats, *Sargassum* rafts, or coral reefs.
2. A 200 yd (182 m) radius buffer zone will be established around the intended target.
3. If surface vessels are involved, lookout(s) will visually survey the buffer zone for marine mammals and sea turtles prior to and during the exercise.
4. Aerial surveillance of the buffer zone for marine mammals and sea turtles will be conducted prior to commencement of the exercise. Aerial surveillance altitude of 500 feet to 1,500 feet is optimum. Aircraft crew/pilot will maintain visual watch during exercises. Firing through cloud cover is prohibited; aircraft must be able to actually see ordnance impact areas.
5. The exercise will be conducted only if marine mammals and sea turtles are not visible within the buffer zone.
6. If applicable, target towing control craft shall maintain a lookout. If a marine mammal or sea turtle is sighted in the vicinity of the exercise, the towing control craft will immediately notify the firing vessel in order to stop gunnery firing until the area is clear.

5.7.8 Air-to-Surface Missile Exercises (explosive)

1. Ordnance shall not be targeted to impact within 1,800 yd (1,646 m) of known or observed *Sargassum* rafts, which may be inhabited by immature sea turtles, or coral reefs.
2. Aircraft will visually survey the target area for marine mammals and sea turtles. Visual inspection of the target area will be made by flying at 1,500 ft altitude or lower, if safe to do so, and at slowest safe speed. Firing or range clearance aircraft must be able to actually see ordnance impact areas. Explosive ordnance shall not be targeted to impact within 1,800 yd (1,646 m) of sighted marine mammals and sea turtles.
3. Aircraft may only conduct this exercise in Air 16 and 17 of W-122.

5.7.9 Air-to-Air Missile Exercises (explosive and non-explosive)

1. The geometry of missile exercises will be oriented in order to minimize the potential for debris to fall within 1,000 yards (914 m) of sighted marine mammals, sea turtles, algal mats, *Sargassum* rafts, and coral reefs.

5.7.10 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 ft or 0-36 m) and is executed by divers using scuba. NMFS issued a Biological Opinion in 2002 for underwater detonations of up to and including 20-lb explosive charges related to MINEX training (NMFS, 2002). These exercises utilize small boats that deploy from shore-based facilities. Often times these small boats are rigid-hulled inflatable boats (RHIBs) which 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 will survey the buffer zone, a 700 yd (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 3 parallel tracklines 219 yd [200 m] apart) using support craft will be conducted at the detonation location 30 minutes prior through 30 minutes post detonation. During late July through October, an additional surface observer will be added to more carefully look for hatchling turtles in the buffer zone. Aerial survey support will 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 will 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 will survey the area for sea turtles and marine mammals and will report any sightings to the surface observers. These animals will 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.
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.
9. Divers may only conduct underwater detonations (UNDET) in the designated UNDET Area within Area 15 of the Cherry Point OPAREA.

5.7.11 Mine Countermeasures – Minesweeping Using Equipment Towed by Helicopters

1. Use trained lookouts to survey for *Sargassum* rafts, sea turtles and marine mammals prior to and during the exercise.
2. Establish a 250 yd (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.

5.7.12 Inert Mine Shape Deployment

1. Known shipwrecks will be avoided when deploying inert mine shapes.
2. Known artificial and oyster reefs will be avoided when deploying inert mine shapes.

5.7.13 Anchorage of Ships

1. These requirements are not applicable if going to an assigned anchorage.
2. Avoid *Sargassum* rafts.
3. 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.
4. Ships will not anchor in areas of known shipwrecks.

5.7.14 Mitigation Measures Related to Acoustic Effects (Taken From the AFAST FEIS)

The AFAST Record of Decision, dated 23 Jan 2009, provides detailed discussion of mitigation measures to be employed during activities analyzed in the AFAST FEIS/OEIS. 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 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.

5.7.15 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 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.

5.7.16 Amphibious Operations

1. Range-specific standard operating procedures (e.g., directives that flora and fauna will not be needlessly damaged or destroyed) will be utilized during conduct of training to minimize damage to vegetation, wetlands, wildlife, and threatened or endangered species.
2. Prescribed routes to and from the ocean to the mainland at MCB Camp Lejeune and/or Eglin AFB during an amphibious landing will be followed.

5.7.17 Standing Operating Procedures for Range Control for Marine Corps Base Camp Lejeune (Areas N-1/BT3)

The following procedures were extracted from Range and Training Regulations (BO P3570.1B), *Standard Operating Procedures for Range Control*, Range Control Division, Training and Operations, Marine Corps Base, Camp Lejeune, North Carolina dated October 17, 2006. These actions are standard operating procedures that are currently in place and will be used in the future for all activities being analyzed in this EIS/OEIS.

1. Exercise play will incorporate and abide by the restriction presented in Base Order P3570.1B, *Standing Operating Procedures for Range Control*. Particular attention should be paid to Chapter 6, Environmental Procedures within the Range Control Standard Operating Procedures. All participating units will appoint an environmental coordinator who will attend a mandatory environmental briefing conducted by the host station. The environmental coordinator will be responsible for obtaining a copy of Base Order P3570.1B and all relevant environmental instruction, directives, and orders/handbook; ensure that all relevant environmental information is disseminated to participating troops; and ensure that all relevant environmental restrictions and/or guidance is followed.
2. The use of live ammunition is prohibited except at authorized target range complexes. Blank small arms ammunition will be issued and used. The use of chemical and riot agents is prohibited.

3. All ranges and training maneuver areas must be scheduled and approved in the Range Facility Management Support System (RFMSS) prior to use. Ranges that are close to the Atlantic Intracoastal Waterway (AIWW) or use the N-1/VT3 Impact Area and training or operations in the Atlantic Ocean Sector, to include Onslow Bay, must be scheduled at least 45 days prior to use to allow publication of a Notice to Mariners (NOTAM), coordination with external agencies, and scheduling of aircraft to perform an aerial sweep of the AIWW and Atlantic Ocean Sector prior to live firing, per the Code of Federal Regulations.
   - Training practice projectiles will not be fired to impact within 200 m of the AIWW.
   - HE bombs are not authorized.
   - Observation Posts, Bear Tower, and Onslow Beach North Tower, serve N-1/BT-3 and Brown's Island.
   - No class 3B and 4 Lasers are authorized.
   - Safety Restrictions: AIWW must be closed during firing.
   - Bear Tower and Onslow Beach North Tower must be scheduled in RFMSS, signed for, and manned prior to firing.
   - An aerial sweep of this area must include a sweep for people, small boats, and marine mammals in the AIWW. It must be conducted before live firing.
   - Night use is authorized after another aerial sweep.
4. While conducting Shore Bombardment, if marine mammals are observed within a 100-foot radius of the ship, operations will be suspended until the area has been cleared of marine mammals.
5. Flora and fauna will not be needlessly damaged or destroyed.
6. Hazardous Materials and Spills. Spills of hazardous materials, fuels, and POLs of any quantity on land and water must be reported promptly to the Base Fire Department by telephoning 911. After reporting the spill, the unit responsible will follow guidance received from the Base Fire Department or senior on-site Environmental Management Division representative and assist in clean up of the spill and management of the recovered product/contaminated soil.
7. Hovercrafts are required to follow prescribed routes to and from the ocean and mainland.
8. The AIWW may need to be closed for a maximum of three hours to facilitate moving exercise equipment from Onslow Beach to designated training areas. An existing crossing site normally used for such operations will be used. The crossing will be coordinated with, and approved by, the U.S. Army Corps of Engineers, and a NOTAM published to inform mariners of the closing times and dates. Most likely, equipment will be lightered (i.e., barged) across the Atlantic Intercoastal Waterway. Lightering support equipment across the waterway will allow the waterway to remain open with minimal delays to civilian/commercial boat traffic.
9. In accordance with Camp Lejeune Standard Operating Procedures, any fuel spill on land or any spill that produces a visible sheen on the water surface will be reported to the unit command to ensure implementation of the designated spill prevention control and countermeasure plan/spill contingency plan. The spilling unit will immediately report the spill to the Camp Lejeune Fire Department at extension 911 and Blackburn on the 38.60 FM, or telephone (910) 451-3064. The unit will follow clean-up and disposal instruction provided by the Fire Department or the Environmental Compliance Branch.
10. Camp Lejeune is known to be home to eight federally listed threatened or endangered species. The waters off Camp Lejeune provide seasonal habitat for seven listed marine mammal species,

including the West Indian manatee and North Atlantic right whale. Guidelines for boating and use of the N1/BT-3 impact area are given in the following sections.

- Unit Commanders, Officers-in-Charge, and Non-commissioned Officers-in-Charge will ensure strict compliance with applicable regulations regarding these protected species, as listed in Base Order 5090.11.
- Manatees. Manatees have occasionally been sighted in the waters adjacent to Camp Lejeune, including Mile Hammock Bay and the AIWW. Manatees can grow to 15 feet in length and are uniformly gray or gray-brown in color. They are very slow moving mammals; boat collisions are a significant source of manatee mortality, both from impact and propeller damage. Everyone conducting waterborne operations should be alert for possible manatee encounters. If a manatee is sighted, immediately slow to a no-wake sped. Allow sufficient room for the manatee and maneuver cautiously away from the encounter area. Do not approach the manatee. Report all sightings to the Camp Lejeune Fish and Wildlife Branch at 451-5063.
- Whales. The northward migration of the North Atlantic right whale, an endangered species, occurs from November 1 to April 30 every year. Females and calves can migrate as close as one-quarter mile off Onslow Beach.

  a. Prior to commencing live fire exercises in the N-1/BT-3 impact area, an air sweep must be conducted to ensure there are no whales in the impact area. Flyovers will be flown at 750 feet and consist of at least two survey lines 2 nm apart and parallel to the coast, with the first line 1-2 miles off the beach, and the second 3-4 miles off the beach. If a whale is spotted in the N-1/BT-3 impact area, the Environmental Management Division must be notified; firing cannot commence until the whale clears the impact area.

  b. If a whale is spotted, all live fire operations into coastal waters (N1/BT-3 Impact Area) shall be halted and Environmental Management Division notified at 451-5063. Live fire will not resume until an air sweep confirms the N1/BT-3 Impact Area is again clear.

  c. To further protect North Atlantic right whales, Range Control issues a daily warning order to trainers from November 1 through April 30 when North Atlantic right whales are present along the North Carolina coast. The warning order states:

     > ENDANGERED NORTH ATLANTIC RIGHT WHALES MIGRATE ALONG THE NORTH CAROLINA COAST ENROUTE TO AND FROM NEW ENGLAND AREAS USED PRIMARILY SPRING THROUGH FALL, AND GEORGIA/FLORIDA CALVING AREAS USED DURING WINTER. RIGHT WHALES, INCLUDING MOTHER/CALF PAIRS, CAN BE FOUND ¼ MILE OR MORE OFF ONSLOW BEACH FROM 1 NOVEMBER TO 30 APRIL. RANGE CONTROL REQUIRES RANGE SWEEPS DURING THIS PERIOD IN CONJUNCTION WITH LIVE FIRING EXERCISE INTO THE BT-3/N1 IMPACT AREA.

  d. All whale sightings (live or dead) must be reported to the Environmental Management Division, 451-5063. Environmental Management Division will distribute a Critical Sightings Program guide to all training crews operating offshore of Camp Lejeune.

11. Display warning signals from the Onslow Beach North and Bear Range Tower flag poles before firing until the range is cleared cold. Scarlet streamers will be flown during daylight and flashing red lights will be used from sunset to sunrise.

12. Position range guards with radio and binoculars (Night Vision Goggles for night firing) at least one half hour prior to the aerial search to serve as air/water sentries in Bear Range and Onslow Beach North Tower. Guards are to promptly notify the range officer in charge or Forward Air Controller (FAC) before a vessel or aircraft not engaged in the exercise penetrates the surface danger zone. Sectors of observation are: Bear Creek Tower 58 degrees to 223 degrees magnetic, and Onslow Beach North Tower 35 degrees to 235 degrees magnetic.
13. Firing will cease if streamers or flashing lights are lowered or extinguished for any reason.
14. Projectiles will not be fired to impact within 200 meters of the AIWW.
15. The using unit will ensure that a visual search has been made of the target complex, AIWW, inlets, marshes, dunes, and that the guard boats are in position half an hour prior to firing to ensure that the area is safe. The FAC may use aircraft as appropriate in conducting aerial search immediately prior to aircraft firing exercises.
16. The Range Safety Officer (RSO) is required to have positive and continuous communications with tower guards, the Range Officer in Charge (ROIC), guard boats, and the Range Control Duty Officer (RCDO) (BLACKBURN).
17. Air Operations.
    - Unless specifically authorized by the ROIC, the ordnance release point will be south of the AIWW.
    - A line 800 m from the seaward shore of the AIWW is designated as a permanent bomb line, beyond which aircraft ordnance may not be impacted.
    - Close air support operations will be under positive control of a FAC or the Air Support Radar Team (ASRT). The FAC/ASRT must inform aircraft performing missions of gun positions, ranges, and training areas adjacent to N-1/BT-3 that are occupied.
    - During nighttime close air support operations, when weather conditions are below a 2,000-foot ceiling and less than 5 miles visibility, or when range guards visually observe waterborne traffic in the AIWW or seaward for 1,000 m, aircraft firing or bombing exercises will not be permitted without continuous lighting by flares (or other measures approved by the Base Range Control Officer to ensure no vessels enter the surface danger zone.
18. For MCB Camp Lejeune, North Carolina, the Base Public Affairs Office will be designated to receive inquiries and/or comments from the public during the exercise period. Public Affairs Office Telephone Number is (910) 451-5655/7440.
19. Commander, Naval Air Force, Atlantic shall ensure that information in the proceeding paragraphs is promulgated to all participating exercise units and all shipcrew, aircrew, and bridge watchstanders are familiar with its contents.

5.7.17.1 Expeditionary Fighting Vehicle (EFV)

In the USFWS response to the Biological Assessment (DoN, 2008c), *Testing of the Expeditionary Fighting Vehicle Prototypes, Effects on Terrestrial Species at Marine Corps Base, Camp Lejeune, North Carolina*" dated August 7, 2008, the USFWS validated that EFV testing on Onslow Beach, the Base terrestrial training areas, "G" and "K" live fire ranges, Atlantic Intercoastal Water Way and New River would adhere to all stipulations of the SOP for Range Control contained in Base Order P3570.1B as seen in the previous section (USFWS, 2008).

5.7.17.2 Manatee Protection Measures

In the USFWS response to the Biological Assessment (DoN, 2008c), *Testing of the Expeditionary Fighting Vehicle Prototypes, Effects on Terrestrial Species at Marine Corps Base, Camp Lejeune, North*

Carolina" dated August 7, 2008 (DoN, 2008d), the USFWS directed that all water-based exercises would observe North Carolina Division of Marine Fisheries manatee protection measures (NCDMF, 2007) as follows:

If a manatee is seen within 300 ft of the active vessel movement, all appropriate precautions shall be implemented to ensure protection of the manatee. The precautions shall include the operation of all moving vessels no closer than 50 ft of a manatee. Operation of any vessels closer than 50 ft to a manatee shall necessitate immediately placing any motors in neutral or shutting them off. Activities will not resume until the manatee has departed the project area on its own volition. Manatees should not be herded away or harassed into leaving.

5.7.17.3 MCB Camp Lejeune Range Operations, Environmental Assessment

The EA addresses the proposed action, which is the preferred alternative, and the No Action Alternative. The No Action Alternative consists of continuing current training and range operations within the MCB Camp Lejeune Complex, at the current temp and intensity. Under the proposed action, the types of training operations at the MCB Camp Lejeune Range Complex will remain the same as those conducted today; however, certain components of training will increase. These increases include the following:

- 20 percent in small arms training; except .50 caliber arms;
- 33 percent in CH-53 rotary-winged helicopter sorties;
- 100 percent in AH-1 and UH-1 rotary-winged helicopter sorties;
- 10 percent MK-19 40-mm grenade rounds;
- 5 percent artillery, mortar, and other large arms;
- 39 percent tank rounds; and
- 33 percent tactical vehicle operations.

MCB Camp Lejeune has previously implemented extensive environmental protection measures for current range and training operations. These include policies and procedures that conserve and protect environmental resources: avoidance and minimization measures outlined in current Standard Operating Procedures; Best Management Practices, or actions already implemented as part of the Integrated Natural Resources Management Plan; Range and Training Regulations; Standing Operating Procedures for Range Control (Base Order P3570.1B [see Section 5.7.17]);, and the Environmental Handbook for Trainers. The proposed action will have no effects left unaddressed by these procedures and practices; thus, no new mitigation measures are required (DoN, 2009b).

5.7.17.4 MCAS Cherry Point Range Operations, Environmental Assessment

The MCAS Cherry Point EA proposed action would provide a training environment within the MCAS Cherry Point Range Complex with the capacity and capability to fully support required training tasks for operational units, military schools, and other users. The proposed action would accommodate future increases in the operational training tempo at the MCAS Cherry Point Range Complex; support existing warfare missions at the range complex; and maintain the long-term viability of the complex while protecting the environment. The proposed action (the preferred alternative) would require increases in training operations at existing ranges with the addition of an intermittently used, new water restricted area around BT-11, Piney Island. These training operations would be conducted within special use airspace and on land and water ranges within the existing range complex.

Under the proposed action, increased sorties and munitions expenditures associated with rotary-wing aircraft squadrons will take place in water restricted areas that are currently within a prohibited or restricted area of Pamlico Sound. An increase in .50 caliber weapons firing from helicopters and small boats will occur within a new, intermittent water restricted area, which currently has commercial, recreational, and state sponsored fisheries activities. The intermittent use of this area (estimated to be

five weekdays per month, for seven hours per day between 4 p.m. and 11 p.m., during each of approximately 10 months of the year; February through November) will result in periodic commercial and recreational fishing prohibitions for a maximum duration of 50 seven-hour periods (350 hours per calendar year). MCAS is planning to establish a phone number the public can call to find out whether the intermittent water restricted area is open or closed to further minimize the impacts to public use. The new intermittent water restricted area must go through the U.S. Army Corps of Engineers process for inclusion in the Code of Federal Regulations before these proposed actions can begin.

Continual monitoring of the ranges under the Range Environmental Vulnerability Assessment Program at MCAS Cherry Point will ensure that increased munitions usage under the proposed action will not have adverse impacts to water quality or pose a risk to human health and the environment. MCAS Cherry Point will employ several management approaches and protection measures that will minimize impacts to wetlands and floodplains. These measures include keeping vehicles on existing roads, prohibiting new road creation during exercises, and no authorization of extensive digging throughout the range complex.

The relatively low number of actual and predicted bird/wildlife aircraft strikes within the MCAS Cherry Point airspace indicates that the aircraft strike avoidance procedures already in place have been successful in the past and are expected to continue to be utilized under the proposed action. Laser usage would increase in training exercises under the proposed action and there is a potential for public mishaps; however, existing precautions to maintain public safety will be utilized. The public is notified of hazardous activities through the use of Notice to Airmen and Notice to Mariners. Prior public notification of Marine Corps training activities, use of known training areas, avoidance of non-military aircraft and civilians, and the remoteness of the training areas from coastal population centers reduces the potential for interaction between the public and military aircraft. To date, these strategies have been successful in maintaining public safety and are anticipated to continue to do so.

There are no identified mitigation measures for the proposed action alternative beyond the current Standard Operating Procedures, Best Management Practices, or actions already planned for in the Integrated Natural Resources Management Plan or other Air Station Orders and programs (DoN, 2009a).

5.8 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.

5.9 Measures considered but eliminated

As described in Chapter 3, the vast 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 have achieved 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 already 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 they might encounter during deployment and in combat, and be in a state of readiness that allow 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 all East Coast Range Complexes where feasible. For example, the Navy considered seasonal training restrictions related to North Atlantic right whale calving season and migration (December to April), particularly for Unit Level Training events involving explosive ordnance. However, these limitations would interfere with training missions and goals and would not provide the necessary exposure of personnel to the full spectrum of environmental conditions they may encounter during deployment and combat.

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 the Navy conducts in order 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 in order to man the observation decks or aircraft during that timeframe. There are severe space limitations onboard ships for berthing third-party crews, and there are no additional seats in aircraft that are involved in exercises. Overnight berthing of contractors and visitors are 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 are instead 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 vessels and slow, low-flying civilian aircraft operating in the same seaspace 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.

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 and MK-48s), the distance to the isopleth 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. Under this measure, NMFS considered a requirement for Navy to continue monitoring the exclusion zone throughout the exercise and to take appropriate mitigation measures during the exercise should a marine mammal be spotted within that zone.

5.10 Detection Probability and Mitigation Efficacy

5.10.1 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, 1989). 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, 1989). 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 5.10-1 provides a range of values for *g(0)* for cetacean species in the Navy Cherry Point 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.

5.10.1.1 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 East Coast Range Complexes 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.

Cetaceans

Large Whales

Species of large whales found in the Navy Cherry Point Study Area include all the baleen whales and the sperm whale. Baleen whales are generally large (adult size ranging from 9 to 27 m [30 to 89 ft]), often making them immediately detectable. Many species of baleen whales have a prominent blow ranging from 3 m (10 ft) to as much as 12 m (39 ft) above the surface. However, there are at least two species (Bryde's whale and common minke whale) that often have no visible blow. Baleen whales tend to travel singly or in small groups ranging from pairs to groups of five; the exception to this is the fin whale, which is known to travel in pods of seven or more individuals. However, all species of baleen whales are known to form larger-scale aggregations in areas of high localized productivity or on breeding grounds. Baleen whales may or may not fluke at the surface before they dive; some species fluke regularly (humpback whale, North Atlantic right whale), some fluke variably (blue whale, fin whale) and some rarely fluke (sei whale, common minke whale, and Bryde's whale). Baleen whales may remain at the surface for extended periods of time as they forage or socialize. North Atlantic right whales are known to form surface-active groups (SAG) and humpback whales to corral prey at the surface. Dive behavior varies amongst species, as well. Many species will dive and remain at depth for as long as 30 minutes. Some will adjust their diving behavior according to the presence of vessels (North Atlantic right whale, humpback whale, fin whale). Sei whales are known to sink just below the surface and remain there between breaths. Baleen whales have *g(0)* values ranging from 0.11 to 1.00 (Table 5.10-1).

Table 5.10-1 Range of Estimates for g(0) for Marine Mammal Species Found on the Atlantic Coast

g(0)[1]	Location	Platform	Source
Threatened/Endangered Cetacean Species			
Right whale (*Eubalaena* spp.)			
0.29-1.00	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.11-0.71	U.S. Atlantic Coast	Aerial	(Hain *et al.*, 1999)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.95	U.S. West Coast	Aerial	(Forney *et al.,* 1995)
Humpback (*Megaptera novaeangliae*)			
0.19-0.21	U.S. Atlantic Coast	Shipboard	(Palka, 2005a)
0.90-1.00	U.S. West Coast	Shipboard	(Barlow, 1995; Calambokidis and Barlow, 2004)
0.95	U.S. West Coast	Aerial	(Forney *et al.*, 1995)
0.26	Hawaii	Aerial	(Mobley *et al.*, 2001)
Blue whale (*Balaenoptera musculus*)			
0.41	U.S. West Coast	Aerial	(Barlow et al., 1997; Carretta, *et al*., 2000)
0.9-1.00	U.S. West Coast	Shipboard	(Barlow and Taylor, 2001)
0.92	U.S. West Coast	Shipboard	(Barlow and Forney, 2007; Forney, 2007)
Sei whale (*Balaenoptera borealis*)			
0.92	U.S. West Coast	Shipboard	(Barlow and Forney, 2007; Forney, 2007)
Fin whale (*Balaenoptera physalus*)			
0.32-0.94	U.S. Atlantic Coast	Shipboard	(Blaylock *et al*., 1995; Palka, 2006)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.90-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al. 1995)
0.90-1.00	Hawaii	Shipboard	(Barlow, 2003b)
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)

Table 5.10-1 Range of Estimates for g(0) for Marine Mammal Species Found on the Atlantic Coast (Continued)

g(0)[1]	Location	Platform	Source
Non-Threatened/Non-Endangered Cetacean Species			
Minke whale (*Balaenoptera acutorostrata*)			
0.31-0.70	U.S. Atlantic Coast	Shipboard	(Blaylock *et al*., 1995; Palka, 2006)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.25-0.90	Eastern North Atlantic	Shipboard	(Butterworth and Borchers,,1988; Øien, 1990; Schweder *et al*., 1991; Schweder and Høst, 1992; Schweder *et a*l., 1992; Schweder *et al*., 1997; Skaug and Schweder, 1999; Skaug *et al*., 2004)
0.84	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney *et al*., 1995)
0.63-0.83	Antarctic	Shipboard	(Doi *et al*., 1982; IWC, 1982, 1983)
Bryde's whale (*Balaenoptera edeni*)			
0.90-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.90	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Beluga (*Delphinapterus leucas*)			
None available.			
***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)
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)*
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)

Table 5.10-1 Range of Estimates for g(0) for Marine Mammal Species Found on the Atlantic Coast (Continued)

g(0)[1]	Location	Platform	Source
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)*
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)**
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)
Common dolphin (*Delphinus delphis*)			
0.52-0.95	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.79-0.81	Eastern North Atlantic	Shipboard	(Cañadas *et al*., 2004)
0.77-1.0	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)
Rough-toothed dolphin (*Steno bredanensis*)			
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Fraser's dolphin (*Lagenodelphis hosei*)			
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)

Table 5.10-1 Range of Estimates for g(0) for Marine Mammal Species Found on the Atlantic Coast (Continued)

g(0)[1]	Location	Platform	Source
White-sided dolphin (*Lagenorhynchus acutus and L. obliquidens*)			
0.27-0.38	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.77-1.00	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)
White-beaked dolphin (*Lagenorhynchus albirostris*)			
None available.			
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)
Harbor porpoise (*Phocoena phocoena*)			
0.35-0.73	U.S. Atlantic Coast	Shipboard	(Palka, 1995; Palka, 1996; Palka, 2006)
0.24-0.49	U.S. Atlantic Coast	Aerial	(Palka, 2005b)

Table 5.10-1 Range of Estimates for g(0) for Marine Mammal Species Found on the Atlantic Coast (Continued)

g(0)[1]	Location	Platform	Source
0.41-0.71	Eastern North Atlantic	Aerial	(Grünkorn *et al*. 2005)
0.08-0.85	U.S. West Coast	Aerial	(Barlow *et al*. ,1988; Calambokidis *et al*., 1993a; Forney *et al*. 1995; Laake *et al.*, 1997; Carretta *et al*., 2001; Carretta *et al*., 2007)
0.54-0.79	U.S. West Coast	Shipboard	(Calambokidis *et al*., 1993b; Barlow 1995; Carretta *et al*., 2001)
Non-Threatened/Non-Endangered Pinniped Species			
Harbor seal (*Phoca vitulina*)			
.28	U.S. West Coast	Aerial	(Barlow *et al*., 1997; Carretta *et al*. 2000)

*These numbers were either determined by the source or applied by the source for abundance/density estimation analyses in the particular geographic location.

[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.

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 5.10-1).

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), dwarf and pygmy sperm whales (*Kogia* spp.), and harbor porpoises.

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 East Coast 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 5.10-1).

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 5.10-1).

Harbor porpoises are better known than beaked whales and *Kogia* spp., but are considered to be cryptic because they are difficult to detect in all but the best of conditions (i.e., no swell, no whitecaps). Harbor porpoises travel singly or in small groups (less than six individuals), but may aggregate into groups of several hundred. They are inconspicuous at the surface, rarely lifting their heads above the surface and often lying motionless. They are small and may actively avoid vessels. Harbor porpoises have *g(0)* values ranging from 0.08 to 0.85 (Table 5.10-1).

Delphinids

There are 18 species of the family Delphinidae that may occur in the East Coast 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, white-beaked dolphins, white-sided dolphins, bottlenose dolphins, Stenellid dolphins, common dolphins, and Fraser's dolphins are known to either actively approach and investigate vessels, or bow ride along moving vessels. Fraser's dolphins and common 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, pantropical spotted dolphins, common 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 5.10-1).

Miscellaneous

Beluga whales may occur in the East Coast Range Complexes and would probably be detected by observers. Belugas have an extremely conspicuous coloration (all white) and reach up to 5 m (16 ft) in total length. They travel in groups ranging from 15 individuals to thousands. They dive for lengths of up to 25 minutes, but are one of the most vocal cetaceans and would likely be detected acoustically. There are no *g(0)* values available for beluga whales.

Pinnipeds

There are no sea lions in North Atlantic waters. Seals are more difficult to detect at sea than cetaceans. They are much smaller, often solitary and generally do not engage in conspicuous surface behavior. There is not a lot of information regarding seal behavior at sea. Some species, such as harbor seals, are known to approach and observe human activities on land or on stationary vessels. Harbor seals and gray seals are solitary at sea. Harp seals appear to be an exception, traveling in large groups at the surface and churning up whitewater like dolphins. Gray seals are known to rest vertically at the surface with only the head exposed. Pinnipeds may be long divers; gray seals may dive for as long as 30 minutes and hooded seals for up to 60 minutes. The only *g(0)* values available for pinnipeds occurring in the East Coast Range Complexes are for the harbor seal. They have a *g(0)* value of 0.28 (Table 5.10-1).

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).

Most information on pinnipeds is gleaned from studies done while individuals are hauled-out on land or on ice. Systematic at-sea sightings information is limited, so a *g(0)* value is available only for harbor seal (Carretta *et al*., 2000). Pinnipeds have a low profile, no dorsal appendage and small body size in comparison with most cetaceans, limiting accurate visual detection to sea states of less than Beaufort 2 (Carretta *et al*., 2000).

5.10.1.2 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.

CHAPTER 6 : CUMULATIVE IMPACTS

6.1 APPROACH

The Navy's past experience in preparing cumulative impacts analyses under the National Environmental Policy Act of 1969 (NEPA) was utilized in determining the scope and format of the cumulative impacts analyses presented within this chapter of the Navy Cherry Point Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS).

The approach taken in the analysis of cumulative impacts follows the objectives of NEPA and CEQ regulations and 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 …cumulative 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 this 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 support and conduct current and emerging training and Research, Development, Testing, and Evaluation (RDT&E) operations in the Navy Cherry Point Range Complex. This Complex consists of targets and instrumented areas, airspace, and surface and subsurface operating areas (OPAREAs). The activities analyzed in this document include current and future proposed Navy

and Marine Corps training and RDT&E operations within Navy and Marine Corps-controlled OPAREAs, airspace, and ranges, and Navy-funded range capabilities enhancements.

The proposed action will not make radical changes to the Navy Cherry Point Range Complex facilities, operations, training, or RDT&E capabilities. 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 and Marine Corps are to maintain a state of military readiness commensurate with their 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 Navy Cherry Point 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 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 the 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 the threshold triggers associated with the environmental response.

6.1.2 Organization of Chapter 6

Presenting past, present and reasonably foreseeable future actions and their potential impacts can be very confusing. The following organization may 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; other non-military federal and state agency activities, including scientific research efforts, are presented in Section 6.2.2; military operations are in Section 6.2.3. Reasonably foreseeable future actions relevant to the Proposed Action are presented in Section 6.3. This 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. Each resource area in Chapter 3 of this EIS/OEIS is discussed in this section and impacts referenced in Sections 6.2 and 6.3 are incorporated, if relevant. 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 affect the resources identified in Chapter 3. The overview of these actions in this section emphasizes components of the activities that are relevant to the effects analysis in Chapter 3. Geographic distribution, intensity, duration, and the historical effects of similar activities are considered when determining whether a particular activity may contribute cumulatively and significantly to the impacts

on resource areas identified in Chapter 3. The past and present actions discussed in this section are based upon the best available data available to the public as of December 1, 2008.

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 and FWC, 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.

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).

6.2.1.1 Commercial and Recreational Fisheries – Atlantic Ocean, Offshore of the Southeastern United States

In 2006, commercial fishing off the southeastern U.S. Atlantic coast brought in 540 million pounds of fish with a value of $249 million (NMFS, 2007c). Examples of fish caught include menhaden, flounder, mackerel, crab, sea scallops, and shrimp. Recreational anglers brought in approximately 71 million pounds of fish in 2006 (NMFS, 2007c).

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, 2007d

*Some Caribbean fisheries are included in this number

6.2.1.2 Cruise Ship/Passenger Ship Operations

Just north of the Cherry Point OPAREA is Norfolk, VA which is a cruise terminal for several cruise ship operations. Norfolk was recently named "Best Up-and-Coming U.S. Homeport" by *Porthole Cruise Magazine.* The terminal is expected to serve over 100,000 cruise passengers to its new state-of-the-art facility, the Half Moon Cruise and Celebration Center. In addition to bringing the obvious economic benefits to the region, they also add volume to ocean traffic and contribute 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 nm of shore, certain types of garbage between 3-25 nm offshore, and discharging plastic anywhere), and the Clean Water Act (prohibits discharging pollutants from a point source into waters of the US) to name a few.

6.2.1.3 Marine Ecotourism (Whale-Watching and Dolphin-Watching)

Migrating baleen whales may be affected by whale-watching activities off the East Coast as well as in the Caribbean (Hoyt, 1995). 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 (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.

6.2.2 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 Minerals Management Service (MMS), within the Department of the Interior, manages the mineral resources of the federal offshore lands of the Outer Continental Shelf (OCS). MMS leases OCS lands to commercial companies for the exploration, extraction, and production of mineral resources. The Atlantic OCS area is divided into four planning areas along the Atlantic seaboard: the Atlantic Ocean, Mid-Atlantic, South Atlantic, and the Straits of Florida (MMS, 2007a).

For the past 26 years leasing of specific portions of the Federal OCS has been prohibited via the annual Congressional appropriations process (e.g. Congress not appropriating funds for MMS to conduct leasing for the specified OCS areas). From 1982 to 1992, Congress supported annual moratoria in specific OCS areas off the coast of California, the North Atlantic, the Mid-Atlantic, the Eastern Gulf of Mexico and all of the North Aleutian Basin (EIA, 2005).

In 1990, President George H. W. Bush issued a Presidential Directive that enacted a blanket moratorium until 2000 on all unleased areas offshore Northern and Central California, Southern California except for 87 tracts, Washington, Oregon, the North Atlantic coast, and the Eastern Gulf of Mexico coast. Separate from the annual moratoria in appropriations legislation, this directive meant that no leasing or pre-leasing activities were allowed to occur in these areas during the entire period. In 1998, President Clinton extended the moratorium through 2012 (EIA, 2005).

On August 8, 2005, President George W. Bush signed into law the Energy Policy Act of 2005. This legislation has several provisions that pertain to natural gas and oil development including alternative energy related projects in offshore areas. Of note, the Act requires MMS to conduct a comprehensive inventory and analysis of the estimated natural gas and oil resources on the OCS. The inventory includes moratoria areas which were closed to natural gas and oil leasing. Several provisions in the Act provide increased incentives for natural gas and oil development in offshore areas in order to maintain and stimulate production. Finally, the Energy Policy Act of 2005 granted authority to MMS to manage and oversee alternative-energy related projects on the OCS. Prior to this provision, there was a gap in the law with respect to alternative energy projects (EIA, 2005).

In April 2007, MMS published the Proposed Final Program (PFP) Outer Continental Shelf Oil and Gas Leasing Program 2007-2012 in conjunction with the Final FEIS 2007-2012 OCS Oil and Gas Leasing Program (MMS, 2007b; 2007c). The FEIS evaluated the possible environmental affects of a proposed leasing program that includes the entire area offshore the coast of Virginia, the Gulf of Mexico, the North Aleutian Basin, and the Chukchi Sea.

In October 2007 MMS released a final programmatic EIS supporting the establishment of a program for authorizing alternative energy and alternate use (AEAU) activities on the OCS, as authorized by Section 388 of the Energy Policy Act of 2005 (EPAct), and codified in subsection 8(p) of the Outer Continental Shelf Lands Act (OCSLA) (MMS, 2007d). 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. Under the program, MMS has jurisdiction over AEAU projects on the OCS including, but not limited to: offshore wind energy, wave energy, ocean current energy, offshore solar energy, and hydrogen generation. MMS will also have jurisdiction over other projects that make alternate use of existing oil and natural gas platforms in Federal waters on the OCS. Future AEAU activities on the OCS will be evaluated by the Navy on a case by case basis to determine if operational conflicts with Navy activities may exist in a specific area.

MMS issued the Record of Decision to establish the AEAU program by selecting the Preferred Alternative described in the Final programmatic Environmental Impact Statement. This decision

establishes an AEAU program for issuance of leases, easements, and rights-of-way (ROWs) on the OCS for alternative energy activities and the alternate use of structures on the OCS. The Preferred Alternative also provides MMS the option to authorize, on a case-by-case basis, individual AEAU projects that are in the national interest prior to promulgation of the final rule. At the same time, the MMS stated it would vigorously pursue its efforts to complete a comprehensive program with regulations for authorizing and managing AEAU activities on the OCS. Upon promulgation of the final rule, MMS leases, easements, and ROWs for AEAU activities on the OCS would be issued subject to the rule's provisions. On July 9, 2008, MMS issued the proposed regulations for establishing a program to grant leases, easements, and rights-of-ways for alternative energy on the OCS. MMS is working toward issuance of several leases for data gathering and technology testing. These leases will look at varied renewable energy sources in different portions of the OCS (MMS, 2008f).

On July 14, 2008, President Bush removed the executive prohibition on producing oil from the OCS that was in effect until 2012, as mentioned earlier, and requested that Congress take action to lift the restrictions in order to give states the option to recommend the opening of the OCS off their coasts to environmentally responsible exploration (The White House, 2008). In September 2008, the congressional ban on offshore drilling was allowed to expire (Washington Post, 2008).

Many Section 7 consultations have been completed on MMS activities. Until 2002, Biological Opinions (BOs) resulting from Section 7 consultations concluded that one take of sea turtles may occur annually due to vessel strikes. Biological Opinions issued on July 11, 2002 (lease sale 184), November 29, 2002 (multi-lease sales 185, 187, 190, 192, 194, 196, 200, and 201), and August 20, 2003 (lease sales 189 and 197), have concluded that in addition to vessel strikes to sea turtles, adverse effects may occur from seismic surveys and expended materials. Explosive removal of offshore structures may adversely affect sea turtles and marine mammals (USAF, 2005).

In April 2006, MMS applied for a Letter of Authorization (LOA) from NMFS to "take" by harassment a small number of marine mammals, incidental to explosive removal of offshore structures in the Gulf of Mexico (NMFS, 2006a). In this application it was estimated that Level A harassment takes would be five dolphins over the course of five years, and Level B harassment takes would be 457 dolphins and whales combined per year (NMFS, 2006a). However, it was stated that these numbers would be much lower in actuality due to the implementation of mitigation measures (NMFS, 2006a).

In April 2007, a final rule was printed in the Federal Register by MMS requiring the lessees to provide information on how they will conduct their proposed activities in a manner consistent with the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) (MMS, 2007e). Each lessee would be required to employ monitoring systems and mitigation measures, submit biological environmental reports and environmental effects analyses, and obtain its own authorized incidental "take" permits from NMFS (MMS, 2007e).

6.2.2.2 MMS Regulated Activities – Atlantic Ocean, Offshore of the Southeastern United States

The southeastern Atlantic Coast is divided by MMS into three planning areas: Mid-Atlantic, South Atlantic, and Straits of Florida. These areas combined cover 208,477 nm^2 (715,970 km^2) from Delaware to the southern most tip of Florida. From 1959 until 2000, 307 blocks (2,484 nm^2 or 8,531 km^2) were leased (MMS, 2007f). There are currently no active leases and no activity in this area (MMS, 2007c).

6.2.2.3 Dredging Operations

The construction and maintenance of federal navigation channels are ongoing activities on the U.S. Atlantic coast. NMFS has 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 has issued BOs with the U.S. Army Corps of Engineers (USACE) for the U.S. Atlantic coast and the Gulf of Mexico and has concluded that the 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.

6.2.2.4 Commerce and Shipping Lanes

The waters off the U.S. Atlantic coast support a large volume of maritime traffic heading to and from foreign ports as well as traffic traveling north and south to various U.S. ports. Commercial shipping comprises a large portion of this traffic, and a number of commercial ports are located along the Atlantic U.S. coast.

The Cherry Point (CHPT) and Jacksonville/Charleston (JAX/CHASN) OPAREAs are in the direct path of commercial shipping traffic traveling between New York, Boston, and Miami and other ports in the southeast. There are seven major shipping lanes in the JAX/CHASN and CHPT OPAREAs. Most of the lanes are parallel to the coastline but several branch off the main routes where they approach major shipping ports (DoN, 2008a).

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 affect marine mammals' use of sound for communication and hunting.

6.2.2.5 Ship Strikes

NMFS 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, 2004). 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 in order to restore 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. These species include fin whales, right whales, humpback whales, sperm whales, and gray whales. Of these, fin whales are hit most frequently. On the East Coast of North America, ship strikes remain a significant threat to some whale populations. For North Atlantic right whales, for example, ship strikes are believed to be a significant factor limiting the recovery of this species (Knowlton and Kraus, 2001).

A review of recent reports on ship strikes provides some insight regarding the types of whales, locations and vessels 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, 2004). The report also notes that these totals represent a minimum number of collisions, because the vast majorities go 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 number of crew.

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. Military crew sizes are also much larger than those of merchant ships, and they 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 more likely to detect any strike that occurs, and these agencies' standard operating procedures include reporting of ship strikes. Overall, the percentage of Navy traffic relative to other large shipping traffic is very small (on the order of 2 percent).

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, 2004), 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 Atlantic Ocean right whales in particular (Jenson and Silber, 2004).

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) in communication to each other (NMFS, 2006b). 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, 2006b). 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).

6.2.2.5.1 Implementation of Vessel Operational Measures to Reduce Ship Strikes to North Atlantic Right Whales

In August 2008, NMFS released a Final EIS to analyze the potential effects associated with the implementation of vessel operational measures in waters off the East Coast of the United States to reduce vessel collisions with the endangered North Atlantic right whale (NMFS 2008a). The proposed action addresses the lack of recovery of the North Atlantic right whale population by reducing the probability and threat of ship strike related deaths and serious injuries to the species.

Due to regional differences in right whale distribution and behavior, oceanographic conditions, and ship traffic patterns, the proposed vessel operational measures would apply only in certain areas and at certain times of the year, or under certain conditions. To account for regional variations, the U.S. East Coast is divided into three regions: northeastern United States (NEUS), mid-Atlantic United States (MAUS), and southeastern United States (SEUS). All vessels 65 ft (19.8 m) and greater in overall length and subject to US jurisdiction would be required to abide by the operational measures, except for vessels owned or operated by, or under contract to the Federal government, and law enforcement vessels of a state, or political subdivision thereof, when engaged in enforcement or human safety missions. An additional exemption would apply for vessels to maintain safe maneuvering speed under certain conditions. The measures considered include the following:

- **Seasonal Management Areas (SMAs).** SMAs are predetermined and established areas within which seasonal speed restrictions apply.
- **Dynamic Management Areas (DMAs).** DMAs are temporary areas consisting of a circle around a confirmed right whale sighting. The radius of this circle expands incrementally with the number of whales sighted and a buffer is included beyond the core area to allow for whale movement. Speed restrictions apply within DMAs, which may be mandatory or voluntary and apply only when and where no SMA is in effect.
- **Routing Measures.** These consist of a set of routes designed to minimize the co-occurrence of right whales and ship traffic. Use of these routes is voluntary; therefore, they constitute a non-regulatory measure. However, mandatory speed restrictions would apply in the portions of the routes located

within an active SMA. NMFS would monitor these routes and consider making them mandatory if use is low.

Within the proposed SMAs (when in effect) and DMAs (when in effect), NMFS' proposed restriction is 10 knots/hour (kn) (19 kilometers/hour [km/hr]); however, for comparison purposes, the FEIS also considers speed limits of 12 and 14 kn (22 and 26 km/hr). The following six alternatives were considered:

1. Alternative 1-No Action.
2. Alternative 2-Mandatory DMA.
3. Alternative 3-Speed restrictions in designated areas.
4. Alternative 4-Recommended shipping routes.
5. Alternative 5-Combination of Alternatives 1 through 4.
6. Alternative 6-Proposed Action and Preferred Alternative.
   - In the SEUS region, Southeast SMA and recommended routes.
   - In the MAUS region, separate SMAs (20 nm [37 km] SMAs option).
   - In the NEUS region, Cape Cod Bay SMA, Off Race Point SMA, and Great South Channel GSC SMA, as well as recommended routes.
   - In all three regions, Voluntary DMAs.

Not all vessel operation measures are considered for all regions. The specific measures considered for each of the regions of the VACAPES Study Area implementation are shown in Table 6.2-2.

TABLE 6.2-2
SUMMARY OF PROPOSED OPERATIONAL MEASURES BY REGION

Region	Proposed Measures	Period of Application	Alternative
Southeast	Southeast SMA off the coast of Georgia and Florida, bounded to the north by latitude 31º27'N, to the south by latitude 29º45'N, to the east by longitude 80º51.6'W, and to the west by the shoreline.	November 15 to April 15	6
	or		
	SMA including all waters within the Mandatory Ship Reporting System WHALESSOUTH reporting area and the presently designated right whale critical habitat	November 15 to April 15	3 and 5
	and/or		
	Recommended routes into and out of the ports of Jacksonville and Fernandina Beach, Florida, and Brunswick, Georgia.	Year-round	4, 5, and 6

The EIS analyzed potential effects to the North Atlantic right whale, other marine species, physical environment, port areas and vessel operations, commercial fishing vessels, ferry vessels and ferry passengers, whale-watching vessels, charter vessels, environmental justice, and cultural resources. For the purposes of the cumulative impacts analysis in this EIS/OEIS, the Preferred Alternative, Alternative 6, will be discussed. It was determined that there would be a direct positive effect on right whale populations and indirect positive effects on marine mammals and sea turtles. In addition, implementation of Alternative 6 would result in negligible impacts on water quality in the NEUS had minor adverse impacts in the SEUS, as well as minor, direct positive effects to ocean noise. There

would be only minimal impact on the financial revenues of port vessel operators, commercial fishing vessels, and charter vessels. There would be annual financial adverse effects to ferry vessels and ferry passengers and whale-watching vessels. There were no environmental justice concerns identified and no effects to cultural resources (NMFS, 2008b).

In addition, NMFS has promulgated a Final Rule to implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic right whale population effective December 9, 2008 through December 9, 2013, speed restrictions of no more than 10 kn (18.5 km/hr) will apply to all vessels 65 ft (19.8 m) or greater in overall length in certain locations and at certain times of the year along the east coast of the U.S. Atlantic seaboard (NMFS, 2008b). Also see 50 Code of Federal Regulations 224.105 (2008). The purpose of the regulations is to reduce the likelihood of deaths and serious injuries to North Atlantic right whales that result from collisions with ships. These restrictions are not mandatory for naval vessels as stated by NMFS since it was recognized that national security, navigational, and human safety missions of some federal agencies may be compromised by mandatory vessel speed restrictions. The Navy currently implements mitigation measures to address ship strikes; and, NMFS has stated that most of these measures are similar to, if not more stringent than, the measures considered in the Final Rule.(NMFS, 2008a, see section 2.4.8. and Appendix A of the NMFS EIS).

6.2.2.6 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 6.2-3, expended fishing line was responsible for nearly half of all entanglements, followed closely by rope and fishing nets (OC, 2007). This is an annual effort by the Ocean Conservancy and the summary of animals entangled in expended materials is published annually.

Table 6.2-3
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

There are several events that promote cleaning up debris along shorelines (ocean and river) in and around Marine Corps Base Camp Lejeune and Marine Corps Air Station New River to include *Beach Sweep* (April 2007-2009) at Onslow Beach, *Operation Spring Clean* (April 2005-2008) and *Operation Big Sweep* (October 2002-2008) at New River shoreline from the MCASNR O'Club to the marina, and *Southwest Creek Paddle Cleanup* (April 2007 and October 2008) to clean-up from Highway 17 to the marina. Marines and civilian employees regularly participate in these events as well as volunteering in the local big sweep events held at the beach along Topsail and Emerald Isles and participate with the *Stewards of the White Oak River Basin* by paddling the New River and tributary creeks picking up litter and debris.

6.2.2.7 Scientific Research

Scientific research on protected species such as marine mammals and sea turtles and studies on the marine environment in general occur throughout the world. For targeted research on particular species regulated by NMFS and the USFWS, a scientific research and enhancement permit is required for any proposed research activity that involves the "take" of a marine species. Scientific Research and Enhancement Permits are required for research that results in the take of marine mammal species or involves any ESA-listed species that are not covered by the General Authorization. Permits cover a five-year period. The most recent permit was issued by NMFS in August 2007 for activities being conducted by NMFS's Office of Science and Technology. The permit authorizes research on marine mammals in waters to the east of Andros Island, Bahamas. Activities include the attachment of tags to and photography of cetaceans, and exposing them to sound, particularly from mid-frequency sonar. Additional permits authorized that are of particular interest in the Navy Cherry Point Study Area include a wide variety of research activities on right whales. NMFS is currently analyzing the cumulative effects of these authorizations in the proposed Programmatic EIS on Northern Right Whale Research.

The 1994 amendments to the MMPA authorized, under a General Authorization, 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 (305 m) (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.

6.2.2.8 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 mortality activities (die-offs) have been reported for cetaceans. Biotoxins, viruses, bacteria, and El Nino 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.* (1989) concluded that the whales died from saxitoxin poisoning after consumption of Atlantic mackerel containing the toxin. During the summer of 2003, 17 humpback whales, 3 fin whales, 1 minke whale, 1 long finned pilot whale, and 3 whales of undetermined species were found dead in the vicinity of Georges Bank. Although a biotoxin (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, 2005).

6.2.3 Military Operations

This section will discuss past and present military operations occurring within the Navy Cherry Point Study Area. Specifically, the first three sections will discuss military exercises generally since these activities are associated with ESA Section 7 consultations with NMFS. In addition, this section will also discuss the Navy's Tactical Training Theater Assessment and Planning Program, which focuses on the sustainability of ranges, OPAREAs, and special use airspace within the Navy Cherry Point Study Area.

6.2.3.1 Sinking Exercise of Surface Targets

A Sinking Exercise of Surface Targets (SINKEX) is defined as the use of a vessel as a target or test platform against which live ordnance is fired. The purpose of a SINKEX is to train personnel, test weapons, and study the survivability of ship structures. The result is the sinking of the vessel. SINKEX operations differ from ship shock trials in that the warheads used in a SINKEX are significantly smaller. The environmental considerations of a SINKEX are associated with the weapons used. The exact amount of ordnance and the type of weapon used in a SINKEX is situational and training-need dependent (DoN, 2006a).

The potential expended materials created during a SINKEX are metals from the sunken vessel and shell fragments. Disposable plastics and other materials that could be considered marine debris are removed from the vessel prior to conducting a SINKEX. Expended material associated with the target vessel would not include ropes, lines, plastic or other materials with the potential to ensnare or entangle marine animals. All expended materials would sink rapidly to the ocean floor and since SINKEXs would not be continuously conducted within the same areas the sunken debris would settle over a large area. The minimal amount of materials settling to the ocean floor would not affect the sediment stability of the ocean floor or cause disturbance to natural ocean processes (DoN, 2006a).

In the late 1980's, Polychlorinated biphenyls (PCBs) was raised as a potential environmental issue. Some of the materials (i.e., insulation, wiring, felts and rubber gaskets) present on the targeted vessels were confirmed to contain PCBs. As a result, the Navy has been removing the majority of the materials containing PCBs prior to conducting a SINKEX event. However, it is still estimated that even after removal activities any given target vessel sunk during a SINKEX could contain up to 100 lbs (45 kg) of PCBs. In an effort to determine if the remaining PCBs would be an environmental issue, the Navy begun conducting a PCBs monitoring study in 1995 on sunken Navy vessels. The monitoring study has not been completed but as of November 2006 it was determined that enough data had been gathered and transferred to the EPA to indicate that there was little likelihood that PCBs from sunken Navy vessels would present an unacceptable risk to the environment or human health. The Navy SINKEX Program currently holds a General Permit from the EPA under the Marine Protection, Research and Sanctuaries Act for conducting SINKEX activities (40 CFR 229.2).

The U.S. Navy submitted a Biological Assessment (BA) to the National Oceanic and Atmospheric Administration (NOAA) pursuant to compliance with the ESA. NOAA concluded that SINKEXs in the western Atlantic Ocean are not likely to jeopardize the continued existence of ESA listed species in a BO dated September 22, 2006 (NMFS, 2006c).

The Navy submitted a Biological Assessment (BA) to the National Marine Fisheries Service (NMFS) pursuant to compliance with the ESA. NMFS concluded that SINKEXs in the western Atlantic Ocean are not likely to jeopardize the continued existence of ESA-listed species in a BO dated September 22, 2006 (NMFS, 2006c). The incidental take statement (ITS) included with the opinion exempts the take of listed sea turtle species if the reasonable and prudent measures and terms are implemented. The ITS does not include exemption of take of any ESA-listed whales.

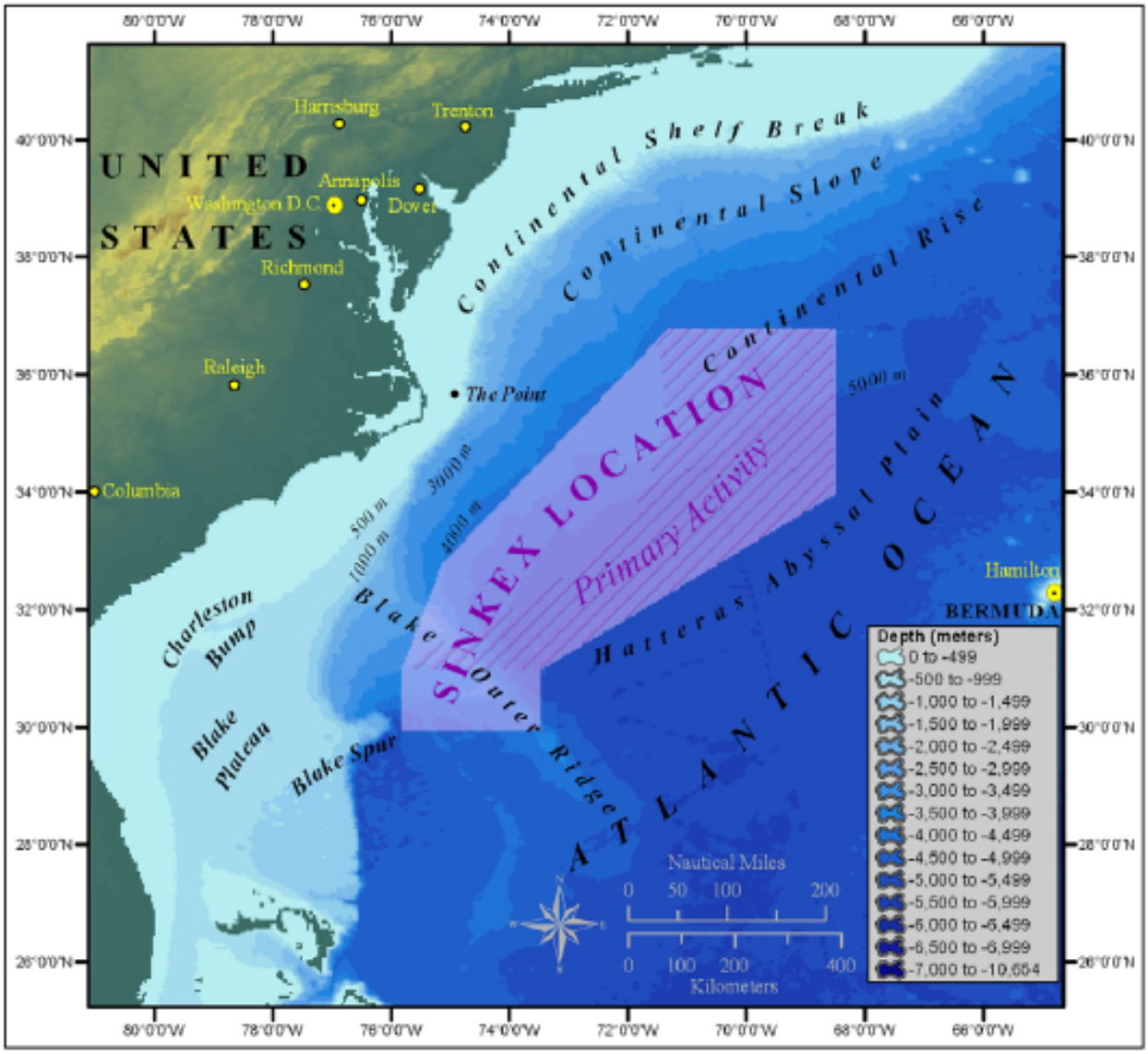
The action area would be in the open ocean areas off the Virginia, North Carolina, and South Carolina coasts. The area can be described as 2 to 4-degrees wide in a contour between latitudes 37°00' and 30°00'N that follows the Exclusive Economic Zone (EEZ). SINKEXs would usually be conducted within the "Primary Activity" zone as indicated in Figure 6.2-1. Vessels would be traveling from ports along the mid-Atlantic of the United States to the exercise locations in the western North Atlantic. The mid-Atlantic area includes the coast from Block Island Sound in Rhode Island southward to South Carolina. These areas are also part of the action area, but the focus of the analysis is the location where the SINKEXs would take place (NMFS, 2006c).

After reviewing the current status of the blue, fin, humpback, northern right, sei, and sperm whales and the green, hawksbill, Kemp's ridley, loggerhead, and leatherback sea turtles, the environmental baseline for the action area, the effects of the proposed research program, and the cumulative effects, it was NMFS's biological opinion that the SINKEXs in the western Atlantic Ocean are not likely to jeopardize the continued existence of these species. Critical habitat has not been designated in the action area so critical habitat will not be destroyed or adversely affected by the proposed action (NMFS, 2006c).

6.2.3.2 Marine Base Camp Lejeune Range Operations

The Marine Corps has been conducting training operations in the MCB Camp Lejeune Range Complex for more than 60 years. Training operations currently conducted in the MCB Camp Lejeune Range Complex generally fall within three categories: munitions firing; movement of personnel, vehicles, and aircraft; and support. Within these categories, training activities occur in three types of ranges at MCB Camp Lejeune Range Complex: land, water, and special use airspace. For a more detailed description see Section 1.5.2. An environmental assessment was prepared (DoN, 2009a) to evaluate the potential environmental consequences from current and emerging training operations at the MCB Camp Lejeune Range Complex. The no action alternative of the proposed action includes a description of past and present training operations at MCB Camp Lejeune. For a description of current operations see Section 2.1 of the referenced document. Currently in place at MCB Camp Lejuene, there are avoidance and minimization measures to protect the following threatened and endangered species:

- Seabeach amaranth
- Rough-leaved Loosestrife
- Red-cockaded Woodpecker
- Piping Plover
- American Alligator
- Nesting Sea Turtles
- West Indian Manatee



Source: NMFS, 2006c

Figure 6.2-1 SINKEX Location

There are existing biological opinions that address the Red-cockaded Woodpecker, Piping Plover, and nesting sea turtles. For additional information see Section 4.1.6.3 of the MCB Camp Lejuene EA (DoN, 2009a).

Training operations have the potential to directly or indirectly affect archaeological and architectural resources eligible for listing on the National Register of Historic Places. Within the land ranges and maneuver areas both current training activities and the increased activities of the proposed action involve ground disturbing activities. MCB Camp Lejeune manages the risk to cultural resources from these activities through range standard operating procedures and user education, training area inspections, and marking of resources known to be eligible for inclusion on the National Register of Historic Places.

Water range activities have a low potential to affect underwater archaeological resources; submerged artifacts are unlikely to be affected by munitions firing since the vast majority of rounds impacting the

water are non-explosive small arms rounds whose momentum will likely be insufficient to disturb buried items on the river or sea floor. Current and proposed training activities will involve minimal high explosive firing with the potential to impact the waters of the BT-3 impact area, and there are no known shipwrecks in the BT-3 impact area.

Current and proposed military use of the waterways around MCB Camp Lejeune is expected to cause only short-term and extremely localized disturbances of sediments and water column. These actions are unlikely to affect aquatic life or water quality. Increased training and munitions expenditures will have minor impacts on wetlands. Wetland and floodplain areas on the Base downrange of firing points receive some portion of fired rounds and this impact may alter the vegetative community, but is not sufficient to cause long-term changes to the soils, hydrology, or extent of wetlands or floodplains.

The proposed action will have negligible impacts on marine birds, marine invertebrates, and fish. Impacts will be direct, including disturbance of individual animals during firing and movement on surface waters, but these disturbances will be short-term and infrequent, and therefore will have no population level or long-term effects. The Integrated Natural Resources Management Plan addresses

Current training and range activities have the potential to incur incidental effects on species that are federally protected under the Endangered Species Act. Critical habitat does not exist within the action area of this environmental assessment. ESA Section 7 consultations are pending concerning the seabeach amaranth, rough-leaved loosestrife, nesting sea turtles (loggerhead, leatherback, and green sea), Red-cockaded woodpecker, piping plover, and the West Indian manatee. The proposed increases in training discussed earlier in this section will not be implemented until the ESA Section 7 have been completed with USFWS and NMFS.

Potential disturbances to the West Indian manatee from activities associated with the Preferred Alternative would be similar to those discussed for the No Action Alternative (DoN, 2009a). This species is not known to occur commonly in the project area, and as a result, effects from the Preferred Alternative which includes an increase in training activities in this area would lead to a slightly higher likelihood of adverse impacts than the No Action Alternative. The Preferred Alternative may affect, but is not likely to adversely affect the West Indian manatee.

The West Indian manatee is occasionally sighted near the New River Inlet and the surrounding beaches, and has the potential to occur in other nearshore areas at MCB Camp Lejeune. Sightings are not common, but appropriate habitat is abundant in the project area. Vessel strikes to manatees are common in general, as this species is slow-swimming with the exception of small bursts of speed. Precautionary measures implemented for sea turtles and marine mammals would be the same for the West Indian manatee, including halting training activities upon sighting a manatee. Due to the low probability of an amphibious vehicle, small boat, or munitions strike, the low occurrence of this species in the project area, and the preventative measures in place, the activities associated with the No Action Alternative may affect, but are not likely to adversely affect the West Indian manatee.

Preventative measures to avoid harm to the West Indian manatee include those described for marine mammals in general in addition to several specifically in place for the manatee. To avoid harm to the West Indian manatee, the procedures as outlined in the *Range and Training Regulations, Standing Operative Procedures for Range Control* (Base Order P3570.1B). Refer to the MCB Camp Lejeune EA for details (DoN, 2009a).

MCB Camp Lejeune has previously consulted with the US Fish and Wildlife Service and National Marine Fisheries Service regarding these impacts and continues to adhere to the monitoring and conservation measures developed during these consultations. Increased firing and tactical vehicle usage associated with the proposed action has the potential to increase these effects, but these effects are not expected to jeopardize the continued existence of these species or their habitat.

The public is notified of hazardous activities through the use of Notice to Mariners and Notices to Airmen. Prior public notification of Marine Corps training activities, use of known training areas, avoidance of non-military aircraft and civilians, and the remoteness of the training areas from coastal population centers reduces the potential for the interaction between the public and the military. These strategies have been successful in maintaining public safety and are anticipated to continue to do so (DoN, 2009a).

6.2.3.3 Marine Corps Air Station Cherry Point Range Operations

The Marine Corps has been conducting training operations in the Marine Corps Air Station (MCAS) Cherry Point Range Complex for more than 65 years. Training operations currently conducted in the MCAS Cherry Point Range Complex can be characterized as occurring in special use airspace, land ranges, and water ranges. Current training operations at MCAS Cherry Point Range Complex are performed on ground ranges, water ranges, and in special use airspace within and adjacent to the installation, using existing vehicles, aircraft, munitions, and weapons. For more detail description see Section 1.5.1. An environmental assessment was prepared (DoN, 2009b) to evaluate the potential environmental consequences from current and emerging training operations at the MCAS Cherry Point Range Complex. The no action alternative of the proposed action includes a description of past and present training operations at MCAS Cherry Point. For a description of current operations see Section 2.1 and Table 2.1-3 of the referenced document.

The following federally listed threatened and endangered species potentially occur on MCAS Cherry Point's BT-9 and BT-11 targets due to the presence of suitable habitat:

- Seabeach amaranth
- Piping Plover
- Roseate Tern
- Four species of Sea Turtles

There would be no impacts to these species from current operations or munitions usage.

All marine mammals are protected under the MMPA, and therefore numerous studies have been conducted to assess marine mammal species distributions in the region of influence. A limited number of marine mammals occur in the very nearshore, estuarine waters of MCAS Cherry Point and the associated training areas. These include the coastal stock of bottlenose dolphin and the federally endangered West Indian manatee.

The West Indian manatee is the only ESA-listed marine mammal known to occur in the region of influence. This species has been reported occasionally along the Atlantic Intracoastal Waterway, inside the barrier islands of the North Carolina coast, and on several occasions off the beaches and nearshore banks of North Carolina. Manatees prefer warm water temperatures, so the region of influence is unsuitable during winter. Sightings in or near the region of influence are not common; manatees are not known to occur in the BT-9 or BT-11 water prohibited or restricted areas. If manatees were to occur in the vicinity of training activities they may be disturbed and temporarily leave the area.

Potential disturbances to the West Indian manatee from activities associated with the Preferred Alternative would be similar to those for the No Action Alternative and Alternative 1 (DoN, 2009b). Vessel strikes to manatees are common in general, as this species is slow-swimming with the exception of small burst of speed. Precautionary measures implemented for sea turtles and marine mammals would be the same for the West Indian manatee, including halting training activities upon sighting a manatee. In order to minimize adverse impacts to manatees, MCAS Cherry Point personnel have implemented procedures listed in the MCAS Cherry Point EA (Section 4.3.5.3 DoN, 2009b).

Live-fire and ammunitions testing potentially could lead to disturbances, injury, or mortality to dolphins from falling debris, ordnance landing in the water, or underwater noise. Training activities taking place within R-5306A include air-to-ground live-fire (BT-9 and BT-11), explosive ordnance (BT-9), and non-explosive ordnance (BT-9 and BT-11) at water targets surrounded by the waters of Pamlico Sound.

An environmental assessment was developed (DoN, 2009b) and a FONSI was signed on February 11, 2009 to evaluate the potential environmental consequences from current and emerging training operations at the MCAS Cherry Point Range Complex.

Ingestion of expended ordnance is not expected to occur in the water column where dolphins feed because ordnance quickly sinks. Specific information on potential toxic effects of ingestion of the types of ordnance used in military activities on marine mammals is not available. Even though there is a lack of directed studies on this topic, it is clear that the type of ordnance would determine potential effects: relatively small objects with smooth edges such as a cannon shell or small caliber ammunition would likely pass through the digestive tract without causing harm, while a piece of metal shrapnel with sharp edges would be more likely to cause internal damage. As mentioned above, the fact that ordnance quickly sinks to the bottom leads to a highly unlikely scenario of a dolphin ingesting expended ordnance.

Explosions from ordnance landing in the water have the potential to impact marine mammals. As a result, an analysis of the potential for Level A (injurious) or B (non-injurious) harassment as defined by the MMPA was conducted for the MCAS Cherry Point bombing target areas. Activities that may pose a risk to marine mammals include those that involve amphibious vehicle and small boat traffic and the use of live-fire near the water, which could lead to Level A or B harassment. The different levels of harassment include Level A harassment leading to mortality or injury (injures or has significant potential to injure) and Level B (non-injurious) harassment causing potential disturbance of natural behavioral patterns or Temporary (Auditory) Threshold Shift (TTS), which is a slight, recoverable loss of hearing sensitivity. Level A injury or mortality could be caused by direct or near contact with live or non-live-fire munitions or underwater noise associated with explosive ordnance. Level B harassment resulting in TTS could be caused by underwater noise associated with explosive ordnance. Level B harassment altering natural patterns could be caused by significant disturbances on the surface of the water that deter marine mammals from surfacing including vessel traffic or live or inert missile firing. For training operations at MCAS Cherry Point, it was determined that noise from non-explosive ordnance does not pose a risk to marine life; noise levels above water are at levels that would not harm animals, and moderate-level noise (e.g., from non-explosive ordnance) below water's surface is quickly absorbed (DoN, 2009b).

Potential impacts to marine mammals from underwater noise associated with explosive munitions that may land in the water and detonate underwater were analyzed specifically for the BT-9 area only, since explosive ordnance is delivered solely at this range (DoN, 2009b). The analysis assumes that some high explosive munitions could miss their target (the ship hull or two barges) and inadvertently detonate in the water. The noise from these detonations may have potential adverse effects on marine mammals, resulting in Level A or Level B harassment. The munitions containing high explosives that have the potential to land in the water include 30-mm and 40-mm high explosive incendiary machine gun fire, the 5-lb/2.75-in rocket, and the 35-lb/5-in rocket. The most likely cause of exposures at BT-9 is underwater noise generated by explosions of 2.75-in rockets. Take estimates do not account for the reduction in impact due to application of mitigation procedures. Therefore, the estimated number of exposures without mitigation is a conservative estimate that likely overvalues the potential number of exposures. The analysis of explosive underwater noise impacts to marine mammals is fairly complex and requires an explanation of the metrics, criteria, and thresholds used to predict noise impacts.

During one year of training with explosive ordnance at BT-9 with no precautionary measures in place, calculations of the largest impacts from noise indicated that 0.057 bottlenose dolphins could die from extensive lung hemorrhage (Level A harassment-onset mortality), 0.160 dolphins could suffer from slight, but recoverable, lung injury (Level A harassment), and 4.783 dolphins could encounter behavioral disruption due to TTS (Level B harassment) For more information, see Table 4.3-5 of the MCAS Cherry Point EA (DoN, 2009b).

The likelihood of a direct hit to a marine mammal is extremely low. The probability of a direct strike was determined by first calculating the area of the potential strike surface and multiplying it by the total number of rounds that may enter the water. The area of the potential strike surface is a dolphin's dorsal surface area multiplied by the dolphin density in that location. See Table 4.3-6 of the MCAS Cherry Point EA for a list of marine mammal densities and probabilities of direct impact to bottlenose dolphins (*Tursiops truncates*) from munitions that may land in the water under the No Action Alternative. The average number of ordnance fired from the years 2001–2005 were used for probability calculations.

The analysis for the potential for direct strikes of munitions on marine mammals under the proposed action confirms that the risk of a direct strike is improbable. With preventative measures in place and the extremely low probability of ordnance striking a marine mammal (dolphin) and the low number of expected exposures of dolphins to harmful noise levels, implementation of the No Action Alternative would not adversely impact marine mammals.

Four species of federally-listed sea turtles (loggerhead, green, Kemp's ridley, and leatherback) may occur in the region of influence, but none of the species is known to nest on beaches directly located within MCAS Cherry Point. Sea turtles in the immediate vicinity of delivered ordnance may experience major disturbances from noise; injury from noise created by ordnance delivered in proximity; injury and direct mortality if struck by ordnance; or entanglement in debris. Most of these disturbances are not well-studied for sea turtles.

Potential impacts to sea turtles from underwater noise associated with explosive munitions that may land in the water and detonate underwater were analyzed specifically for BT-9, since explosive ordnance is delivered solely at this range. The analysis combined all hardshell turtles known to occur in the project area; leatherback sea turtles were excluded from the analysis because density estimates on this species are not available. The analysis assumes that some high explosive munitions could miss their target and inadvertently detonate in the water. The noise from these detonations may have potential adverse effects on marine mammals. TTS has not been documented for sea turtles, so criteria are based on the exposure categories identified for marine mammals (see MCAS Cherry Point EA, Appendix B (DoN, 2009b). The munitions containing high explosives that have the potential to land in the water include 30-mm and 40-mm high explosive incendiary machine gun fire, the 5-lb/2.75-in rocket, and the 35-lb/5-in rocket. Take estimates do not account for the reduction in impact due to application of mitigation procedures. Therefore, the estimated number of exposures without mitigation is a conservative estimate that likely overvalues the potential number of exposures.

Modeling of underwater detonations predicts that there would be less than one mortality to sea turtles. Noise exposure to sea turtles is likely overestimated since these animals may be detected within the training area and avoided prior to training. It is current practice to cease training activities if a sea turtle is spotted within the water range. See Table 4.3-7 of the MCAS Cherry Point EA (DoN, 2009b).

A Biological Opinion was issued by NMFS for ordnance-related activities taking place at BT-9 and BT-11 that may impact sea turtles. NMFS concluded that the proposed action was not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, green, or leatherback sea turtles, but that incidental takes might occur, resulting in a "may affect" determination (NMFS, October 2002). This Biological Opinion did not address all of the activities associated with the current No Action

Alternative, but did include the use of live fire at the BT-9 and BT-11 ranges. The No Action Alternative may affect the loggerhead, green, Kemp's ridley, and leatherback sea turtles. Due to its extremely rare occurrence, project activities related to the No Action Alternative would have no affect on the hawksbill sea turtle.

6.2.3.4 Basing the U.S. Marine Corps Joint Strike Fighter F-35B on the East Coast

The Marine Corps variant of the Joint Strike Fighter (JSF), the F-35B, is a short take-off/vertical landing (STOVL), multi-role fighter aircraft whose primary emphasis is air-to-ground combat. The aircraft is designed to replace existing fleets of F-18 A/C/D Hornets (strike fighter), AV-8B Harriers (attack), and the EA-6B Prowler (electronic warfare) aircraft. The F-35B east coast basing proposal would take approximately 11 years to implement and would begin in 2012. The proposal would base up to 216 aircraft (i.e., 10 active-duty and one reserve squadron of up to 16 aircraft each and two Pilot Training Center (PTC) squadrons at 20 aircraft each) at MCAS Beaufort and MCAS Cherry Point. Facility construction and modifications would occur prior to and continue throughout F-35B squadron arrivals; the F-35B would operate within existing airspace and at training ranges currently used by Marine Corps Hornet, Harrier, and Prowler aircraft (DoN, 2009d).

The Notice of Intent to prepare the EIS was published in the Federal Register on January 15, 2009. Public scoping meetings were conducted in April 2009 and the Final EIS is anticipated in October 2010. The EIS will evaluate the potential environmental effects associated with each of the alternatives. The alternative development process identified five preliminary basing alternatives:

- No Action Alternative: F-35B aircraft would not replace F-18A/C/D, AV-8B, and EA-6B squadrons at MCAS Beaufort and MCAS Cherry Point.
- Alternative 1: base three F-35B squadrons and the PTC (with two squadrons) at MCAS Beaufort; MCAS Cherry Point would receive eight squadrons.
- Alternative 2: base the PTC (with two squadrons) at MCAS Beaufort; MCAS Cherry Point would receive eleven squadrons.
- Alternative 3: base eight squadrons at MCAS Beaufort; MCAS Cherry Point would receive three squadrons and the PTC (with two squadrons).
- Alternative 4: base eleven squadrons at MCAS Beaufort; MCAS Cherry Point would receive the PTC (with two squadrons).
- Alternative 5: base two F-35B squadrons and the PTC (with two squadrons) at MCAS Beaufort; MCAS Cherry Point would receive nine squadrons (DoN, 2009d).

6.2.3.5 Military Operations – Atlantic Ocean, Offshore of the Southeastern United States

Designated bomb boxes have been established in each OPAREA where inert bombs could be dropped during a major Atlantic Fleet training exercise. The process for selecting these sites within each OPAREA involved balancing operational suitability (close proximity to where the strike group is operating) and environmental suitability. Environmental suitability includes an area that possesses a low likelihood of encountering threatened and endangered species and that avoids the continental shelf, canyon areas, and the Gulf Stream, all of which are locations where threatened and endangered marine mammal and sea turtle species are most abundant. Based on the combination of prudent site-selection and the mitigation measures to be implemented in all OPAREAs that were developed as part of the BO for protection of the North Atlantic right whale (NMFS, 1997), it is anticipated that dropping inert bombs in the established bomb boxes associated with major Atlantic Fleet exercises would not affect listed species.

6.2.3.6 Navy Training in the Jacksonville and Charleston Operating Areas

Jacksonville (JAX) Range Complex EIS/OEIS

The JAX Range Complex Final EIS/OEIS was released in March 2009. The JAX Range Complex geographically encompasses offshore, near-shore, and onshore OPAREAs, ranges, and Special Use Airspace (SUA) located near the east coast of the United States. The JAX Range Complex, which covers both the Charleston (CHASN) and Jacksonville Range Complexes, is a set of operating and maneuver areas with defined ocean surface and subsurface areas. The surface water area of the Range Complex covers the coast of South Carolina, Georgia, and Florida, encompassing 50,090 nm^2 (172,023.6 km^2). The shoreward extent of the OPAREA is roughly aligned with the 3 nm (5.6 km) state territorial limits. Due to the Navy's training requirements, the objective of the JAX/CHASN Range Complex is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support the mission. The Study Area also serves as critical support for Navy operational readiness training and for RDT&E of emerging maritime and combat technologies (DoN, 2009e).

The Navy prepared an EIS/OEIS to assess the potential environmental effects in the JAX Range Complex over a 10-year planning horizon. The JAX Final EIS/OEIS (DoN, 2009e) is incorporated by reference and is available for downloading/viewing via the internet at the following website address: (http://www.jacksonvillerangecomplexeis.com). As stated in the JAX Range Complex Final EIS/OEIS, the No Action Alternative would continue current operations, including surge capabilities, consistent with the FRTP. For the purposes of this chapter, the No Action Alternative represents both past and present naval operations in the JAX Range Complex. Training operations in the JAX/CHASN Range Complex are very similar to the training performed at the VACAPES Range Complex; they can vary from unit level exercises to integrated major range training events. A description of non-ASW training operations typically conducted in the JAX Range Complex can be found in Table 6.2-4 (DoN, 2009g).

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there would be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the JAX/CHASN Range Complex (DoN, 2009e).

Table 6.2-4 JAX/CHASN Range Complex Typical Operations (Non-ASW)

Range Operation	Description
Mine Warfare (MIW)	
Mine Laying	Airborne mine-laying training uses two types of training operations: Mine Exercises (MINEX) and Mine Readiness Certification Inspections. In the typical mining training profile, MINEXs usually involve a single aircraft sortie planting several inert training mine shapes in the water. The aircrew drops a series of (usually four) inert training shapes in the water.
Mine countermeasures	Mine Countermeasure (MCM) exercises train forces to detect, identify, classify, mark, avoid, and disable (or verify destruction of) sea mines using a variety of methods, including, air, surface, and subsurface assets.
Mine neutralization	Mine Neutralization operations involve the detection, identification, evaluation, rendering safe, and disposal of underwater unexploded ordnance that constitute a threat to ships or personnel.
Surface Warfare (SUW)	
MISSILEX (A-S)	MISSILEX (A-S) (Live Fire) trains aircraft and helicopter crews in the delivery of optical, infrared seeking, or laser guided missiles (Hellfire and Maverick) at surface targets.
GUNEX (A-S)	GUNEX (A-S) trains aircraft and helicopter crews to attack surface targets at sea using guns.
GUNEX (S-S)	GUNEX (S-S) trains ship gun crews by firing against surface targets at sea.
BOMBEX (sea)	BOMBEX (sea) allows aircrew to train in the delivery of bombs against maritime targets.
Laser targeting	MISSILEX (A-S) (Laser Only) trains aircraft or helicopter crews in the delivery of optical, infrared seeking or laser guided missiles at surface targets. This operation does not result in live missile fire, only discrimination of the target and illumination of the target with a laser.
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship	Non-firing ULT and major exercise events. Each ship must conduct one VBSS/MIO every six months. Target vessel is typically another strike group ship or Mobile Sea Range (MSR) vessel such as Prevail.
MSO to include VBSS/MIO- Helo	Non-firing ULT & major exercise events. NSW personnel fast-rope onto target vessel from 1st helicopter. 2nd helicopter flies close cover, and 3rd helicopter flies surveillance.
GUNEX (S-S) (Fast Attack Craft/Fast Inshore Attack Craft [FAC/FIAC])	Non-firing major exercise event only. Typically involves multiple ships prosecuting multiple targets (High Speed Maneuverable Seaborne Targets or other small craft) during a choke point transit event.
Air Warfare (AW)	
ACM	ACM is the general term used to describe an air-to-air (A-A) event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, and airspeed. No live weapons are fired during ACM operations.
Air Intercept Control	Surface ships and fixed wing aircraft train in using their search radar capability to direct strike fighter aircraft toward threat aircraft.
ACM Chaff Exercise	Chaff exercises train shipboard personnel and helicopter crews in the use of chaff to counter missile threats. Training and testing evens not necessarily dedicated events, but combined with other exercises.

Table 6.2-4 JAX/CHASN Range Complex Typical Operations (Non-ASW) (Continued)

Range Operation	Description
ACM Flare Exercise	Trains aircraft personnel in the use of flares for defensive purposes when countering heat-seeking missile threats. Training and testing events not necessarily dedicated sorties, but may be combined with other exercises.
MISSILEX (A-A)	MISSILEX (A-A) are training operations in which air-to-air AIM missiles are fired from aircraft (live and non-explosive) against unmanned aerial target drones such as BWM-34 and BQM-74.
GUNEX (S-A)	GUNEXs (S-A) are conducted by surface ships with 5-inch, 76mm and 20mm Close In Weapons Systems. Targets include unmanned drone as well as targets towed behind aircraft.
Detect-to-Engage	Shipboard personnel use all shipboard sensors (search and fire control radars and Electronic Support Measures (ESM)) in the entire process of detecting, classifying, and tracking enemy aircraft and/or missiles up to the of engagement, with the goal of destroying the threat before it can damage the ship.
Strike Warfare (STW)	
FIREX with Integrated Maritime Portable Acoustic Scouring and Simulator System (IMPASS)	Surface-to-surface gunnery exercises with IMPASS are training operations that direct naval gunfire to strike land targets and support military operations ashore. This training is conducted at-se using a computer-simulated land target and a series of buoys that can acoustically score the training event.
BOMBEX (A-G)	BOMBEXs (Land) allow aircrews to train in the delivery of bombs against ground targets.
Combat Search and Rescue (CSAR) and Convoy Operations	CSAR operations train rescue forces personnel the tasks needed to be performed to affect the recovery of distressed personnel during war or military operations other than war.
Electronic Combat (EC)	
EC Operations	Air or ship crews attempt to control critical portions of the electronic spectrum used by threat radars, communications equipment, and electronic detection equipment to degrade or deny enemy attacks.
Chaff Exercise	Exercises train aircrews the use of chaff to counter enemy threats by creating radar reflective false targets. Chaff may also be used offensively by aircrews or shipcrews to hide inbound striking aircraft or ships.
Flare Exercise (Aircraft Self-Defense)	Fixed-wing aircraft and helicopters deploy flares to disrupt threat infrared missile guidance systems to defend against an attack.
Other Training	
Shipboard Electronic Systems Evaluation Facility Utilization (SESEF)	SESEF operations test ship antenna radiation pattern measurements and communications systems.

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 3 of the Jacksonville Range Complex EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis under the No Action Alternative indicates that 1,126 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level B harassment. Acoustic analysis also indicates that 32 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment.

The results of the acoustic analysis indicate the quantity of ESA-listed marine mammals that may be exposed to levels of sound, one exposure of an ESA-listed species may result in Level B harassment. No mortalities are predicted due to the proposed activities. The results also indicate the quantity of ESA-listed sea turtles that may be exposed to levels of sound under the No Action Alternative, 444 sea turtles may be exposed to Level B harassment and 9 may be exposed to Level A harassment. The exposure estimates for the No Action Alternative 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 (DoN, 2009e). These exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal and sea turtle species or populations.

NSB Kings Bay

NSB Kings Bay, Georgia, is located in coastal southeastern Georgia, along the western shore of Cumberland Sound approximately 2 mi (3 km) north of St. Mary's, Georgia and approximately 35 mi (56 km) north of Jacksonville, Florida. The site was designated as NSB Kings Bay in 1982, and encompasses approximately 25 mi^2 (65 km^2). Facilities at the base enable Kings Bay to serve as a homeport, refit site, and training facility for the Navy personnel who operate and maintain the Ohio-class submarines (GlobalSecurity.org, 2007a).

The Navy Strategic Systems Programs proposed to construct and maintain security facilities to support continuous security service and incident response at NSB Kings Bay. Security improvements include a Waterfront Security Force Facility, an Auxiliary Reaction Force Facility, an Armored Fighting Vehicle Operational Storage Facility (AFVOSF); an Armory; road improvements to ensure efficient access to and from the proposed facilities; and construction of a new parking lot to replace lost parking spaces. No significant effects to environmental resources were expected.

NS Mayport

NS Mayport is located near the Port of Jacksonville on the St. Johns River in northeast Florida. NS Mayport is home to 55 tenant commands and private organizations. Some two dozen ships are berthed in the Mayport basin, including Airborne Early Warning/Ground Environment Integration Segment (AEGIS) guided-missile cruisers, destroyers, guided-missile frigates, and aircraft carriers (GlobalSecurity.org, 2007b). NS Mayport covers 5 mi^2 (14 km^2) and is the third largest naval facility in the continental United States. NS Mayport is unique in that it is home to a busy seaport as well as an air facility that conducts more than 135,000 flight operations each year (GlobalSecurity.org, 2007b).

6.2.3.7 Virginia Capes Training Complex

The VACAPES Range Complex Final EIS/OEIS was released in March 2009. The VACAPES Range Complex geographically encompasses offshore, near-shore, and onshore OPAREAs, ranges, and Special Use Airspace (SUA) located near the eastern coast of the United States. The VACAPES Range Complex is a set of operating and maneuver areas with defined ocean surface and subsurface areas. The surface water areas of the Range Complex covers the coast of Delaware, Maryland, Virginia, and North Carolina, encompassing 27,661 nm^2 (94,995.9 km^2). The shoreward extent of the OPAREA is roughly aligned with the 3 nm (5.6 km) state territorial limits. Due to the Navy's training requirements, the objective of the VACAPES Range Complex is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support the mission. The Study Area also serves as critical support for Navy operational readiness training and for RDT&E (DoN, 2009f).

The Navy prepared an EIS/OEIS to assess the potential environmental effects in the VACAPES Range Complex over a 10-year planning horizon. The VACAPES Final EIS/OEIS (DoN, 2009h) is incorporated by reference and is available for downloading and viewing via the internet at the following website address (http://www.vacapesrangecomplexeis.com). As stated in the VACAPES Range Complex EIS/OEIS, the No Action Alternative would continue current operations, including surge capabilities, consistent with the Fleet Response Training Plan (FRTP). For the purposes of this chapter, the No Action Alternative represents both past and present naval operations in the VACAPES Range Complex. Training operations in the VACAPES Range Complex range from unit-level exercises to integrated, major, range training events. A description of non-ASW training operations typically conducted in the VACAPES Range Complex can be found in Table 6.2-5.

Table 6.2-5 VACAPES Range Complex Typical Operations (Non-ASW)

Range Operation	Description
Mine Warfare (MIW)	
Mine countermeasures exercise	These exercises train forces to detect, identify, classify, mark, avoid, and disable (or verify destruction of) sea mines using a variety of methods, including, air, surface, and subsurface assets.
Mine neutralization	These operations involve the detection, identification, evaluation, rendering safe, and disposal of underwater unexploded ordnance (UXO) that constitute a threat to ships or personnel.
Surface Warfare (SUW)	
Bombing exercise (BOMBEX) (sea)	These exercises allow aircrew to train in the delivery of bombs against maritime targets.
Missile exercise (MISSILEX) (air-to-surface)	These exercises use laser and live fire to train fixed-wing aircraft and helicopter aircrews in the delivery of optical, infrared seeking, or laser guided missiles at surface targets.
Gunnery exercise (GUNEX) (air-to-surface)	Gunnery exercises train fixed-wing aircraft and helicopter aircrews to attack surface targets at sea using guns.
GUNEX (surface-to-surface) (boat)	In these exercises, small boat gun crews train by firing against surface targets at sea.
GUNEX (surface-to-surface) (ship)	Ship gun crews in these exercises train by firing against surface targets at sea.
Laser targeting	Laser targeting exercises are used to train aircraft personnel in the use of laser targeting devices to illuminate designated targets for engagement with laser-guided weapons.
Maritime Security Operations (MSO) to include Visit, Board, Search, and Seizure/Maritime Interdiction Operations (VBSS/MIO)-Ship	Crews from Navy helicopters and 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.

Table 6.2-5 VACAPES Range Complex Typical Operations (Non-ASW) (Continued)

Range Operation	Description
Air Warfare (AW)	
Air combat maneuver (ACM)	ACM is the general term used to describe an air-to-air event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No weapons are fired during ACM operations.
GUNEX (air-to-air)	In these training operations, guns are fired from aircraft against unmanned aerial target drones.
MISSILEX (air-to-air)	These are training operations in which air-to-air missiles are fired from aircraft against unmanned aerial target drones such as BQM-34 and BQM-74.
GUNEX (surface-to-air)	These operations are conducted by surface ships with 5-inch, 76 mm, and 20 mm Close-In Weapons System. Targets include unmanned drones or targets towed behind aircraft.
Strike Warfare (STW)	
High-speed Anti-Radiation Missile Exercise (HARMEX) (air-to-surface)	Aircraft crews train in the use of HARM missiles, the primary weapon designed to target anti-aircraft missile sites.
Amphibious Warfare (AMW)	
FIREX with Integrated Maritime Portable Acoustic Scouring and Simulator System (IMPASS)	Surface-to-surface gunnery exercises with IMPASS are training operations that direct naval gunfire to strike land targets and support military operations ashore. This training is conducted at-se using a computer-simulated land target and a series of buoys that can acoustically score the training event.
Electronic Combat (EC))	
EC Operations	Air or ship crews attempt to control critical portions of the electronic spectrum used by threat radars, communications equipment, and electronic detection equipment to degrade or deny enemy attacks.
Chaff Exercise	Exercises train aircrews the use of chaff to counter enemy threats by creating radar reflective false targets. Chaff may also be used offensively by aircrews or shipcrews to hide inbound striking aircraft or ships.
Flare Exercise (Aircraft Self-Defense)	Fixed-wing aircraft and helicopters deploy flares to disrupt threat infrared missile guidance systems to defend against an attack.
Other Training	
Shipboard Electronic Systems Evaluation Facility Utilization (SESEF)	SESEF operations test ship antenna radiation pattern measurements and communications systems.

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there will be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the VACAPES Range Complex (DoN, 2009f).

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 3 of the VACAPES Range Complex EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis under the No Action Alternative indicates that 63,664 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result

in Level B harassment. Acoustic analysis also indicates that 730 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment. The analysis also indicates that seven marine mammal mortalities may result. The results of the acoustic analysis indicates the quantity of ESA-listed marine mammals that may be exposed to levels of sound, 173 exposures of an ESA-listed species may result in Level B harassment and one exposure may result in Level A harassment. The results also indicate the quantity of ESA-listed sea turtles that may be exposed under the No Action Alternative to levels of sound, 11,340 exposures may result in Level B harassment, 97 exposures may result in Level A harassment, and two may result in mortality. The exposure estimates for the No Action Alternative 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 (DoN, 2009f). In addition, these exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal and sea turtle species or populations.

6.2.3.8 USS Mesa Verde Ship Shock Trial

A Record of Decision was published in the Federal Register (FR) on July 28, 2008 (FR, Vol. 73, No. 145) in which the Navy announced its decision to conduct a shock trial for USS MESA VERDE in the area of the Atlantic Ocean offshore of Naval Station Mayport, Jacksonville, Florida during the summer (June 21 – September 20, 2008). The Final EIS considered all components of the physical, biological, and socioeconomic environment and concluded that potential impacts from execution of the shock trials would be less at the Mayport, Florida alternative site than at the alternative sites of Norfolk, Virginia or Pensacola, Florida.

The NMFS determined that the incidental taking of marine mammals resulting from conducting a Full Ship Shock Trial on USS MESA VERDE in the waters offshore of Mayport, Florida during the summer months would have a negligible impact on the affected marine mammal species or stocks. The Final Rule was published in the FR on July 24, 2008 (FR, Vol. 73, No. 143). The FR notice provides a list of mitigations and requirements for monitoring and reporting before, during, and after the trials are conducted.

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 4 of the Mesa Verde Ship Shock Trial EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis indicates that 489 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level B harassment. Acoustic analysis also indicates that 8 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment. The analysis also indicates that the effect to 1 marine mammal mortalities may also result. The results of the acoustic analysis indicate that no ESA-listed marine mammal species will be exposed or injured due to the training activities. The results also indicate the quantity of ESA-listed sea turtles that may be exposed to levels of sound, 2,079 species may result in Level B harassment, 46 may result in Level A harassment, and 1 may result in mortality. The exposure estimates for each alternative represents 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 finds that ESA-listed species may experience a cumulative impact from AFAST active sonar activities; however, they are not expected to adversely affect the populations of ESA-listed species (DoN, 2008b).

The first shot of MESA VERDE's shock trial was successfully conducted August 16, 2008. The second shot was successfully completed on August 26, 2008 and the third and final shock trial event was completed September 13, 2008 (DoN, 2008b). As detailed in the After-Action Mitigation Report for the Shock Trial of USS MESA VERDE submitted to the Director of NMFS' Office of Protected Resources,

the NMFS' Southeast Region, and the Chief of NMFS' Endangered Species Division - Office of Protected Resources, the mitigation component of the shock trial was successful. No mortalities or injuries to marine mammals or sea turtles were detected during the shock trial events or during post-mitigation monitoring. In addition, no marine mammal or sea turtle stranding has been attributed to the shock trial.

6.2.3.9 Homebasing MH-60R/S Helicopters on the East Coast of the US

The Navy is in the process of homebasing new MH-60S and MH-60R (helicopters) on the East Coast of the United States (DoN, 2002). The MH-60S aircraft type are replacing the CH-46D, HH-60H, SH-3H, and HH-1N helicopters. The missions assigned to this aircraft include combat search and rescue (CSAR); surface ship protection; and a new, organic, airborne, mine countermeasures role. The MH-60R aircraft type will replace the SH-60B and SH-60F aircraft. The missions assigned to this aircraft include anti-submarine warfare (ASW), surface warfare (SUW) and naval gun fire support (NGFS). No significant adverse short-term or long-term impacts were identified as resulting from implementing the Navy's preferred alternative, which was to homebase all or most MH-60S helicopters at Naval Station (NS) Norfolk, Virginia and all or most MH-60R helicopters at stations in the Jacksonville region.

6.2.3.10 Operational Testing of Hellfire Missile System Integration on H-60 helicopters

The Navy proposed developmental and operational testing of Hellfire missile system integration with the H-60 helicopter (DoN, 2002). Testing involved the firing of non-explosive practice rounds and high-explosive (HE) Hellfire missiles at floating targets located in the VACAPES OPAREA. After evaluating potential impacts from the proposed action, the determination was that the proposed action would not significantly impact the environment; would have no effect on essential fish habitat (EFH); would not result in reasonably foreseeable "takes" of marine mammals; and would have no effect on threatened and endangered species under the ESA.

6.2.3.11 Homebasing F/A-18E/F Super Hornets to the East Coast of the US

The Navy has replaced F-14 fighter jets in its fleet inventory with F/A-18E/F Super Hornets. The EIS analyzed 10 Super Hornet Squadrons and one Super Hornet Fleet Replacement Squadron at several combinations of east coast Navy and Marine Corps air stations along with the impact to nearby training ranges (BT-9, BT-11, Dare County Range, and Townsend Bombing Range). The final EIS analyzed the amount of ordnance typically used at each range. The final EIS concluded there would not be an increase in the amount of ordnance expended at any of the ranges and that there would not be a significant impact to resources at these ranges (DoN, 2003).

6.2.3.12 Establishment of a Military Operations on Urban Terrain (MOUT) at Navy Dare County Bombing Range (NDCBR)

The Navy evaluated the potential impacts of air-to-ground bombing using practice, non-explosive munitions, and construction of a military operations on urban terrain (MOUT) target at NDCBR located near Manteo, North Carolina (DoN, 2008c). No significant impacts to the environment were anticipated as a result of the proposed action.

6.2.3.13 Testing of Expeditionary Fighting Vehicle (EFV) Prototypes at Marine Corps Base Camp Lejeune, North Carolina

The Marine Corps is evaluating the potential impacts of the performance of EFV prototypes under realistic test conditions at MCB Camp Lejeune. The EFV prototypes are being tested on land, in the riverine environment, and at-sea. EFV testing is being conducted on the same beaches, ranges, and training areas on Camp Lejeune used by the Amphibious Assault Vehicle (AAV) and other vehicles.

Riverine operations take place in the New River and Atlantic Intracoastal Waterway in existing AAV operating areas. Riverine operations include entering and exiting the river from existing splash points, slow speed water maneuverability, river to land gunnery testing at established ranges, towing vehicles and navigation. Testing at sea is conducted off shore of Camp Lejeune in N-1/BT-3 Range and Warning Area W-122 (USMC, 2004).

6.3 Reasonably Foreseeable Future Actions Relevant to the Proposed Action

6.3.1 Military Operations

6.3.1.1 VACAPES Range Complex

As stated in Section 6.2.3.7, the VACAPES Range Complex Final EIS/OEIS was released in March 2009 (DoN, 2009f). In that Final EIS/OEIS, the Navy's preferred alternative was identified as Alternative 2: Increases and Modifications in Operational Training, Accommodate Force Structure Changes, and Implement Enhancements. The Navy's preferred alternative is considered representative of its future actions within the VACAPES Range Complex.

Under Alternative 2, the Navy proposes to increase or modify training and RDT&E operations from current levels in support of the FRTP, accommodate mission requirements associated with force structure changes, including those resulting from the introduction of new platforms (aircraft and weapons systems), and implement enhanced range complex capabilities in the VACAPES Range Complex. Alternative 2 would implement enhancements to the minimal extent possible to meet the components of the FRTP to implement the FRP. It would also increase operational training, expand warfare missions, and accommodate force structure changes, which would include changing weapon systems and platforms, and homebasing new aircraft and ships, as well as additional mine warfare training capabilities, the establishment of MIW training areas with small fields of inert (non-explosive) mine shapes, and implementation of additional enhancements to enable the range complex to meet future requirements (DoN, 2009f). (Mine detection sonar will be used and use of this sonar is covered under the Final AFAST EIS/OEIS.)

The Navy's goal with Alternative 2 is to reduce the number of BOMBEX training events that involve dropping live, high-explosive ordnance on targets at-sea in comparison to the No Action Alternative, which depicts current operations and activities (DoN, 2009f).

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there will be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the VACAPES Range Complex under Alternative 2 (DoN, 2009f).

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles in response to Alternative 2 (Preferred Alternative). Refer to Chapter 3 of the VACAPES Range Complex EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis indicates that 3,751 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level B harassment. Acoustic analysis also indicates that 36 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment. The analysis indicates that one marine mammal mortality may result. The results of the acoustic analysis indicate the quantity of ESA-listed marine mammals that may be exposed to levels of sound, 173 exposures of an ESA-listed species may result in Level B harassment. The results also indicate the quantity of ESA-listed sea turtles that may be exposed to levels of sound, 1,181 exposures may result in Level B harassment, 11 may result in Level A harassment, and none will result in mortality. The exposure estimates for the preferred Alternative 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 (DoN, 2009f). In addition, these exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal or sea turtle species or populations.

6.3.1.2 JAX Range Complex

As stated in Section 6.2.3.6, the JAX Range Complex Final EIS/OEIS was released in March 2009 (DoN, 2009e). In that Final EIS/OEIS, the Navy's preferred alternative was identified as Alternative 2: Increases and Modifications in Operational Training, Accommodate Force Structure Changes, and Implement Enhancements Mine Warfare Training Capability. The Navy's preferred alternative is considered representative of its future actions within the JAX Range Complex.

The proposed action's purpose is to: achieve and maintain Fleet readiness using the JAX Range Complex to support and conduct current, emerging, and future training operations and RDT&E operations; expand warfare missions supported by the JAX Range Complex; and upgrade and modernize existing range capabilities to enhance and sustain Navy training and RDT&E. Also, the proposed action is needed to provide range capabilities for training and equipping combat-capable naval forces ready to deploy worldwide (DoN, 2009e).

Under Alternative 2, the Navy intends to increase or modify training and RDT&E operations from current levels as necessary in support of the FRTP, accommodate mission requirements associated with force structure changes, including those resulting form the introduction of new platforms (aircraft and weapons systems), and implement enhanced range complex capabilities in the JAX Range Complex. Alternative 2 would increase operational training, expand warfare missions, accommodate force structure changes (including changing weapon systems and platforms and homebasing new aircraft and ships), and implementing enhancements, to the minimal extent possible to meet the components of the proposed action. This alternative is composed of all currently conducted operations including the introduction of the new MH-60 helicopter and new organic mine countermeasure systems. Additional mine warfare training capabilities and implementation of additional enhancements to enable the range complex to meet future requirements can also be expected of Alternative 2 (DoN, 2009e).

With the preferred alternative, the Navy expects to eliminate live bombing exercises (BOMBEX) and designate MIW Training Areas in the JAX/CHASN OPAREA for enhanced mine countermeasures and neutralization training during major exercises (DoN, 2009e). (Mine detection sonar will be used and use of this sonar is covered under the AFAST EIS/OEIS.)

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there will be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the JAX/CHASN Range Complex under Alternative 2 (DoN, 2009e).

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles as a result of activities performed with Alternative 2 (Preferred Alternative). Refer to Chapter 3 of the Jacksonville Range Complex EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis indicates that 79 exposures to marine mammals (including ESA-listed species) may result in Level B harassment and two exposures may result in Level A harassment. The results of the acoustic analysis indicate that no ESA-listed marine mammal species are expected to be exposed to levels of sound which will result in some sort of harassment. No mortalities are predicted due to the proposed activities. The results also indicate the quantity of ESA-listed sea turtles that may be exposed to levels of sound, 36 exposures may result in Level B harassment and no exposures would

result in Level A harassment. The exposure estimates for the Preferred Alternative represents 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 (DoN, 2009e). In addition, these exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal and sea turtle species or populations.

6.3.1.3 Undersea Warfare Training Range

The Navy released a Draft EIS/OEIS in September 2008 to evaluate the potential environmental effects associated with the construction and operations of an underwater instrumented range off the Southeastern U.S. Coast (DoN, 2008d). A revised Notice of Intent to prepare the EIS/OEIS and a thirty day scoping period was published in the Federal Register on September 21, 2007. Four public meetings were held during the months of September and October 2008, and comments were received from September 12, 2008 to October 27, 2008. The Draft EIS/OEIS is incorporated by reference and is available for downloading/viewing via the internet at the following website address: (http://projects.earthtech.com/uswtr/USWTR_index.htm). The proposed action is to place undersea cables and transducer nodes in a 500 NM^2 (1,713 km^2) area of the ocean to create an undersea warfare training range (USWTR) for use as an ASW training range. The ASW training would involve up to three vessels and two aircraft using the range for any one training event, although events would typically involve fewer units. The instrumented area would be connected to the shore via a single trunk cable. The proposed action would require logistical support for ASW training, including the handling (launch and recovery) of exercise torpedoes (non-explosive) and submarine target simulators (DoN, 2008d. The purpose of the proposed action is to enable the Navy to train effectively in a shallow water environment at a suitable location for Atlantic Fleet ASW capable units. The 120- to 900-ft (37- to 274-m) depth parameter for the range was derived from collectively assessing depth requirements of the platforms that would be using this range, and approximate the water depth of potential areas of conflict that the Navy has identified.

The Navy analyzed potential environmental impacts at the following four sites:

- Site A – offshore of northeastern Florida (JAX OPAREA).
- Site B – offshore of central South Carolina (CHASN OPAREA).
- Site C – offshore of southeastern North Carolina (CHPT OPAREA).
- Site D – offshore of northeastern Virginia (VACAPES OPAREA).

The Preferred Alternative has been determined to be Site A. Potential effects to physical, ecological, and socioeconomic resources were analyzed in the USWTR OEIS/EIS. With the exception of EFH, it was determined there would be no significant impact to physical, ecological (non acoustic effects only), or socioeconomic resources. Cable installation may have a temporary impact on benthic organisms, including benthic fish, during the placement of the transducer nodes and interconnect cable and the burial of the trunk cable. As this action would result in a reduction of the quantity and/or quality of some types of EFH, installation of the proposed USWTR may adversely affect EFH at all of the four proposed sites (DoN, 2008d).

Acoustic analysis was performed to determine potential effects to marine mammals from sonar operations. Refer to Chapter 4 of the USWTR OEIS/EIS for a discussion of the methodology used to measure these effects. Acoustic analysis indicates that 108,108 non-injurious effects on marine mammals annually as a result of exposure to sonar activities that NMFS would classify as Level B harassment under the MMPA at the preferred alternative site. In addition, the Navy estimates the potential for 7 injurious effects on marine mammals annually as a result of exposure to active sonar activities that NMFS would classify as Level A harassment under the MMPA. This estimate does not take into consideration any avoidance of vessels or sound sources by marine mammals or the

implementation of mitigation measures. Navy does not anticipate Level A harassment to occur with the implementation of mitigation measures. Of these marine mammals, no threatened or endangered marine mammals will be exposed to levels of sound likely to result in Level A harassment, and 156 will be exposed to levels of sound likely to result in Level B harassment (DoN, 2008d). Based on the acoustic screening analysis, plankton, invertebrates, seabirds, sea turtles, pinnipeds, and manatees were excluded from acoustic effect analysis (DoN, 2008d).

6.3.1.4 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 Navy Cherry Point Study Area.

6.3.1.5 Construction and Operation of an Outlying Landing Field (FCLP) to Support Carrier Air Wing Aircraft at Naval Air Station Oceana and Naval Station Norfolk, Virginia

In a Notice of Intent published on April 9, 2008, (73 *Federal Register* [FR] 19196), the Department of the Navy announced its intent to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental consequences of the construction and operation of an Outlying Landing Field (OLF) at five alternative sites to support Field Carrier Landing Practice (FCLP) training requirements for carrier-based fixed-wing aircraft stationed at and transient to NAS Oceana, Virginia Beach, Virginia (F/A-18CHornet and F/A-18E/F Super Hornet squadrons and Fleet Replacement Squadrons (FRS)), and Naval Station (NS) Norfolk Chambers Field, Norfolk, Virginia (E-2-C Hawkeye, C-2A Greyhound, and E-2C/C-2A FRS). The five alternative OLF sites identified to date are: (1) Cabin Point Site, located tin Surry, Prince George, and Sussex counties, Virginia; (2) Dory Site, located in Southampton and Sussex counties, Virginia; (3) Mason Site, located in Sussex and Southampton counties, Virginia; (4) Sandbanks Site, located in Gates and Hertford counties, North Carolina, and (5) Hale's Lake Site, located in Camden and Currituck counties, North Carolina. These five site alternatives were identified by applying operational environmental and population criteria to a list of 13 sites provided by the State of North Carolina and the Commonwealth of Virginia.

While Naval Auxiliary Landing Field (NALF) Fentress would continue to provide necessary support for FCLP and other training requirement, this landing field alone cannot fully support training requirements of home-based and transient aircraft from NAS Oceana and NS Norfolk Chambers Field. Training requirements for aircraft based at these airfields can exceed NALF Fentress capacity up to 63% of the time during summertime when hours of darkness are limited. Capacity problems are further exacerbated when operational demands require surging additional carrier strike groups. A new OLF is

required to provide year round capacity to support FCLP training requirements under the Fleet Response Plan, provide operational flexibility needed to respond to emergent national defense requirements, and FCLP training consistent with at-sea operating conditions.

Facilities at the OLF would include an 8,000-foot runway, aircraft traffic control tower, and other support buildings. The Navy also proposed to establish Class D airspace around the OLF. Property and property interests for construction of the facilities, airfield safety zones, and projected high-noise zones would need to be acquired through purchase, lease, or acquisition of restrictive use or conservation easements.

The EIS will address environmental consequences associated with construction of the airfield, associated infrastructure and support facilities, and aircraft operations. In addition, the EIS will assess socioeconomic consequences associated with acquisition of property and property interests for the OLF and any relocation of residences within the proposed airfield safety and projected high-noise zones.

Seven public scoping meetings were held during the months of April and May 2008 by the Navy on the proposed construction and operation of an OLF and public comments were accepted until June 7, 2008. Additional information concerning this EIS can be obtained from visiting the project web site at http:www.OLFEIS.com.

6.3.1.6 USMC Grow the Force

The USMC proposes the incremental permanent increase its overall end strength from 180,000 to 202,000 marines by the end of Fiscal Year 2011. The USMC is preparing an EIS to evaluate the permanent assignment of approximately 9,900 additional Marines and support service personnel at MCB Camp Lejeune, MCAS New River, and MCAS Cherry Point. The increases at these three installations are so closely related, that the Marine Corps decided to evaluate the proposed increases together in an environmental impact statement. The proposed action includes the increases in marines and support service personnel, construction of permanent facilities and infrastructure upgrades. These changes are needed to provide adequate time for troops to recover between deployments, train to meet combat readiness, and prepare for redeployment. Alternatives to the proposed action may consist of alternative siting locations on these installations for new facility construction, renovation and use of existing facilities, or a combination of both new and existing facilities. The no-action alternative, of not permanently basing these Marines and support service personnel will also be examined in the EIS.

To support this growth, all three installations would need (at least to some extent) to:

- Construct administrative, educational, training, maintenance, and operations facilities; lodging accommodations (housing and mess halls); Morale, Welfare, and Recreation facilities (fitness centers, medical/dental clinics, child development center);
- Demolish existing buildings and infrastructure;
- Construct and/or upgrade infrastructure (e.g., roads, power, and communications) within the existing Mainside and cantonment areas at MCB Camp Lejeune and Air Stations; and
- Support on-going and potentially expanded training mission.

The EIS will evaluate potential impacts to numerous resources such: social and economic inputs (including housing); traffic on and off base; noise; water resources (quality and use); land resources; wetlands and floodplains; North Carolina waters and coastal consistency; air quality; archaeological/cultural resources; public services (schools, police, etc.); utilities; and threatened and endangered species. The schedule for the EIS began with the publication of the Notice of Intent on December 14, 2007 in the Federal Register. The official 30-day scoping period also started on December 14, 2007 and concluded on February 3, 2008. Three public scoping open house meetings were conducted during the month of January 2008. A Draft EIS is expected to be published and released to the public in the Summer of 2009.

6.3.1.7 Marine Corps Base Camp Lejeune Training

The MCB Camp Lejeune, Range Operations EA (DoN, 2009a) addresses environmental impacts of current and future training facilities, ranges, air and ground maneuver areas, and waters within and adjacent to MCB Camp Lejeune including one offshore range (BT-3). Section 6.2.3.2 discusses past and present range operations. The preferred alternative of the MCB EA includes:

- 20 percent increase in small arms training except .50 caliber arms;
- increase in rotary-winged (helicopter) operations including a 33 percent increase in CH-53 sorties and a 100 percent increase in AH-1 and UH-1 sorties;
- 10 percent increase in training with MK-19 40-mm grenade rounds;
- 5 percent increase in training with artillery, mortar, and other large arms;
- 39 percent increase in training with tank rounds; and
- 33 percent increase in tactical vehicle operations.

The EA determined there are no identified mitigation measures in addition to those that MCB Camp Lejeune has previously implemented for range and training operations. The analysis determined that implementing the preferred alternative would result in the following environmental impacts:

- No land use changes. Existing ranges and training areas would accommodate the increased operations; therefore, no planning or zoning ordnances would be affected.
- Minor impacts to soils will occur, but will be offset and corrected by land management efforts, best management practices, and erosion and sedimentation control techniques already in place at MCB Camp Lejeune.
- Minor increased impact on local air quality from increased detonation of munitions and increased tactical vehicle and aircraft activity. MCB Camp Lejeune is currently within an attainment area. The air quality within the region is well within regulatory limits and air pollution concentrations for all criteria pollutants within the region are well within regulatory limits. Implementing the preferred alternative will not change the attainment status.
- Small arms and aircraft noise contours will remain below levels where land use constraints or the proximity of noise sensitive land uses are of concern.
- The increases of hazardous materials and wastes are minimal and within the existing capacities of transporters and treatment and disposal facilities at MCB Camp Lejeune.
- Increased training operations within the land ranges and maneuver areas involve ground disturbing activities that have the potential to directly or indirectly affect archaeological and architectural resources eligible for listing on the National Register of Historic Places. MCB Camp Lejeune manages the risk to cultural resources from these activities through range standard operating procedures and user education, training area inspections, and marking of resources known to be eligible for inclusion on the National Register of Historic Places.
- Water range activities have a low potential to affect underwater archaeological resources; submerged artifacts are unlikely to be affected by munitions firing since the vast majority of rounds impacting the water are non-explosive small arms rounds whose momentum will likely be insufficient to disturb buried items on the river or sea floor. Current and proposed training activities will involve minimal high explosive firing with the potential to impact the waters of the BT-3 impact area, and there are no known shipwrecks in the BT-3 impact area.
- Increased training activities may result in short-term and extremely localized disturbances of sediments and water column. These actions are unlikely to affect aquatic life or water quality.
- Increased training and munitions expenditures will have minor impacts on wetlands. Wetland and floodplain areas on the Base downrange of firing points receive some portion of fired rounds and this impact may alter the vegetative community, but is not sufficient to cause long-term changes to the soils, hydrology, or extent of wetlands or floodplains.

- Negligible impacts on marine birds, marine invertebrates, and fish. Impacts will be direct, including disturbance of individual animals during firing and movement on surface waters, but these disturbances will be short-term and infrequent, and therefore will have no population level or long-term effects.

Training and range activities under the preferred alternative have the potential to incur incidental effects on species that are federally protected under the Endangered Species Act. Critical habitat does not exist within the action area of this environmental assessment. ESA Section 7 consultations are pending concerning the seabeach amaranth, rough-leaved loosestrife, nesting sea turtles (loggerhead, leatherback, and green sea), Red-cockaded woodpecker, piping plover, and the West Indian manatee. MCB Camp Lejeune has previously consulted with the US Fish and Wildlife Service and National Marine Fisheries Service regarding these impacts and continues to adhere to the monitoring and conservation measures developed during these consultations. Increased firing and tactical vehicle usage associated with the proposed action has the potential to increase these effects, but these effects are not expected to jeopardize the continued existence of these species or their habitat.

The public is notified of hazardous activities through the use of Notice to Mariners and Notices to Airmen. Prior public notification of Marine Corps training activities, use of known training areas, avoidance of non-military aircraft and civilians, and the remoteness of the training areas from coastal population centers reduces the potential for the interaction between the public and the military. These strategies have been successful in maintaining public safety and are anticipated to continue to do so (DoN, 2009a).

6.3.1.8 Marine Corps Air Station Cherry Point Training

The MCAS Cherry Point, Range Operations EA (DoN, 2009b) addresses environmental impacts of current and future training facilities, ranges, air and ground maneuver areas, and waters within and adjacent to MCAS Cherry Point including two target areas, BT-9 and BT-11. Operations at Marine Corps outlying field Atlantic and auxiliary field Bogue are also addressed. Section 1.5.1 of this FEIS/OEIS discusses this environmental assessment in greater detail. Section 6.2.3.3 discusses past and present range operations. The MCAS Cherry Point Range Operations EA preferred alternative includes:

- Increased air-to-ground sorties at BT-11;
- Increased air-to-surface sorties at BT-9 (see Table 2.3-1, MCAS Cherry Point EA (DoN, 2009b)); and
- Increased .50 caliber weapons firing from helicopters and small boats within a new intermittent water restricted area.

Implementing the preferred alternative could result in the following environmental impacts:

- No changes to land use within MCAS Cherry Point will be required.
- Consistent to the greatest extent possible with the relevant enforceable policies of the North Carolina Coastal Area Management Act. MCAS Cherry Point has submitted a letter of Negative Determination to the North Carolina Department of Environment and Natural Resources, Division of Coastal Management.
- No disproportionately adverse environmental, economic, or health impacts to minority populations, low-income populations, or children on or near MCAS Cherry Point.
- Minor impact on local air quality; however, air pollution concentrations will not exceed the National Ambient Air Quality Standards.
- No significant aircraft noise impacts. Munitions usage rates at the bombing ranges would increase by approximately 18 percent; however these increases will have minimal noise effects on sensitive land uses.

- No effect on architectural resources included or eligible for inclusion in the National Register of Historic Places.
- Minor impacts to soils; however, the impacts will continue to be minimized through land management efforts and by employing applicable soil and sedimentation control techniques at the training sites.
- Underwater sediments will have a slightly higher incident rate of disturbance from increased boat operations. Localized turbidity resulting from live munitions will cause short-term impacts; however, these impacts would not measurably affect sediment quality.
- Negligible adverse impacts to surface water and groundwater.
- Potential impacts to vegetative communities from limited off-road vehicle traffic during some of the training exercises. Reuse of previously disturbed areas for the increased training activities will result in no adverse impacts.
- Minor impacts to wildlife that are not expected to affect the stability of the wildlife populations on range or migratory bird populations within the region. Federally listed threatened and endangered terrestrial species have not been identified on the land ranges. Training activities conducted in water ranges may negatively impact marine or estuarine organisms or habitat. Noise may cause more frequent disturbances to marine birds. Increased use of munitions may increase the potential for ordnance striking a bird; however, existing precautionary measures are in place.
- Direct, but short-term impacts to marine invertebrates at the seafloor will occur due to the use of ordnance for training operations. Fish residing in the MCAS Cherry Point water ranges may experience temporary, short-term impacts from training activities. Noise from non-explosive ordnance will not pose a risk to marine life; noise levels above water will not harm animals and moderate-level noise below water is quickly absorbed.
- The proposed intermittent water restricted area shown in Figure 2-4 of the EA is shared with commercial, recreational, and state sponsored fisheries activities as discussed in Sections 2.2.2.3 and 4.3.2.1 of the MCAS EA. MCAS Cherry Point will not implement this proposed restricted area until U.S. Army Corps of Engineers approves the modification of the existing water surface danger zone at BT-11. This action will require a separate administrative procedure and notice to the public through the Federal Register to modify the existing Code of Federal Regulation.
- Laser usage would increase proportionally with the increase in training exercises; however, existing precautions should preclude increased potential for public mishaps.

The preferred alternative will have minor impacts on marine mammals and may affect federally listed threatened and endangered marine species. Protocol for avoiding harm for all marine mammals is used for the water range as discussed in MCAS EA Section 4.3.5.3. ESA Section 7 and MMPA compliance consultations are pending. NMFS managed species are currently covered under the ESA Section 7 Consultation on Ongoing Ordnance Delivery at Marine Corps Air Station Cherry Point Bombing Targets 9 and 11 in Pamlico Sound, North Carolina (March 2002) for current military training as discussed in MCAS EA section 1.7.1. Potential impacts from the preferred alternative are shown in Table 6.3-1.

During one year of training with explosive ordnance at BT-9 with no precautionary measures in place, calculations of the largest impacts from noise indicated that 0.057 bottlenose dolphins could die from extensive lung hemorrhage (Level A harassment-onset mortality), 0.160 dolphins could suffer from slight but recoverable lung injury (Level A harassment), and 4.783 dolphins could encounter behavioral disruption due to TTS (Level B harassment) (**Table 4.3-5**; MCAS EA (DoN, 2009b).

Table 6.3-1 Potential Bottlenose Dolphin Exposures (per year) to Underwater Noise at BT-9

Munitions Type	Behavioral Disturbance	TTS	Level A	Mortality
2.75" Rocket HE	N/A	4.97	0.17	0.06
5" Rocket HE	N/A	3.39	0.09	0.03
30-mm HE	2.55	N/A	0.05	0.00
40-mm HE	12.60	N/A	0.16	0.01
G911 Grenade	N/A	0.87	0.03	0.01
Total	**15.15**	**9.23**	**0.5**	**0.11**

Based on the preferred alternative, modeling of underwater detonations predicts less than one mortality to sea turtles (Table 6.3-2). The model likely overestimates noise exposure to sea turtles since range users may detect and avoid these animals prior to commencing training events. It is current practice to cease training activities if a sea turtle is spotted within the water range.

Table 6.3-2 Potential Sea Turtle Exposures (per year) to Underwater Noise at BT-9

Munitions Type	Behavioral Disturbance	TTS	Level A	Mortality
2.75" Rocket HE	N/A	1.5754	0.0273	0.0107
5" Rocket HE	N/A	1.0930	0.0150	0.0057
30mm HE	0.2364	N/A	0.0064	0.0003
40mm HE	1.4656	N/A	0.0391	0.0061
G911 Grenade	N/A	0.2697	0.0067	0.0018
Total	**1.702**	**2.9381**	**0.0945**	**0.0246**

The EA concluded that the preferred alternative would require no additional mitigation measures beyond the current standard operating procedures, Best Management Practices, or actions already planned for in the Integrated Natural Resources Management Plan or other Air Station Orders and programs. Personnel will avoid a release of contaminants during training operations due to procedures that are in place governing the handling of hazardous materials. Live-fire small arms ranges would

retain their berms to stop projectiles fired at the ranges. Mitigation measures are in place to ensure that berms are well maintained and re-graded as needed.

6.3.1.9 Expeditionary Fighting Vehicles at Marine Corps Base Camp Lejeune

The Marine Corps proposes to perform testing and engineering assessments/evaluations on up to four prototype Expeditionary Fighting Vehicles (EFVs) at MCB Camp Lejeune, North Carolina. Six to eight EFV testing events lasting one to two weeks would be conducted through the year 2014. The purpose is to assess the performance of EFV prototypes during water-to-shore gunnery exercises under realistic test conditions. The following types of tests would be performed: Developmental Testing; Operational Assessment; and combined Operational and Developmental testing using vehicles in water modes, combat loaded with Marines. All of these test types would be evaluated in terms of Reliability, Availability, Maintainability, and Durability (RAM-D). Waterborne EFV activities involving water-to-shore gunnery testing would take place in the BT-3 Impact Area, the Atlantic Ocean, the New River, and the Atlantic Intracoastal Waterway (AIWW). The action poses a low risk of adverse effects to listed species because the activities would be subject to the standard operating procedures (SOPs) implemented by Camp Lejeune to protect listed species and minimize the likelihood of incidental take (USMC, 2008).

6.3.2 Other Federal and State Agency Action

6.3.2.1 MMS Regulated Activities: Alternative Energy Development (Offshore Wind, Wave, and Ocean Current Energy Capture)

United States Department of the Interior, MMS, released a final programmatic EIS in support of the establishment of a program for authorizing AEAU activities on the OCS, as authorized by Section 388 of the Energy Policy Act, and codified in subsection 8(p) of the OCSLA. 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 (30 m) 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, 2007g). With the passage of the Energy Policy Act of 2005, MMS was given jurisdiction over offshore alternative energy projects, including wind farms (MMS, 2007g).

Construction and everyday operation of offshore wind farms has 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, the creation of underwater electromagnetic fields, and sea floor alterations due to installation (MMS, 2007h).

6.3.2.2 Proposed Marine Container Terminal at the Charleston Naval Complex

There are five marine terminals in the Charleston Harbor area that are owned and operated by the South Carolina State Ports Authority (SCSPA). North Charleston Terminal, Columbus Street Terminal, and Wando Welch Terminal are primarily container terminals and Union Pier and Veterans terminals are dedicated break-bulk facilities (SCSPA, 2008). Combined, the terminals comprise over two million square feet of warehouse and storage space and can accommodate more than 17 vessels at a time (City of North Charleston, 2008). Channels leading to the terminals are deep and wide enough to handle

8,000 twenty-foot equivalent (TEU) ships. All terminals are located within two hours of the open sea (SCSPA, 2008).

In 2004, the Port of Charleston handled approximately 1.725 million 20-foot equivalent units (TEU) (USACE, 2004). The volume of containerized cargo is projected to increase 4.28 percent per year and will reach four million TEUs by the year 2025 (SCSPA, 2008; USACE, 2007). To accommodate the increase in future demand for the number of containers that pass through the Port of Charleston each year, construction of a sixth terminal was permitted in 2007 (USACE, 2007). This port facility will be located on the Cooper River approximately 0.3 mi^2 (0.9 km^2) of land at the south end of the former Charleston Navy Base in North Charleston, South Carolina (USACE, 2007).

It is estimated that the baseline vessel traffic on the Cooper River will increase from 1,365 trips per year in 2004 to 3,219 trips per year in 2025 (USACE, 2006). This equates to an increase from 3.7 trips per day in 2004 to 8.8 trips per day in 2025, or just over five trips per day over a 21-year period. The proposed facility is estimated to be operational in 2012 (USACE, 2006).

6.3.2.3 Port Access Route Study

The Coast Guard is conducting a Port Access Route Study (PARS) on the area east and south of Cape Cod, Massachusetts, to include North Atlantic right whale critical habitat, mandatory ship reporting system area, and the Great South Channel including Georges Bank out to the exclusive economic zone (EEZ) boundary (DoN, 2008a). The purpose of the PARS is to analyze potential vessel routing measures that might help reduce ship strikes with the highly endangered North Atlantic right whale while minimizing any adverse effects on vessel operations. The recommendations of the study will inform the Coast Guard and may lead to appropriate international actions.

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 the 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 Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS. Cumulative impacts resulting from MCAS Cherry Point Range Operations and MCB Camp Lejeune Range Operations were assessed using the conclusions from their respective EAs completed in April 2009 (DoN, 2009a; 2009b). 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 Navy Cherry Point EIS/OEIS Conclusions

The primary effect of the Navy and Marine Corps' training activities in the Navy Cherry Point Study Area would be the deposition of expended training materials and their accumulation over time. 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 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 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

A wide variety of debris is commonly observed off the Atlantic coast of the United States. 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, expended 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 OPAREA 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 Cherry Point OPAREA 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.

The MCAS Cherry Point Range Operations and Range Operations at MCB Camp Lejeune EAs conclude that disturbance to underwater sediments would occur over a broad region and would not be concentrated or result in a measurable effect on underwater sediment quality (DoN, 2009a; 2009b).

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 Navy Cherry Point 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 Navy Cherry Point 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 Navy Cherry Point 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. 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 Navy Cherry Point 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 operations indicates that concentrations of constituents of concern associated with material expended in the Navy Cherry Point 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 (CO), carbon dioxide (CO_2), hydrogen (H_2), water (H_2O), and ammonia (NH_3). The primary contaminants that would be released from explosives used in mine warfare training are nitro aromatic compounds such as TNT, 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 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.

For the land ranges, the amount of hazardous waste generated would increase, commensurate with the increase in training operations. The increase in hazardous materials and hazardous wast associated with the alternatives would increase the potential damage a release might cause, however the existing Hazardous Materials and Hazardous Waste Management programs and capabilities at MCB Camp Lejeune and MCAS Cherry Point could easily handle such an eventuality and contain the release. For the water ranges, hazardous materials and hazardous waste impacts would be limited to hazardous constituent releases from the munitions that fall into the water and migrate off of the range or from hazardous constituents that might migrate from land ranges into the water. The impact would be extremely small, but in conjunction with any past, present, or reasonably foreseeable projects, would amount to a minor adverse cumulative impact on the waters adjacent to the target areas (DoN, 2009a; 2009b).

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 Navy Cherry Point Study Area.

6.4.4.1 Navy Cherry Point 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 Navy Cherry Point 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).

It is expected that although there would be a potential for minor incremental, but recoverable, adverse cumulative impacts by Navy and Marine Corps 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 and Marine Corps training to existing stressors would be nominal.

Direct impacts upon surface water, including wetlands and floodplains, and ground water quality from the increased munitions expeditures proposed in the MCAS Cherry Point and MCB Camp Lejeune EAs are estimated to result in minimal changes in the potential for increased surface water or groundwater contamination (DoN, 2009a; 2009b).

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 Navy Cherry Point Study Area is generally very good. The analysis considered emission sources associated with warfare areas, distances to shore from where exercises take place, and the percentage of training events that take place below 3,000 feet. Most air emissions associated with range complex operations occur more than 3 nm offshore. Depending on factors such as wind direction, emissions in these offshore areas have the potential to mix with air above adjoining cities and counties in North Carolina.

Other areas assessed for air quality impacts included a small, restricted airspace (R-6606) near Naval Air Station Oceana Dam Neck Annex and an area at the mouth of the Chesapeake Bay north of Naval Amphibious Base (NAB) Little Creek and Naval Station Norfolk. Sussex County, Delaware has been designated "nonattainment," at a level of "moderate nonattainment" for the 8-hour ozone standard.

6.4.5.1 Navy Cherry Point EIS/OEIS Conclusions

Emissions associated with implementation of Alternatives 1 and 2 would result in increases in air emissions above baseline (No Action Alternative) conditions. Within U.S. territory, emission increases are mainly associated with increased helicopter and fixed wing aircraft emissions. Outside U.S. territory, emission increases are mainly associated with increased surface vessel operations and additional contributions from fixed wing 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 testing events analyzed in this Navy Cherry Point EIS/OEIS within or adjacent to North Carolina occur within areas designated by the USEPA as attainment areas for all criteria pollutants. Therefore, the General Conformity Rule would not apply.
- The majority of training event types and the majority of training event operations/sorties occur more than 12 nm from the shore, and would not affect the air quality for human receptors. Furthermore, the vast majority of aircraft training emissions occur above 3,000 feet (above the atmospheric inversion layer), and would be without impact on the local air quality

Therefore, there would be no significant impact to air quality from implementing the No Action Alternative, Alternative 1, or Alternative 2. Furthermore, there would be no significant harm to the air quality over non-territorial waters from implementing the No Action Alternative, Alternative 1, or Alternative 2.

6.4.5.2 Navy Cherry Point 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 Navy Cherry Point Range Complex include various construction projects occurring onshore. Periodically, sand replenishment projects approved by the Minerals Management Service and the U.S. Army Corps of Engineers occur along the beaches of the Navy Cherry Point Study Area. Offshore barges involved in the projects produce minor emissions, as do onshore sand-moving bulldozers. Alternative energy development, construction activities or sand replenishment projects would be temporary and would not, in combination with air emissions associated with the Navy Cherry Point Range Complex operations, 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. The increase in air emissions associated with increased munitions use and aircraft sorties associated with the proposed actions in the MCB Camp Lejeune and MCAS Cherry Point Range Operations EAs would not alter the attainment status of the Southern Coastal Plain Air Quality Control Region where they are located (DoN, 2009a; 2009b). The addition of riverine squadrons at the newly formed Navy Expeditionary Combat Command, Navy Amphibious Base Little Creek, VA will contribute to these air emissions. Air emissions within the Navy Cherry Point Study Area also emanate from F/A-18E/F Super Hornets training at Navy Dare County Bombing Range, NC. These training exercises have been required to demonstrate conformity with applicable SIP (unless conducted within an attainment area), which involves a demonstration that the emissions would not result in a cumulatively significant impact for nonattainment criteria pollutants. Given the vast area across which

these emissions occur and the relative sparse emission sources, no significant cumulative impacts to air quality would occur as a result of these activities with the additional training activities proposed from either, the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to air quality 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 Airborne Noise

Increases in operational activity in the Navy Cherry Point Study Area will increase airborne noise levels. However, because Navy and Marine Corps 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 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 Navy Cherry Point EIS/OEIS Conclusions

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to the area sound environment. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to the sound environment of the global commons. 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 Navy Cherry Point Study Area 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;
- Noise would be generated in training areas that have been in similar use for more than 50 years - no new public areas would be exposed to noise from training and testing activities; and
- The incremental increases in the numbers of range events would not substantially increase long term average noise levels; hourly average equivalent noise levels are and would remain relatively low.

6.4.6.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

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 Navy Cherry Point Study Area. Commercial aircraft departing and arriving at airports adjacent to the Navy Cherry Point Study Area can also contribute to the overall Study Area airborne noise levels.

Analysis of the land and water ranges and the proposed actions at those ranges in the MCB Camp Lejeune and MCAS Cherry Point Range Operations EAs determined that noise impacts would increase very little from the no action levels. The increase above existing noise impacts, would be barely perceptible (DoN, 2009a; 2009b). Due to the vast size of the Study Area and the flight altitudes at which many of the Navy and Marine Corps training and testing operations take place, the average

ambient airborne noise contributed by these current and proposed Navy and Marine Corps 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 Navy Cherry Point 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. No significant cumulative impacts to airborne noise quality 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 in non-territorial waters is expected as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.7 Marine Communities

This section of the EIS/OEIS addresses plankton and macroalgae, benthic communities, and artificial habitats within the Navy Cherry Point 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. There are 100 offshore artificial reefs within the Cherry Point OPAREA, found primarily nearshore on the inner continental shelf The Cherry Point OPAREA also contains numerous shipwrecks, most of which are more widely dispersed on the continental shelf than the artificial reefs. The concentration of shipwrecks off the North Carolina coast near Cape Hatteras and the Outer Banks gives evidence to why this area is called "the graveyard of the Atlantic."

6.4.7.1 Navy Cherry Point 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. 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 Navy Cherry Point 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 Navy Cherry Point 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. Additional potential threats 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

Endangered Species Act

The Navy is consulting with NMFS under Section 7 of the ESA regarding its determination of effect for federally listed marine mammals and critical habitat. Table 3.7-20 provides a summary of the Navy's determination of effect for federally listed marine mammals that potentially occur in the Navy Cherry Point Study Area. The Study Area does not contain designated critical habitat for any listed species. Consequently, the proposed action would have no effect on critical habitat. The Navy had informal consultation with USFWS regarding effects of the proposed action on the West Indian manatee. The USFWS concurred with the Navy's conclusion that there would be no effect under the Preferred Alternative (Alternative 2).

Marine Mammal Protection Act

The analysis presented in Chapter 3 indicates that several species of marine mammals could be exposed to impacts associated with underwater detonations and explosive ordnance use under the No Action Alternative, Alternative 1, or Alternative 2 (Preferred Alternative) that could result in Level A or Level B harassment as defined by MMPA provisions that are applicable to the Navy. Exposure estimates are provided in Tables 3.7-5, 3.7-6 and 3.7-7. Other stressors associated with the No Action Alternative, Alternative 1, or 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

With the exception of historic whaling in the 19th and early part of the 20th century, during the past few decades there has been an increase in marine mammal mortalities associated with a variety of human activities (Geraci *et al*., 1999; NMFS, 2007a). These include fisheries interactions (bycatch and directed catch), pollution (marine debris, toxic compounds), habitat modification (degradation, prey reduction), vessel strikes (Laist *et al*., 2001), and gunshots. In addition, during the past 10 years, naval sonar has been putatively linked to only 5 stranding events worldwide, with a total of 51 stranded animals and 37 mortalities. The 37 mortalities equate to an average of fewer than 4 marine mammal mortalities per year over the past 10 years.

These five strandings are unique from other strandings because 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. For example, 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. 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 each 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, the mean annual bycatch from 1990 through 1999 was

3,029 marine mammals (Read *et al*., 2006). Bycatch data from 1990 through 1994 was extrapolated by Read *et al.,* (2006) to consider global impacts; when this was done, approximately 308,000 marine mammal deaths have resulted annually. Waring *et al*., (2008) provided a mean annual mortality of 702 to Western North Atlantic cetaceans (excluding pinnipeds) by observed fisheries in 2001 through 2005. In addition to by-catch, some countries still engage in whaling operations for research and commercial purposes. Such operations led to the death of almost 1,500 marine mammals in 2006 (IWC, 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 6.4-1.

The Navy has made the protection of marine mammals a top priority. The Navy has led the way in marine mammal research, and in conjunction with the National Oceanic and Atmospheric Administration (NOAA), has developed 29 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.

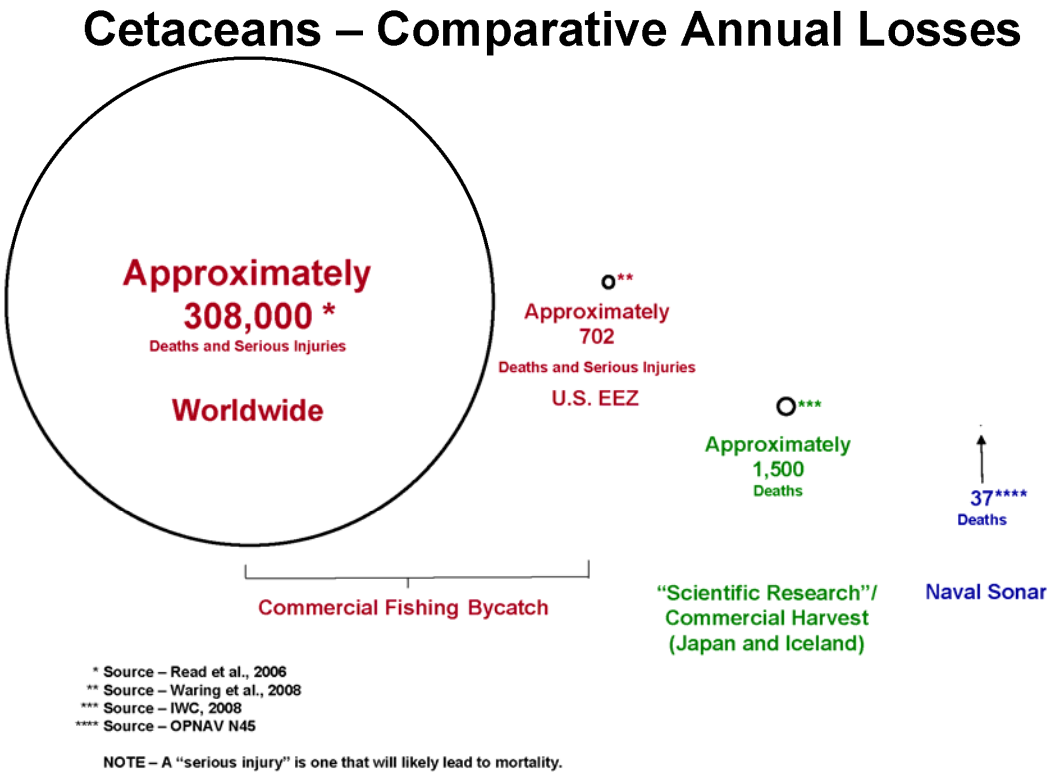


Figure 6.4-1 Annual Comparison of Cetacean Death by Activity

6.4.8.2 Navy Cherry Point 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 Navy Cherry Point EIS/OEIS Study Area. The AFAST FEIS/OEIS also analyzed the effects to marine mammals due to exposure to small explosives during deployment of the

AN/SSQ-110A IEER sonobuoy. The AFAST FEIS/OEIS used the same small explosives criteria (for single explosions) presented in Section 3.7.3.1 of this 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 Navy Cherry Point 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.

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 Cherry Point OPAREA).

Due to the above reasons, quantitative exposure estimates should be used in conjunction with a qualitative analysis to assess potential impacts.

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 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 AFAST FEIS/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 AFAST FEIS/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 AFAST FEIS/OEIS for a discussion of what is known about the possibility of these phenomena.

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 marine mammals 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 marine mammals in territorial waters. In addition, there will be no significant harm to marine mammals in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

Table 6.4-1 Estimated Annual Takes of Marine Mammals Under the AFAST Selected Alternative

Species	Mortality	PTS	TTS	Risk-Function (Behavioral)
North Atlantic right whale**	0	0	0	30
Humpback whale**	0	0*	6	686
Minke whale	0	0	0	36
Bryde's whale				
Fin whale**	0	0	0	0
Sperm whale**	0	0	4	317
***Kogia* spp.**	0	0	8	703
Beaked whale	0	0	5	423
Rough-toothed dolphin	0	0	4	334
Bottlenose dolphin	0	7	738	66340
Pantropical spotted dolphin	0	2	183	15491
Atlantic spotted dolphin	0	3	551	41887
Spinner dolphin				
Clymene dolphin	0	1	87	7401
Striped dolphin	0	0	1	61
Common dolphin	0	0	1	111
Fraser's dolphin				
Risso's dolphin	0	1	100	8639
Atlantic white-sided dolphin				
Melon-headed whale				
Pygmy killer whale				
False killer whale				
Killer whale				
Pilot whales***	0	1	134	12249
Short-finned pilot whale				

* Indicates an exposure greater than or equal to 0.05, therefore, is considered a "may affect" for ESA-listed species.
** Denotes species listed in accordance with the Endangered Species Act
*** Pilot whales include both short- and long-finned pilot whales along the East Coast

6.4.8.3 Navy Cherry Point 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 and Marine Corps 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 (e.g., Fair and Becker, 2000).

The major impact-producing factors of oil/gas exploration, alternative energy development, and other development activities include degradation of water quality resulting from operational discharges; noise from helicopter and vessel traffic, operating platforms, and drill ships; explosive platform removals; seismic surveys; oil spills; oil spill response activities; and discarded debris.

A wide variety of debris is commonly observed off the Atlantic 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. 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. NMFS changes to the Atlantic Large Whale Take Reduction Plan may have a positive impact on Atlantic large whales.

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*., 1996).

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.*, 1989; 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 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, 2007).

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 activity and have resulted in the ocean pH dropping 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. The Navy's quantitative analysis of acoustic sources affecting marine mammals and sea turtles is based on the best available sicience; *e.g.* for sonar, modeling involved analysis in areas based on potential activities and transmission loss (DoN, 2009c). 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).

Military operations other than those described in the Proposed Action may contribute to the impacts on marine mammals in the Navy Cherry Point Study Area. MCAS Cherry Point increased weapons firing at targets on BT-9 and BT-11 and the continued, but modest increase, of training at MCB Camp Lejeune (DoN, 2009a; 2009b), airborne noise from aircraft operations based at NAS Patuxent River (DoN, 1999) operating primarily in W-386 and NAS Oceana transiting to and from Navy Dare County Bombing Range, NC (DoN, 2003; 2008e), contribute to the anthropogenic noise environment. Small boats proposed to be homebased at Navy Amphibious Base Little Creek would also contribute to the cumulative impacts with their vessel movements and engine noise.

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.

With respect to the cumulative effects from the Navy's use of active mid and high frequency sonar , the acoustic analysis from the AFAST FEIS/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 Navy Cherry Point Study Area as discussed in section 3.19 of this document).

In the AFAST FEIS/OEIS, an acoustic analysis was performed in order to estimate the effects associated with active sonar use. Chapter 4 of the AFAST FEIS/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 FEIS/OEIS, the Navy finds 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 FEIS/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 Biological Opinion.

The AFAST FEIS/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 Letter of Authorization.

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 has initiated 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 Navy Cherry Point 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 Navy Cherry Point Study Area. The AFAST FEIS/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 AFAST FEIS/OEIS using the same methods and criteria presented for small explosive impacts (single explosions) to sea turtles in the Navy Cherry Point Range Complex EIS/OEIS (Section 3.8).

Table 6.4-2 shows that no acoustic exposures resulting in a physiological effect are anticipated in the Navy Cherry Point Study Area. In the case of single explosions, behavioral effects are expected to be limited to short-term startle effects.

Table 6.4-2 Estimated Sea Turtle Acoustic Exposures from Explosive Source Sonobuoys

Species	Mortality	PTS	TTS
Loggerhead sea turtle	0	0[3]	0[3]
Kemp's ridley sea turtle[1]	0	0	0
Leatherback sea turtle	0	0	0
Hardshell sea turtles[2]	0	0	0

1. *This category does not include Kemp's ridley sea turtles in the Gulf of Mexico. They are included in the hardshell sea turtle class.*
2. *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.*
3. *Indicates an exposure greater than or equal to 0.05, therefore is considered a "may affect" for ESA listed species*

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.

6.4.9.2 Navy Cherry Point 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 and Marine Corps 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 (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 *et al*., 2007). 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 (PCB) and dichlorodiphenyldichloroethylene (DDE) 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 has been 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).

Military operations other than those described in the Proposed Action may contribute to the impacts on sea turtles in the Navy Cherry Point Study Area. MCAS Cherry Point increased weapons firing at targets on BT-9 and BT-11 and the continued, but modest increase, of training at MCB Camp Lejeune (DoN, 2009a; 2009b), airborne noise from aircraft operations based at NAS Patuxent River (DoN, 1999) operating primarily in W-386 and NAS Oceana transiting to and from Navy Dare County Bombing Range, NC (DoN, 2003; 2008e), contribute to the anthropogenic noise environment. Small boats proposed to be homebased at Navy Amphibious Base Little Creek would also contribute to the cumulative impacts with their vessel movements and engine noise.

With respect to the cumulative effects from the Navy's use of active mid and high frequency sonar, the acoustic analysis from the 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 Navy Cherry Point Study Area as discussed in section 3.19 of this document).

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 AFAST FEIS/OEIS. Acoustic analysis in the AFAST FEIS/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 AFAST FEIS/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 for non-sonar related activities. Protection and conservation measures would be implemented during the proposed action to minimize potential adverse impacts to sea turtles and to avoid significant or long-term adverse impacts to threatened and endangered species. As such, there is a potential for minor, but recoverable, cumulative impacts to sea turtles under the No Action Alternative, Alternative 1, Alternative 2, and Alternative 3. Impacts would be temporary and localized and would not be considered significant. No significant cumulative impacts to sea turtles would occur as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to sea turtles in non-territorial waters is expected as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.10 Fish and Essential Fish Habitat

Potential threats 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 (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, 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 and Marine Corps 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 Navy Cherry Point 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 unavoidable significant adverse effects to fish populations, managed species, or essential fish habitat. 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 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 for the No Action Alternative, Alternative 1, or Alternative 2. Therefore, EFH consultation with NMFS is not required.

Findings for ESA-listed fish included the following.

- Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on the shortnose sturgeon.
- Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on the smalltooth sawfish.

The Study Area does not contain designated critical habitat for any listed species. Consequently, the proposed action would have no effect on critical habitat.

The Navy is consulting with NMFS regarding its determination of effect for federally listed fish. The analysis of environmental stressors and alternatives indicated no significant impact to fish populations or habitat in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.10.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The overall effect on fish stocks would be negligible compared to the impact of commercial and recreational fishing in the Navy Cherry Point Study Area. Past, present, planned, and reasonably foreseeable actions within the Navy Cherry Point 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 threats 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; Field *et al.*, 2003). NMFS changes to the Atlantic Large Whale Take Reduction Plan may have a positive impact on fish (NMFS, 2008b)

Military operations other than those described in the Proposed Action may contribute, though very minor, to the impacts on fish in the Navy Cherry Point Study Area. Airborne noise from NAS Oceana transiting to and from Navy Dare County Bombing Range, NC (DoN, 2003; 2008e), contribute to the anthropogenic noise environment. Small boats proposed to be homebased at Navy Amphibious Base Little Creek would also contribute to the cumulative impacts with their vessel movements and engine noise.

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.

With respect to the cumulative effects from the Navy's use of active mid and high frequency sonar , the acoustic analysis from the AFAST FEIS/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 Navy Cherry Point 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 AFAST FEIS/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 overall effect on fish stocks, Managed Species and EFH would be negligible compared to the impact of commercial and recreational fishing. Thus, no significant cumulative impacts to fish or EFH would occur in U.S. territorial waters as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. Likewise, no significant harm in non-territorial waters would be expected.

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

A total of 61 seabird species could potentially occur in the OPAREA. Two federally listed seabird species, the roseate tern (*Sterna dougallii*) and Bermuda petrel (*Pterodroma cahow*) potentially occur in the Navy Cherry Point Study Area. Offshore pelagic waters support non-breeding and transient pelagic seabirds, loons, gannets, and terns. Potential threats 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).

6.4.11.1 Navy Cherry Point EIS/OEIS Conclusions

Analyses of vessel movements, aircraft overflights, and other training activities in the Navy Cherry Point Study Area were conducted to identify potential effects on seabirds and migratory birds. The analysis 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. 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 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. 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.

6.4.11.2 Navy Cherry Point 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 Navy Cherry Point Study Area. Past, present, planned, and reasonably foreseeable actions within the Navy Cherry Point Study Area includes commercial and recreational fishing, commercial and general aviation traffic, alternative energy development and coastal development. Military operations other than those described in the Proposed Action may contribute to the bird strike effects in the Navy Cherry Point Study Area. Airborne noise from aircraft operations based at NAS Patuxent River (DoN, 1999) operating primarily in W-386 and NAS Oceana transiting to and from Navy Dare County Bombing

Range, NC (DoN, 2003; 2008c), contribute to the anthropogenic noise environment, causing minor behavior disturbances.

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 confer with the USFWS on the 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 U.S. territorial waters. Likewise, there is the potential for minor, but recoverable, cumulative harm to seabirds and migratory birds under the No Action Alternative, Alternative 1, and Alternative 2 non-territorial waters.

6.4.12 Land Use

The Navy Cherry Point Range Complex does not include any land areas. Instead, it is a set of operating and maneuvering areas with defined air, ocean surface and subsurface areas. 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 most of the time.

6.4.12.1 Navy Cherry Point 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.

6.4.12.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

There are no unavoidable significant cumulative impacts to land use as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2. Proposed increased training on land ranges in the MCB Camp Lejeune EA and MCAS Cherry Point Range Operations EA adds to the potential for soil disturbances and erosion; however, mitigation in the *Installation Natural Resource Management Plan* would counter or contain adverse direct impacts associated with the increase in training operations. Review of relevant past and present projects indicated minor impacts during clearing and grading activities, however potential erosion impacts were temporary and minimized by utilizing best management practices for soil erosion and sedimentation. Future project located at MCB Camp Lejeune and MCAS Cherry Point would be required to follow the mitigations in the *Installation Natural Resource Management Plan* (DoN, 2009a; 2009b). No significant cumulative harm to land use in non-territorial waters is expected from the No Action Alternative, Alternative 1, or Alternative 2. The Proposed Actions would be consistent with the enforceable policies of States of Delaware, Maryland, Virginia, and North Carolina's Coastal Zone Management Programs and there are no cumulative effects.

6.4.13 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 operations 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 characteristics of the shipwreck. Eventually, the expended materials would provide a substrate for benthic colonization and would likely be covered by shifting sediments.

6.4.13.1 Navy Cherry Point EIS/OEIS Conclusions

Potential stressors analyzed for their potential to affect shipwrecks were related to mine warfare training, use of non-explosive practice munitions, underwater detonations and high-explosive ordnance, and military expended materials. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable adverse effects to cultural resources. 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 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.

6.4.13.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

There are no architectural resources listed, or eligible for listing, on the NRHP in the MCAS Cherry Point Range Complex (DoN, 2009b). On MCB Camp Lejeune, projects that had the potential to impact archaeological sites that may be eligible for inclusion in the National Register of Historic Places due to construction proposed on the range in the Greater Sandy Run area have archaeological surveys being conducted under a Programmatic Agreement with the North Carolina State Historic Preservation Officer prior to any development, thus there would be no adverse effects to historic properties (DoN, 2009a).

Most past, present, and reasonably foreseeable future ocean activities such as commercial ship traffic, fishing, dredging, debris, 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. 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 in territorial waters under the No Action Alternative, Alternative 1 or Alternative 2. No significant cumulative harm to cultural resources in non-territorial waters is expected from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.14 Transportation

Because the Navy Cherry Point Range Complex does not include land areas, the transportation analysis addressed only marine and air traffic. As demonstrated by current conditions, military and civilian uses of the offshore sea and air areas are compatible. Where naval vessels and aircraft are conducting operations that are not compatible (for example, hazardous weapons firing), they are confined to the OPAREA away from shipping lanes and inside special use airspace. Hazardous operations are communicated to all vessels and operators by the U.S. Coast Guard, FAA, and Fleet Area Control and Surveillance Facility Virginia Capes (FACSFAC VACAPES), located at Naval Air Station Oceana, Virginia.

6.4.14.1 Navy Cherry Point EIS/OEIS Conclusions

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 operations, especially if coincident with peak fishing locations and periods, could cause temporary displacement to individual travelers. However, most offshore operations are of short duration and have a small operational footprint.

The transportation analysis evaluated the potential for existing or proposed military air or vessel traffic to affect existing transportation and circulation conditions in the Navy Cherry Point Study Area. 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 transportation. 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 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. The analysis of environmental stressors and alternatives indicated no significant impact to transportation in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.14.2 Navy Cherry Point 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 military operations, commercial ship traffic, fishing, energy exploration, or scientific research, would not substantially affect transportation. Although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to transportation, there would be a potential for minor incremental, but recoverable, 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.

6.4.15 Demographics

Demographics were assessed through the identification and evaluation of socioeconomic factors, including population trends, age structure, race and ethnicity, and educational achievement. The affected environment for demographics includes only the state of North Carolina. 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).

6.4.15.1 Navy Cherry Point 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 of the coastal counties of North Carolina. Neither would there be a change to the local population or economy as a result of the proposed offshore training activities under the proposed action.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in impacts to demographics of the counties of North Carolina; the alternatives performed in non-territorial waters would not cause significant harm to demographics of the counties of North Carolina. 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 demographics in territorial waters. In addition, there would be less than significant harm to demographics in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.15.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

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 EIS/OEIS, no further analysis of cumulative impacts is relevant.

6.4.16 Regional Economy

The regional economy was assessed through evaluation of economic factors, including industry, commercial fishing, tourism, and recreational fishing. The Study Area for assessment of the regional economy includes only the state of North Carolina. Specific data for regional economic indicators on industry, commercial fishing, tourism, and recreational fishing were assessed in the EIS/OEIS.

6.4.16.1 Navy Cherry Point EIS/OEIS Conclusions

The analysis of environmental stressors, including vessel movements, aircraft overflights, inert mine shape deployment and recovery, and Military Expended Materials, indicated that 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.

6.4.16.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

NMFS changes to the Atlantic Large Whale Take Reduction Plan may contribute to cumulative impacts to the commercial fishing industry economy (NMFS, 2007b). Alternative energy exploration and

development along the Atlantic seaboard may contribute to the regional economy in a positive way (MMS, 2007c). 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 EIS/OEIS, no significant cumulative impacts to the regional economy is expected.

6.4.17 Recreation

Water-based recreation occurs throughout the Navy Cherry Point Study Area, but most activities are conducted in bays or nearshore ocean waters in small boats (less than 25 feet). Fishing is probably the most common activity with more than a million people participating in marine recreational fishing off the Coast of North Carolina each year. Boating and diving on artificial reefs and shipwrecks also are popular.

Where naval vessels and aircraft are conducting operations that are not compatible (*e.g.*, hazardous weapons firing), they are confined to OPAREAs away from shipping lanes and inside Special Use Airspace. Advanced notice of hazardous operations is communicated to all vessels and operators by use of NOTMARs, issued by the USCG, and NOTAMs, issued by the 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.

6.4.17.1 Navy Cherry Point 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 unavoidable significant adverse effects to recreation. The analysis of environmental stressors and alternatives indicated no significant impact to recreation 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 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.

6.4.17.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

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 and Marine Corps 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 and Marine Corps training to existing stressors would be nominal.

6.4.18 Environmental Justice

The affected environment is open water with no permanent human populations. Because of the absence of populations of children in these areas and the safety restrictions placed on the general public during military operations in the Navy Cherry Point Study Area, children would not experience health risks or

safety risks. Because of the absence of people beyond the 12 nm territorial limit, environmental justice was considered only from a NEPA perspective and was not evaluated in accordance with EO 12114.

6.4.18.1 Navy Cherry Point EIS/OEIS Conclusions

Impacts to environmental justice or protection of children would occur if the alternatives disproportionately affected minority populations, low-income populations, or populations of children. 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 impacts to environmental justice.

6.4.18.2 Navy Cherry Point EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

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 environmental justice impacts proposed in this EIS/OEIS, no further analysis of cumulative impacts is relevant.

6.4.19 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 and Marine Corps 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 Navy Cherry Point Study Area.

6.4.19.1 Navy Cherry Point 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 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.

6.4.19.2 Navy Cherry Point 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 Navy Cherry Point Study Area. Past, present, planned, and reasonably foreseeable actions within the Navy Cherry Point 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.

6.5 Assessing Individual Past, Present, and Future Impacts

In this chapter, past and present actions, as well as reasonably foreseeable future action, have been 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:

- An "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, an 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 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.

Table 6.5-1 Summary of Cumulative Impacts by Resource Area

		Bathymetry/Sediments	Hazardous Materials/Waste	Water Resources	Air Quality	Noise Environment	Marine Communities	Marine Mammals	Sea Turtles	Fish	Seabirds/Migratory Birds	Land Use	Cultural Resources	Transportation	Demographics	Regional Economy	Recreation	Environmental Justice	Public Health and Safety
Past and Present Actions	Commercial and Recreational Fishing	*	*	NE	NE	NE	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Maritime Traffic	*	*	*	NE	*	NE	**	*	NE	NE	NE	*	*	NE	*	*	NE	*
	Scientific Research	NE	*	NE	NE	NE	*	*	*	*	*	NE	NE	NE	NE	NE	NE	NE	NE
	Debris	*	*	*	NE	NE	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Environmental Contamination and Biotoxins	NE	NE	**	NE	NE	**	**	**	**	**	NE	NE	NE	NE	NE	NE	NE	NE
	Marine Ecotourism	NE	NE	*	NE	NE	NE	*	*	NE	NE	NE	NE	NE	NE	*	*	NE	NE
	Military Operations	*	*	*	*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	*
	MMS: Oil and Gas	**	*	**	**	*	*	**	**	*	**	NE	*	NE	NE	NE	NE	NE	NE
	Dredging	**	**	**	**	*	**	NE	**	**	NE	NE	*	NE	NE	NE	NE	NE	NE
Future Actions	Military Operations	*	*	*	*	*	*	*	*	*	*	NE	*	NE	NE	NE	NE	NE	*
	MMS Oil and Gas Leases	*	NE	*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Navy Cherry Point 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

CHAPTER 7 REFERENCES

The following references are subdivided by their corresponding chapters where they are cited. Chapter 3 references are further subdivided by section for ease in locating a citation.

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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 as of the landscape.

Air Basin—a region within which the 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, the location, and the 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—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 PCBs, 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 whose saline content is intermediate between that of streams 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—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—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 including long-range air strikes, naval surface fire support, and other surface gunnery and missile exercises.

CATM-9—Captive Carry Training Missile (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 Program (Hawaii Revised Statutes Chapter 205 A).

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 which 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 the State of Hawaii 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 [5,486.4 meters] 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 OMCM) 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 (e.g. CSAR training in VACAPES Range Complex, previously done primarily in JAX Range Complex).

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's (MEU) 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 that are designed to replicate the types of missions they are likely to face during their 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 they 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 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.

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.

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 of 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 will allow 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.

Global Commons—areas established by treaty or recognized under customary international law that are beyond the territorial jurisdiction of any nation. The High Seas (Global Commons) do not include EEZs established and recognized under international law as set forth in reference (i). In addition, although the Antarctica continental land mass is part of the global commons, by court decision, NEPA (and not E.O. 12114), applies to U.S. actions that would impact the environment of the continental land mass of Antarctica.

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. For the Vandal launch, the arc is 6,000 feet.

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 wastes, 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—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.

Inhibited Red Fuming Nitric Acid (IRFNA)—a liquid hypergolic propellant utilized as an oxidizer (as in the Lance). This reddish-brown acid is highly corrosive, spontaneously reacting with UDMH and certain other organic substances. It also dissolves in water, and care must be taken regarding its induced boiling effects. Its highly toxic, characteristically pungent vapors irritate skin and eyes.

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 to support the gaining CINC.

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 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 3-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—a heavy metal which 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 an indurated rock.

Littoral—species found in tide pools and near-shore surge channels.

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, JTFEX, SACEX, and CAX. 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 in order 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—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 Operating Area—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—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.

Munitions Constituents—any materials originating from unexploded ordnance, expended military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

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 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. The National Environmental Policy Act procedures require that environmental information be made available to the public before decisions are made. Information contained in the National Environmental Policy Act documents must focus on the relevant issues in order 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 in order 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—gas formed primarily from atmospheric nitrogen and oxygen when combustion takes place at high temperatures.

Nitrogen Oxides—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—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.

Off-Shore—open-ocean waters over the continental slope which are deeper than 200 meters, 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 (RDT&E).

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 that is under the jurisdiction, custody, or control of the Secretary of Defense and is 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 272.2 kilograms (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 100 meters (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 5400 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 RDT&E 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, RDT&E test, 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 it 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, ESQDS, surface danger zones, special use airspace, HERO/HERP areas, 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, which acoustically score bomb drops during a training exercise from the sound where a bomb impacts the surface of the ocean.

Sortie—a single operational training or RDT&E event conducted by one aircraft tin 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—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 (W/kg).

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 stormwater outfall refers to the mouth of a drain or sewer that channels this runoff.

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—a toxic gas that is 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. Could also include SEPTAR, AQM, BQM, MQM, etc.

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).

Unsymmetrical Dimethyl Hydrazine (UDMH)—a liquid hypergolic propellant utilized as a missile fuel (as in the Lance); clear and colorless, UDMH has a sharp ammonia-like or fishy odor, is toxic when inhaled, absorbed through the skin, or taken internally. It is dissolvable in water, but not sensitive to shock or friction; however, when in contact with IRFNA, or any other oxidizing material, spontaneous

ignition occurs. In addition, UDMH vapors greater than 2 percent in air can be detonated by electric spark or open flame.

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 force.

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 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 (MIW, AMW, SUW, ASW, AW, STW, EC, NSW) as further broken down into sub-events (MCM, amphibious assault, GUNEX(S-S), TRACKEX(Sub), MISSILEX(A-A), BOMBEX(A-G), CHAFFEX, CSAR).

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 1.8 meters (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.

CHAPTER 9 LIST OF PREPARERS

The following list identifies the Navy personnel that were primarily responsible for preparing this EIS/OEIS and associated documents:

Susan Admire (NAVFAC Atlantic), Navy Technical Representative
M.S.(ABT), Environmental Science and Policy, George Mason University
M.B.A., University of Hawaii
B.A., Geography/Urban & Regional Planning, University of North Carolina, Charlotte
Years of Experience: 15
Sections: Project manager for the Navy

Bryan Murphy (US Fleet Forces), USFF Representative
M.B.A., University of West Florida
B.S. (Chemical Engineering), University of Notre Dame
Years of Experience: 31
Sections: USFF Representative for all sections

Keleigh Biggins (NAVFAC Atlantic), Navy Assistant Counsel
J.D., Southern Illinois University School of Law
B.A., Southern Illinois University, Carbondale
Years of Experience: 10
Sections: Legal Reviewer, all sections

Deanna Rees (NAVFAC Atlantic)
B.S., Univertsity of Idaho, Wildlife Resources
Years of Experience: 11
Responsibility: Marine mammals; MMPA; ESA Section 7 Consultation

Mandy Shoemaker (NAVFAC Atlantic)
M.E.M. Duke University
B.S., University of California, Santa Cruz
Years of Experience: 5
Responsibility: Explosive modeling; fish

CDR Dominick G. Yacono, US Navy, Judge Advocate general's Corps
United States Fleet Forces Command, Deputy Fleet Judge Advocate Environmental
B.A. Economics, History and International Studies, American University, Washington DC
M.L.I.R., Michigan State University
J.D., The College of Law, Ohio State University
Years of Experience: 11
Responsibility: Legal Reviewer, all sections

The following list identifies in alphabetical order contractors that assisted in the preparation of the EIS/OEIS or associated documents:

Matthew E. Bartlett (Parsons), Environmental Scientist
B.S., Environmental Policy & Planning, Virginia Polytechnic & State University
Years of Experience: 4
Sections: Public Health & Safety, Other Considerations, Appendix B

Susan L. Bupp (Parsons), Cultural Resources Specialist
M.A., Anthropology, University of Wyoming, Laramie
B.A., Anthropology, Wichita State University, Kansas
Years of Experience: 32
Section: Cultural Resources

Steve Buss (Parsons), Deputy Program Manager
M.S., Physical Oceanography Naval Postgraduate School;
B.S., U.S. Naval Academy
Years of Experience: 25
Sections: Appendix D and E

Jeffery Butts (Parsons), Principal Scientist
J.D., Catholic University; M.U.R.P., Virginia Tech;
B.A.., University of Virginia
Years of Experience: 15
Sections: Noise, Air Quality, Appendix D, Appendix E, Appendix G, Appendix H

Steffanie A. Chan (ManTech SRS Technologies, Inc.), Terrestrial Biologist
B.S., Biology, George Mason University;
B.B.A., International Business, Marymount University
Years of Experience: 11
Sections: Recreation, Transportation, Land Use, Regional Economy

Mark A. Collins (Parsons), Environmental Scientist
B.S., Environmental Science, Ferrum College
Years of Experience: 21
Sections: Marine Communities, Marine Mammals, Sea Turtles, Fish and Essential Fish Habitat, Seabirds and Migratory Birds, Terrestrial

Colleen Conklin (Parsons), Environmental Planner
B.S., University of South Florida
Years of Experience: 22
Sections: Water Quality and reviewer of all sections

Dawn M. DeMartino (Parsons), Senior Scientist
B.S., Earth Systems Science, George Mason University
Years of Experience: 10
Sections: Hazardous Material and Hazardous Waste, Marine Mammals

Meredith Fagan (Geo-Marine, Inc.), Sea Turtle Biologist
M.S. (Marine Science), Virginia Institute of Marine Science (VIMS); College of William and Mary
B.A., University of Virginia
Years of Experience: 8
Sections: BE; Section 3.8 reviewer

Thomas H. Glinski, MS (Q&S Engineering, Inc.), Senior Marine Ecologist
M.S., B.A., Biology, San Diego State University
Years of Experience: 25 years
Section: Essential Fish Habitat Assessment

Nora Gluch (Geo-Marine, Inc.), Marine Mammal Biologist
MEM (Master of Environmental Management), Duke University;
BA, Grinnell College
Years of Experience: 3
Sections: BE, LOA

Joseph B. Kaskey (Geo-Marine, Inc.), Fisheries Biologist
M.S., Botany, Southern Illinois University;
B.A., Biological Sciences, Southern Illinois University
Years of Experience: 30
Section: BE

Sherrie G. Keenan (Parsons), Sr. Technical Writer/Editor
B.A., Journalism
Years of Experience: 30
Sections: All

Robert Kull (Parsons), Senior Project Manager
M.S., Biology, University of North Carolina
B.A.., Biology, University of the Pacific
Years of Experience: 28
Sections: All

Conrad I. Leslie, REA (Q&S Engineering, Inc.), President and CEO
Marine Industrial Technology, California Maritime Academy; Professional Certificate in Environmental Management, University of California, San Diego
Years of Experience: 15 years
Section: Essential Fish Habitat Assessment

Tammy Jo Mitnik (ManTech SRS Technologies, Inc.), Project Manager
M.B.A., Management, American InterContinental University
B.S., Justice and Public Safety, Auburn University
Years of Experience: 14
Sections: Socioeconomic Sections

John Pitcher (ManTech SRS Technologies, Inc.), Director, ESD Business Ops
M.B.A., Management, University of Virginia;
S.B., Chemical Engineering, Massachusetts Institute of Technology
Years of Experience: 19
Sections: Bathymetry and Sediments

Buffy Quinn (Parsons), PARCOMM/Principal GIS Specialist
M.A., Geography, University of Denver;
B.S., Geography, University of Southern Mississippi
Years of Experience: 17
Sections: GIS Figures

Jason H. See (Geo-Marine, Inc.), Department Manager, Marine Sciences
Ph.D., Marine Sciences, Virginia Institute of Marine Science, College of William and Mary;
B.S., Zoology, Texas A&M University
Years of Experience: 9
Sections: BE, LOA

Amy Danae Whitt (Geo-Marine, Inc.), Marine mammal biologist
M.E.M. (Master of Environmental Management), Coastal Environmental Management, Duke University
B.S., Biology, Lyon College
Years of Experience: 6
Sections: BE, LOA

Arthur A. Wolfson, PhD (Q&S Engineering, Inc.), Principal Scientist
Ph.D., Scripps Institution of Oceanography, University of California, San Diego
Years of Experience: 30 years
Section: Essential Fish Habitat Assessment

Michael J. Zickel (Geo-Marine, Inc.), Marine Scientist
M.S., Marine Estuarine Environmental Science, University of Maryland-College Park
B.S., Physics, College of William and Mary
Years of Experience: 10
Section: BE

CHAPTER 10 :DISTRIBUTION LIST

The individuals, agencies, and organizations listed in Table 10-1 received a copy of the Navy Cherry Point Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). Table 10-2 is a list of stakeholders: individuals, agencies, and organizations that received notification of the availability of the Navy Cherry Point Range Complex FEIS/OEIS.

Table 10-1 Navy Cherry Point Range Complex FEIS/OEIS Distribution List

STATE CLEARINGHOUSES OR APPROPRIATE STATE AGENCY	
North Carolina	
Ms. Valerie McMillan State Clearinghouse NC Department of Administration 1301 Mail Service Center Raleigh, NC 27699-1301	
FEDERAL AGENCIES	
U.S. Environmental Protection Agency	
US Environmental Protection Agency Office of Federal Activities EIS Filing Section Mail Code 2252-A, Room 7241 Ariel Rios Building (South Oval Lobby) 1200 Pennsylvania, NW Washington, DC 20460	Mr. Heinz J. Mueller Regional Administrator US EPA Region IV 61 Forsyth Street SW Atlanta, GA 30303
Mrs. Marthea Roundtree US Environmental Protection Agency Office of Federal Activities 1200 Pennsylvania Avenue NW South Oval Office RM 7239A (MC-2252A) Washington, DC 20460	
National Oceanic & Atmospheric Administration	
Craig Johnson NMFS Headquarters 1315 East-West Highway Silver Spring, MD 20910	Jolie Harrison NMFS Headquarters 1315 East-West Highway Silver Spring, MD 20910

TABLE 10-1 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS DISTRIBUTION LIST (Continued)

United States Marine Corps.	
Major M. Fahy Commander, General Attn PAO MCBCL USMC PAO Virginia Dare Drive, Building 37 Camp Lejeune, NC 28547	
U.S. Army Corps of Engineers	
LTG Robert L. Van Antwerp Commander US Army Corps of Engineers 441 G Street Northwest Washington, DC 20314-1000	Tracey Wheeler US Army Corps of Engineers PO Box 1000 Washington, NC 27889-1000
Colonel John E. Pulliam Jr. Commander, District Engineer U.S. Army Corps of Engineers P. O. Box 1890 Wilmington, NC 28402-1890	COL Jefferson Ryscavage District Commander U.S. Army Corps of Engineers, Wilmington District P. O. Box 1890 Wilmington, NC 28402-1890
Mr. Coleman Long Chief, Planning and Environmental Branch U.S.Army Corps of Engineers USAED, Wilmington P.O. Box 1890 Wilmington, NC 28402-1890	
Department of Interior	
Dr. Willie Taylor Office of Environmental Policy and Compliance 1849 C Street, NW (Mail Stop 2342) Washington DC, 20240 Attn: Ms Loretta Sutton	
Marine Mammal Commission	
Dr. Robert Gisiner Scientific Program Director Marine Mammal Commission 4340 East-West Highway, Room 905 Bethesda, MD 20814	Mr. Timothy Ragen Executive Director Marine Mammal Commission 4340 East-West Highway, Room 905 Bethesda, MD 20814

TABLE 10-1 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS DISTRIBUTION LIST (Continued)

Appointed Councils	
Mr. Daniel T. Furlong Executive Director Mid-Atlantic Fishery Management Council Federal Building, Suite 2115 300 S. New Street Dover, DE 19904	Mr. Robert Mahood Executive Director South Atlantic Fishery Management Council 4055 Faber Place Drive, Suite 201 North Charleston, SC 29405
INFORMATION REPOSITORIES	
Hatteras Library 57690 NC Highway 12 Hatteras, NC 27943	New Hanover County Library 201 Chesnut Street Wilmington, NC 28401
Webb Memorial Library Center 812 Evans Street Morehead City, NC 28557	Onslow County Library 58 Doris Avenue East Jacksonville, NC 28540
Kill Devil Hills Branch Library 400 S. Mustian St Kill Devil Hills, NC 27948	Havelock-Craven County Public Library 301 Cunningham Boulevard Havelock, NC 28532
CONGRESSIONAL REPRESENTATIVES	
North Carolina	
The Honorable Richard Burr US Senate 217 Russell Senate Office Building Washington, DC 20510	The Honorable Elizabeth Dole US Senate 555 Dirksen Senate Office Building Washington, DC 20510
The Honorable G.K. Butterfield US Congressman 1st District, North Carolina 413 Cannon House Office Building Washington, DC 20515	The Honorable Walter B. Jones US Congressman 3rd District, North Carolina 2333 Rayburn House Office Building Washington, DC 20515
The Honorable Mike McIntyre US Congressman 7th District, North Carolina 2437 Rayburn House Office Building Washington, DC 20515	

STAKEHOLDER LIST

Postcards were disseminated to individuals, agencies, and organizations listed in Table 10-2. The postcards acted as formal notification of the availability of the Navy Cherry Point Range Complex FEIS/OEIS and announcement of public hearings. A sample of the postcard is presented at the end of Table 10-2.

Table 10-2 Navy Cherry Point Range Complex FEIS/OEIS Stakeholder List

STATE ELECTED OFFICIALS	
North Carolina	
The Honorable Michael F. Easley Office of the Governor 20301 Mail Service Center Raleigh, NC 27699	The Honorable Harry Brown NC Senate – 6th District Legislative Office Building, Room 515 Raleigh, NC 27603-5925
The Honorable Ed Jones NC Senate – 4th District Legislative Office Building, Room 623 Raleigh, NC 27603-5925	The Honorable Marc Basnight NC Senate – 1st District Legislative Office Building, Room 2007 Raleigh, NC 27601
The Honorable Jean Preston NC Senate – 2nd District 16 West Jones Street Legislative Office Building, Room 1121 Raleigh, NC 27603	The Honorable Julia Boseman NC Senate – 9th District Legislative Office Building, Room 309 Raleigh, NC 27603
The Honorable R.C. Soles, Jr. NC Senate – 8th District Legislative Office Building, Room 2022 Raleigh, NC 27601	The Honorable Bonner L. Stiller NC House – 17th District Legislative Office Building, Room 306A2 Raleigh, NC 27603
The Honorable Bill Owens NC House – 1st District Legislative Office Building, Room 635 Raleigh, NC 27601	The Honorable Timothy L. Spear NC House - 2nd District Legislative Office Building, Room 402 Raleigh, NC 27601
The Honorable Annie W. Mobley NC House – 5th District 300 N. Salisbury Street, Room 638 638 Legislative Office Building Raleigh, NC 27603-5925	The Honorable Russell E. Tucker NC House – 4th District 300 N. Salisbury Street Legislative Office Building, Room 416B Raleigh, NC 27601
The Honorable Alice Graham Underhill NC House – 3rd District 16 W. Jones Street Legislative Building, Room 1206 Raleigh, NC 27601-1096	The Honorable William L. Wainwright NC House – 12th District 300 N. Salisbury Street Legislative Office Building, Room 301F Raleigh, NC 27603-5925
The Honorable Thomas E. Wright NC House – 18th District Legislative Building, Room 528 Raleigh, NC 27601-1096	The Honorable Dewey L. Hill NC House – 20th District Legislative Building, Room 1309 Raleigh, NC 27601-1096

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

The Honorable Arthur Williams NC House – 6th District Legislative Office Building, Room 637 Raleigh, NC 27603-5925	The Honorable Daniel F. McComas NC House – 19th District Legislative Office Building, Room 506 Raleigh, NC 27603
The Honorable Pat McElraft NC House – 13th District 300 N. Salisbury Street Legislative Office Building, Room 603 Raleigh, NC 27603	The Honorable George G. Cleveland NC House – 14th District Legislative Office Building, Room 504 Raleigh, NC 27603
The Honorable W. Robert Grady NC House – 15th District Legislative Office Building, Room 302 Raleigh, NC 27603	The Honorable Carolyn H. Justice NC House – 16th District Legislative Office Building, Room 306A3 Raleigh, NC 27603
CITY and COUNTY OFFICIALS	
North Carolina	
The Honorable Gerald Jones, Jr. Mayor of Morehead City Town of Morehead City 706 Arendell Street Morehead City, NC 28557	Mr. John Langdon Carteret County Manager 302 Courthouse Square Beaufort, NC 28516
The Honorable Bill Saffo Mayor of Wilmington PO Box 1810 Wilmington, NC 28402	Mr. John Bauer County Manager, Pender County P.O. Box 661 Burgaw, NC 28425
The Honorable Renee Cahoon Mayor of Nags Head P.O. Box 714 Nags Head, NC 27959	The Honorable Jimmy Sanders Mayor of Havelock PO Box 368 Havelock, NC 28532
The Honorable Jan Slagle Mayor of Jacksonville PO Box 128 Jacksonville, NC 28451	County Manager Onslow County 118 Old Bridge Street Jacksonville, NC 285404259
Mr. Donny Ward Economic Development Council (Past member) 293 Pinners Point Road Beaufort, NC 28516	Mr. JT Garrett Carteret Co. Health Dir. 3820 Suite A, Bridges St Morehead City, NC 28557
Mr. Harold Blizzard County Manager County of Craven 406 Craven St New Bern, NC 28560	Mr. James Creech Chair Craven Region Airport Authority PO Box 3258 New Bern, NC 28562

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Mr. Roy Brinson Board of Commissioners County of Pamlico PO Box 776 Bayboro, NC 28515	Ms. Christine Mele Board of Commissioners County of Pamlico PO Box 776 Bayboro, NC 28515
Mr. Jimmy Spain Board of Commissioners County of Pamlico PO Box 776 Bayboro, NC 28515	Mr. Carl Ollison Board of Commissioners County of Pamlico PO Box 776 Bayboro, NC 28515
Mr. J Douglas Brinson Board of Commissioners County of Pamlico PO Box 776 Bayboro, NC 28515	Mr. Tim Buck County Manager County of Pamlico PO Box 776 Bayboro, NC 28515
Mr. Douglas Harris Chairman, Board of Commissioners County of Carteret PO Box 3006 Atlantic Beach, NC 28512	Mr. William Holt Faircloth, Jr. Vice-Chairman, Board of Commissioners County of Carteret PO Box 1526 Morehead City, NC 28557
Mr. Jonathan Robinson Board of Commissioners County of Carteret 682 Seashore Dr Atlantic, NC 28511	Mr. Greg Lewis Board of Commissioners County of Carteret PO Box 365 Morehead City, NC 28557
Mr. Pete Allen Board of Commissioners County of Carteret PO Box 5111 Emerald Isle, NC 28594	Mr. Wade Nelms Board of Commissioners County of Carteret PO Box 818 Newport, NC 28570
Mr. Thomas Steepy Board of Commissioners County of Carteret 217 Rudolph Drive Beaufort, NC 28516	Mr. Johnnie Sampson, Jr. Board of Commissioners County of Craven 1036 Sampson St New Bern, NC 28560
M Renee Sisk Board of Commissioners County of Craven 218 Gatewood Drive New Bern, NC 28560	Mr. Jason Jones Board of Commissioners County of Craven 1744 Asbury Rd Cove City, NC 28523
Mr. Lee Kyle Allen Board of Commissioners County of Craven 118 Oakwood Dr Havelock, NC 28532	Mr. Theron McCabe Board of Commissioners County of Craven 521 Ferry Rd Havelock, NC 28532
Mr. Perry Morris Board of Commissioners County of Craven 816 Piney Neck Rd Vanceboro, NC 28586	Mr. Steve Tyson Board of Commissioners County of Craven 820 Broad St New Bern, NC 28560

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Ms. Sondra Ipock Riggs Vice-Chairman, Board of Commissioners County of Jones 862 Riggstown Rd Pollocksville, NC 28573	Mr. Jessie Ray Eubanks Board of Commissioners County of Jones PO Box 25 Pollocksville, NC 28573
Mr. W. Michael Haddock Board of Commissioners County of Jones 2331 Wyse Fork Road Trenton, NC 28585	Mr. Joe Wiggins Chairman, Board of Commissioners County of Jones 641 Richlands Rd Trenton, NC 28585
Mr. Charles Battle Jr. Board of Commissioners County of Jones PO Box 158 Comfort, NC 28522	Mr. Franky J. Howard County Manager County of Jones PO Box 340 Trenton, NC 28585
FEDERAL AGENCIES	
U.S. Department of the Interior	
Mr. H. Dale Hall Director US Fish and Wildlife Service 1849 C Street, NW Washington, DC 20240	Mr. Sam Hamilton Director, Southeast Region US Fish and Wildlife Service 1875 Century Blvd., Suite 400 Atlanta, GA 30345
Mr. Pete Benjamin U.S. Fish and Wildlife Service Raleigh Field Office PO Box 33726 Raleigh, NC 27636-3726	Ms. Karen Mayne US Fish and Wildlife Service Virginia Field Office 6669 Short Lane Gloucester, VA 23061
Mr. Stephen C. Jackson US Fish and Wildlife Service Edenton National Fish Hatchery 1102 West Queen Street Edenton, NC 27932	Mr. Bruce Freske US Fish and Wildlife Servic Cedar Island and Swan Quarter National Wildlife Refuge 38 Mattamuskeet Road Swan Quarter, NC 27885
Mr. Mike Bryant US Fish and Wildlife Service Alligator River and Pea Island National Wildlife Refuges P.O. Box 1969 Manteo, NC 27954	Mr. Howard A. Phillips US Fish and Wildlife Service Pocosin Lakes National Wildlife Refuge PO Box 329 Columbia, NC 27925

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Mr. Gregory Hogue Regional Environmental Officer/Office of Enivronmental Policy and Compliance U.S. Department of the Interior/Office of the Secretary Suite 1144 75 Spring Street, S.W. Atlanta, GA 30303-8960	National Park Service US Dept of Interior 1849 C Street Washington, DC 20240
Mr. Mike Hoff US Fish and Wildlife Service Mackay Island and Currituck National Wildlife Refuges PO Box 39 Knotts Island, NC 27950	Superintendent Cape Hatteras National Seashore 1401 National Park Drive Manteo, NC 27954
Superintendent Cape Lookout National Seashore 131 Charles Street Harkers Island, NC 28531	
Department of Commerce	
Ms. Rebecca Lent Director National Marine Fisheries Service Office of Protected Resources 1315 East West Highway Silver Spring, MD 20910	Dr. Roy E. Crabtree Regional Administrator, Southeast Region National Oceanic & Atmospheric Administration National Marine Fisheries Service 263 13th Avenue, South St. Petersburg, FL 33701
Dr. James W. Balsiger Assistant Administrator National Marine Fisheries Service 1315 East West Highway, SSMC3 Silver Spring, MD 20910	Mr. Ron Schler National Marine Fisheries Service Habitat Conservation Division 101 Pivers Island Road Beaufort, NC 28516
Dr. John Merriner National Marine Fisheries Service 101 Pivers Island Road Beaufort, NC 28516	Mr. Ford Cross National Marine Fisheries Service Environmental Assessment Division 101 Pivers Island Road Beaufort, NC 28516
Ms. Karen Kohanowich Director National Marine Fisheries Service Office of Habitat Conservation 1315 East West Highway Silver Spring, MD 20910	Ms. Aleta Hohn NMFS- Supervisory Research Fish Biologist NOAA 101 Pivers Island Road Beaufort, NC 28516

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Mr. Lowell Bahner Special Assistant to the Director National Oceanic and Atmospheric Administration Office of Habitat Conservation 410 Severn Avenue, Suite 107A Annapolis, MD 21403	National Oceanic & Atmospheric Administration 14th St & Constitution Ave NW Room 6217 Washington, DC 20230000
Mr. Annie Gorgne NOAA 190 Shell Landing Road Beaufort, NC 28516	Ms. Gretchen Lovewell NOAA, NMFS Beaufort Lab 211 Pollock Street Beaufort, NC 28516
Ms. Amelia Jugovich NOAA, NMFS Beaufort Lab 103 Gordon Street Beaufort, NC 28516	Ms. Lisa Goshe NOAA, NMFS Beaufort Lab 200 Rochelle Drive Morehead City, NC 28557
Ms. Krista Trono Communications Coordinator NOAA, National Ocean Service Monitor National Marine Sanctuary 100 Museum Drive Newport News, VA 23606	Mr. John O'Shea Executive Director Atlantic States Marine Fisheries Commission 1444 Eye Street NW, 6th Floor Washington, D.C. 20005
U.S. Department of Transportation	
Federal Aviation Administration US Dept of Transportation 800 Independence Ave Washington, DC 20591	
U.S. Department of Homeland Security	
US Coast Guard US Dept of Homeland Security 2100 Second St, SW Washington, DC 20593	Admiral Thad W. Allen Commandant (G-MWV) US Coast Guard – Headquarters 2100 Second Street, SW Washington, DC 20593
Rear Admiral Fred Rosa US Coast Guard – 5th District 431 Crawford Street Portsmouth, VA 23704	
U.S. Department of Defense	
Ms. Shelley Meyer Sylivant Naval Surface Warfare Center (NSWC) 2202 Cambridge Downs Drive Morehead City, NC 28557	

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Native Americans	
Chief Ricky Bruner Croatan Indian Tribe of Orangeburg POB 357 Cordova, SC 290390000	Chief Gene Faircloth Coharie Intra-Tribal Council Route 3, Box 340 E 7531 U.S. Highway 421 North Clinton, NC 20328
Ms. Gladys Hunt Executive Director Cumberland County Association for Indian People 102 Indian Drive Fayetteville, NC 28301	Chief Michell Hicks Eastern Band of Cherokee Indians P.O. Box 455 Cherokee, NC 28719
Mr. Rick Oxendine Executive Director Guilford Native American Association P.O. Box 5623 Greensboro, NC 27435	Chief Ronald Richardson Haliwa-Saponi Tribe P.O. Box 99 Hollister, NC 27844
Mr. Donald Strickland Executive Director Metrolina Native American Association 2601-A East 7th Street Charlotte, NC 28204	Chief W.A. "Tony" Hayes Occaneechi Band of the Saponi Nation P.O. Box 356 Mebane, NC 27302
Mr. Dante Desiderio Executive Director Sappony Indian Tribe P.O. Box 3265 Roxboro, NC 27574	Chief Roscoe Jacobs Waccamaw-Siouan Tribe P.O. Box 221 Bolton, NC 28423
Chief Jimmy Goins Lumbee Tribe of North Carolina P.O. Box 68 Pembroke, NC 28372	Chief Thomas Lewis Meherrin Indian Tribe P.O. Box 508 Winton, NC 27910
STATE AGENCIES	
North Carolina	
Mr. William G. Ross, Jr. Secretary North Carolina Department of Environmental & Natural Resources 1601 Mail Service Center Raleigh, NC 27699	Mr. Bryan E. Beatty Secretary NC Department of Crime Control & Public Safety 4701 Mail Service Center Raleigh, NC 27699

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Ms. Lisbeth C. Evans Secretary NC Department of Cultural Resources 109 East Jones Street 4601 Mail Service Center Raleigh, NC 27699	Mr. Richard Hamilton Executive Director NC Wildlife Resources Commission 1701 Mail Service Center Raleigh, NC 27699
Mr. Wes Seegars Chairman NC Wildlife Resources Commission 2549 South Edgewater Drive Fayetteville, NC 28303	Mr. Steven H. Everhart NC Wildlife Resources Commission 127 Cardinal Drive Wilmington, NC 28405
Charlan Owens North Carolina Department of Environment and Natural Resources Division of Coastal Management 1367 US 17 South Elizabeth City, NC 27909	The Honorable Beverly Purdue President, NC Senate 20401 Mail Service Center Raleigh, NC 27699-0401
Mr. Traux Hawley NC Office of the Governor 20301 Mail Service Center Raleigh, NC 27699	Mr. Ryan Davenport Compliance and Enforcement Representative CAMA NC Division of Coastal Management 400 Commerce Avenue Morehead City, NC 28557
Mr. Duke Daugherty NADEP 310 Old Nassau Smyrna, NC 28579	Mr. Stephen Ryras Federal Consistency CoordinatorNC Division of Coastal Management 400 Commerce Avenue Morehead City, NC 28557
Mr. Randy Gregory NC Division of Marine Fisheries PO Box 769 Morehead City, NC 28557	Mr. Michael W. Stred NC Division of Marine Fisheries PO Box 769 Morehead City, NC 28557
Mr. Mike Bradley NC Marine Trades Services 101 Pivers Island Rd Beaufort, NC 28516	Mr. Brian Efland NC Sea Grant 303 College Circle Morehead City, NC 28557
Mr. John E. Pechmann NC Wildlife Resources Commission 2549 S. Edgewater Drive Fayetteville, NC 28303	Ms. Susan Cameron NCNRC 253 White Oak Blf. Stella, NC 28582
Mr. Bill Flournoy Office of Conservation & Community Affairs North Carolina Department of Environment and Natural Resources 1601 Mail Service Center Raleigh, NC 27699	Dr. Lewis Daniel III Director/Division of Marine Fisheries North Carolina Department of Environment and Natural Resources 3441 Arendell Street PO Box 769 Morehead City, NC 28557

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Mr. William Ross Jr. Secretary/North Carolina Department of Environment and Natural Resources North Carolina Department of Environment and Natural Resources 1601 Mail Service Center Raleigh, NC 27699-1601	Mr. James H. Gregson Director NC Division of Coastal Management 400 Commerce Ave Morehead City, NC 28557
NC Division of Environmental Health 2728 Capital Blvd Raleigh, NC 27699	NC Division of Parks and Recreation 1615 Mail Service Center Raleigh, NC 27699
Mr. Charles Jones Director, North Carolina Division of Coastal Management 400 Commerce Avenue Morehead City, NC 28557	Mr. Keith Bates Sr. Advisory Commission on Military Affairs 5404 Chesapeake Road Fayetteville, NC 28311
Mr. Bill Stanley Advisory Commission on Military Affairs 60 Court Plaza Suite 206 Asheville, NC 288013565	
ORGANIZATIONS	
Southern Environmental Law Center (SELC) Ms. Michele Nowlin Senior Attorney 200 W. Franklin St., Suite 300 Chapel Hill, NC 27516	Pender Watch & Conservancy Mr. Donald Ellson President 1836 Corcus Ferry Road Hampstead, NC 28443
Southern Environmental Law Center (SELC) Ms. Anna Davis 200 W. Franklin Street, Suite 330 Chapel Hill, NC 27516	Pender Watch & Conservancy Mr. Jack Spruill 1836 Corcus Ferry Road Hampstead, NC 28443
The Humane Society of the United States Ms. Naomi Rose, PhD, Marine Mammal Scientist 2100 L. Street, NW Washington, DC 20037	Marine Acoustics, Inc. Ms. Kimberly Skrupky 4100 Fairfax Drive, Suite 730 Arlington, VA 22203
North Carolina Coastal Federation 3609 Highway 24 Newport, NC 28570	Save the Whales Rick, Pam, Victoria, & Veronica Arma 113 Holman Road Williamsburg, VA 231850
North Carolina Coastal Federation Ms. Christine Miller 813 S. Yaupon Terrace Morehead City, NC 28557	Sierra Club of North Carolina North Carolina Chapter 112 S Blount Street Raleigh, NC 27601

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

North Carolina Coastal Federation Frank V. Tursi Cape Lookout Coastkeeper 3609 Highway 24 (Ocean) Newport, NC 28570	Neuse River Foundation 220 S. Front Street New Bern, NC 28560
Carteret County Crossroads P.O. Box 155 Beaufort, NC 28443	NC Wildlife Resources Ms. Wendy Cluse 211 Virginia Avenue Morehead City, NC 28557
Pamlico-Tar River Foundation Ms. Mary A. Alsentzer Executive Director 108 Gladden Street PO Box 1854 Washington, NC 27889	Carteret Fisherman Association 652 Seashore Atlantic, NC 28511
Environmental Defense Michelle Duval 2500 Blue Ridge Road, Suite 330 Raleigh, NC 27607	Ocean Mammal Institute Ms. Marsha L. Green President PO Box 14422 Reading, PA 19612
Environmental Defense 4000 Westchase Boulevard Suite 510 Raleigh, NC 27607	Michelle Nowlin Attorney and Senior Lecturing Fellow Duke Environmental Law and Policy Clinic Duke University Law School, Box 90360 Durham, NC 27708
Institute of Biological Sciences/ University of Aarhus Mr. Peter Teglberg Madsen Universitetsparken 8000 Aarhus C, Building 131 Denmark	Monitor National Marine Sanctuary c/o The Mariner's Museum 100 Museum Drive Newport News, VA 23606
North Carolina Chapter of The Nature Conservancy Mr. Fred Annad Associate Director One University Place, Suite 290 4705 University Drive Durham, NC 27707	North Carolina Sea Turtle Stranding and Salvage Network Dr. Matthew Godfrey Sea Turtle Program Coordinator 1507 Ann Street Beaufort, NC 28516
Southeast Region Marine Mammal Stranding Network 717 General Booth Blvd Virginia Beach, VA 23451	Animal Welfare Institute Ms. Cathy Liss President PO Box 3650 Washington, DC 20027-0150

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

National Estuarine Research Reserve Ms. Amy Clark Program Specialist; Estuarine Reserves Division Office of Ocean and Coastal Resource Management 1305 East West Highway Silver Spring, MD 20910	Audubon North Carolina Mr. Andy Wood Education Director 7741 Market Street Unit D Wilmington, NC 28411-9444
Animal Welfare Institution Ms. Susan Millward Executive Director PO Box 3650 Washington, DC 20027	Carteret Co Crossroads Mr. Irving Hooper Treasurer and Newsletter Editor 775 Highway 101 Beaufort, NC 28516
Australian Defence Estate Organisation Mr. Bill Byrne Shoalwater Bay Military Training 68 Western Street Rockhampton, Queensland 4700	Coastal Conservation Association North Carolina Mr. Bill Mandulak CCA North Carolina Chairman PO Box 58629 Raleigh, NC 27658
Chapel Hill Museum Mr. John E. Andrews Documentary Filmmaker 523 East Franklin Street Chapel Hill, NC 27514	European Coalition for Silent Oceans Mr. Sigrid Lueber Delegate of the European Coalition for Silent Oceans and President of OceanCare PO Box 30 CH-8820 Wadenswil
Emerald Isle Home - 7211 Ocean Road Ms. Carol B. Johnson 1009 Creekside Lane Wilmington, NC 28411	International Fund for Animal Welfare Mr. Chris Cutter Point of Contact 290 Summer Street Yarmouth Port, MA 026750000
Executive Headquarters, Environmental Defense Fund William McDonough + Partners 700 East Jefferson Street Charlottsville, VA 229020000	NC Conservation Network Ms. Veronica Butcher 19 E. Martin Street Suite 300 Raleigh, NC 27601
Natural Resources Defense Council Mr. Joel R. Reynolds Senior Attorney 1314 Second Street Santa Monica, CA 90401	NRDC Action Fund Frances Beinecke President 40 West 20th Street New York, NY 10011
New River Roundtable Board Member PO Box 1506 Dublin, VA 24084	NC Division of Marine Fisheries Mr. Michael W. Street PO Box 769 Morehead City, NC 28557
Ocracoke Preservation Society, Inc. Janey Jacoby Executive Director PO Box 1240 Ocracoke, NC 27960	Sierra Club Ms. Mary Frazer 1716 Evergreen Avenue Raleigh, NC 27603

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Seaflow Inc. Mr. Michael Stocker Science Advisor 1062 Fort Cronkhite Sausalito, CA 94965	Sierra Club North Carolina Chapter Ms. Pat Carstensen Chapter Chair 112 S. Blounc Street Raleigh, NC 27601
Sierra Club Mr. Bill Rlayfer 120 Asbury Road Greenville, NC 27858	North Carolina Aquarium Mr. Neal Conoley President 3125 Poplarwood Ct. Suite 160 Raleigh, NC 27604
Sierra Club, North Carolina Regional Office Ms. Molly Diggins State Director 402 West Trade Street Charlotte, NC 28202	United Plant Savers Ms. Lynda LeMole Executive Director PO 'Box 400 East Barre, VT 05649
Southern Environmental Law Center Deb Carter 200 West Franklin St. Suite 330 Chapel Hill, NC 275162559	Citizens Concerned About Jet Noise Mr. John Schick Chairman 912 Duke of Suffolk Drive Virginia Beach, VA 23454
Allies for Cherry Point's Tomorrow Mr. Jimmy Sanders President PO Box 383 Havelock, NC 28532	NRDC DC Regional Office 1200 New York Ave, NW Suite 400 Washington, DC 20005
Keep Onslow Beautiful (affiliate of Keep America Beautiful) Ms. Lisa Stotesbury Director 604 College St Jacksonville, NC 28540	Carnegie Museum of Natural History ATTN: J Hyland 4400 Forbes Ave Pittsburgh, PA 15213
Acoustic Ecology Institute Mr. Jim Cummings Executive Director 45 Cougar Canyon Santa Fe, NM 87508	Rachel Carson Estuarine Research Ms. Rebecca Ellin Reserve Manager 400 Commerce Ave Morehead City, NC 28557
Endangered Species Coalition PO Box 65195 Washington, DC 20035	Carteret Co Cross Road Mr. Dick Bierly 213 Brandywine Pla Drive Morehead City, NC 28557
Ms. Joy Mason Havelock Chamber of Commerce PO Box 21 Havelock NC 28532	Beach Home & Fishing Mr. Billy C Ellis 3800 Stering Trace Drive Winterville, NC

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Ms. Liz Senn New Bern Chamber of Commerce PO Drawer C New Bern, NC 28563	Big Rock Blue Marlin Tournament Mr. Tom Bennett PO Box 1673 405 Evans Street, Suite E Morehead City, NC 28557
Big Rock Blue Mountain Tournament Ms. Crystal Watters PO Box 1673 405 Evans Street, Suite E Morehead City, NC 28557	Bill Collector Charter - NC Watermen United Captain Stephen Draughon 1905 Clubhouse Drive Morehead City, NC 28557
Ms. Marsha Green North American Representative International Ocean Noise Coalition 300 Broadway Street, Suite 28 San Francisco, CA 94133	Cape Fear Divers LLC Mr. James L. Conner 809 N. Lake Park Blvd Carolina Beach, NC 28428
Boat Captain Fishing Mr. Dale Britt 2012 Shepard Street Morehead City, NC	Dancin Outlaw Charters Mr. Thomas Wood PO Box 585 Harkers Island, NC 28531
Capt Joe Shute, Bait & Tackle Ms. Jennifer Shute 601-H Atlantic Beach Cswy. Atlantic Beach, NC 28512	Diving/Fishing Charters Mr. Bobby Edwards 145 Intercoastal Drive Beaufort, NC 28516
Discovery Diving Co., Inc. Ms. Debby Boyce 414 Orange Street Beaufort, NC 28516	Full Circle Charter Co. Mr. Willy Phillips 1366 Highway 64 Columbia, NC 27925
Diving/Fishing Charters Ms Renae Eichinger 145 Intercoastal Drive Beaufort, NC 28516	Marina Mr. Bill Newbern 153 Camp Morehead Drive Morehead City, NC 28557
Marina Ms. Lisa McCorkle 129 Sir Christophers Drive Newport, NC 28570	North Carolina Watermen United PO Box 150 Hatteras, NC 27943
North Carolina Fisheries Association, Inc. Mr. Sean McKeon PO Box 12303 New Bern, NC 28561	Town Creek Marina Mr. Steve Tulevch 232 W. Beaufort Road Beaufort, NC 28516
Town Creek Marina Mr. Chuck Tulevch General Manager 232 W. Beaufort Road Beaufort, NC 28516	Olympus Dive Center Mr. Gary M. Rufus 713 Shepard Street Morehead City, NC 28557

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

United National Fishermen's Association Mr. James Fletcher 123 Apple Road Mann's Harbor, NC 27953	Woods Hole Oceanographic Institution Dr. Mark P. Johnson Mail Stop #50 Woods Hole, MA 02543
Olympus Dive Center Mr. Robert Purifoy 713 Shepard Street Morehead City, NC 28557	Geo-Marine, Inc. Mr. Brian Bloodworth 111 Spring House Way 101 Newport News, VA 23602
Woods Hole Oceanographic Institution Mr. Peter Tyack Mail Stop #50 Woods Hole, MA 02543	Hydra Aquatic Inc. Ms. Barbara Coleman 15 Little Dipper Road Tijeras, NM 87059
Holistic Animal Health Care Lide Doffermyre 7405 Masonboro Sound Road Wilmington, NC 28409	Pamlico County Chamber of Commerce PO Box 92 Grantsboro, NC 28529
Hydro Optix LLC Mr. Jon Kranhouse 5631 Mesmer Avenue Culver City, CA 90230-6363	Mr. Mike Waggoner Carteret County Chamber of Commerce 801 Arendell St Morehead City, NC 28557
Individuals (Public Scoping Meeting Attendees)	
Ms. Danielle Dunn Morehead City, NC 28557	Ms. Stephanie Danner Beaufort, NC 28516
Ms. Kaitlin Ofatt Morehead City, NC 28557	Ms. Lia Protopapadakis Morehead City, NC 28557
Ms. Wendy Dow Beaufort, NC 28516	Ms. Nancy Young Beaufort, NC 28516
Ms. Katherine Almquist Beaufort, NC 28516	Mr. Dave Plummer Beaufort, NC 28516
Mr. Dale Britt Morehead City, NC	Mr. Tom Roler Beaufort, NC 28516
Mr. Mauric Davis Newport, NC 28570	Mr. Frank Gromadzki Smyrna, NC 28579
Mr. Jeff Gabriel Morehead City, NC 28557	Mr. LJ Gould, JR Morehead City, NC 28557
Mr. Chris Kimray Beaufort, NC 28516	Mr. John D. Lampus Beaufort, NC 28516
Mr. John McGinty Newport, NC 28570	Mr. Carlos Sanderson Beaufort, NC 28516
Mr. Neil Wagones Morehead City, NC 28557	Mr. Charles Hawell Beaufort, NC 28516
Ms. Debby Boyce Beaufort, NC 28516	Capt. USCG Ret Mr. Bill Brogdon Cape Carteret, NC 28544
Ms. Caroline Good Beaufort, NC 28516	Ms. Lucie Hazen Beaufort, NC 28516

TABLE 10-2 NAVY CHERRY POINT RANGE COMPLEX FINAL EIS/OEIS STAKEHOLDER LIST (Continued)

Ms. Jennifer Jackson Beaufort, NC 28516	Ms. Erin LaBrecque Beaufort, NC 28516
Kim Maison Beaufort, NC 28516	Ms. Catherine McClellan Havelock, NC 28532
Mr. Andy Read Gloucester, NC 28528	Mr. David Shiffman Beaufort, NC 28516
ATTN: Leigh Torres Beaufort, NC 28516	Ms. Danielle Waples Beaufort, NC 28516
Ms. Liz Wexler Beaufort, NC 28516	Ms. Lynne Williams Beaufort, NC 28516
Ms. Kelly Price Morehead City, NC 28557	Mr. Jason Roberts Morehead City, NC 28557
Ms. Anna Levina Beaufort, NC 28516	Mr. Joseph Luczkovich Greenville, NC 27858
Mr. Josh Lunas Pittsburg, PA 15206	Ms. D. Ann Pabst Wilmington, NC 28403
Mr. Maray Chen Washington, DC 20007	Mr. William McClellan Wilmington, NC 28411
Mr. Mark Keusen Kothen Washington, NC 23889	Ms. Amanda Southwood Wilmington, NC 28403
Individuals (Public Hearing Attendees)	
Mr. Michael Hargrove Morehead City, NC	Mr. Mark Hobbs Morehead City, NC 28570
Mr. Thomas Taylor Beaufort, NC 28516	Mr. Jonathan Robison Atlantic, NC 28511
Mr. Don DeVan Charlotte, NC	Mr. Lee Johnson Beaufort, NC 28511
Ms. Maria Dunn Washington, NC	Mr. Mark Walker Hobart, NC
Ms. Susan Davis EI, NC	Mr. Keith Rittmaster Beaufort, NC 28516
Ms. Trish Murphy Morehead City, NC	Mr. Tom Braaten New Bern, NC 28562
Mr. Mike Durenberger Greenville, NC	Mr. Greg Lewis Wilmington, NC 28401
Mr. Ken Willson Wilmington, NC 28409	Ms. Ashley Raybould Topsail Beach, NC 28445
Ms. Sandy Sly Surf City, NC 28445	Ms. Mellisa Dionesotes Wilmington, NC 28403
Ms. D. Ann Pabst Wilmington, NC	Ms. Molly Ellword Wilmington, NC
Mr. Mike Giles Wilmington, NC 28403	Mr. John Spruill Hampstead, NC 28443
Ms. Jean Beasley Surf City, NC 28445	Ms. Jennifer Gross Topsail Beach, NC 28445
Ms. Jennifer Poragaw Topsail Beach, NC 28445	Ms. Mary Sheffield Surf City, NC 28445

Navy Cherry Point Range Complex EIS/OEIS

The U.S. Navy is announcing public hearings and a public comment period for the Navy Cherry Point Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). This document assesses the potential environmental consequences associated with Navy and Marine Corps training and research, development, testing, and evaluation (RDT&E) activities, and associated range capabilities enhancements (including infrastructure enhancements) in the Navy Cherry Point Range Complex.

Public hearings will be held on the following dates:

October 14, 2008 North Carolina Maritime Museum; 315 Front Street; Beaufort, NC 28516
October 15, 2008 Coastline Inn & Convention Center; 503 Nutt Street; Wilmington, NC 28401

Copies of the draft document can be found at the following locations:

Hatteras Library; 57690 NC Highway 12; Hatteras, NC 27943
Kill Devil Hills Branch Library; 400 S. Mustian Street; Kill Devil Hills, NC 27948
Manteo Branch Library; 700 North Highway 64/264; Manteo, NC 27954
New Hanover County Public Library; 201 Chestnut Street; Wilmington, NC 28401
Webb Memorial Library Center; 812 Evans Street; Morehead City, NC 28557
Onslow County Public Library; 58 Doris Avenue East; Jacksonville, NC 28540
Havelock-Craven County Public Library; 301 Cunningham Boulevard; Havelock, NC 28532
The document is also available for download at http://www.navycherrypointrangecomplexeis.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 Navy Cherry Point EIS/OEIS can be sent via U.S. mail or fax, as well as through the Navy Cherry Point Range Complex EIS/OEIS website. The mailing address is: Naval Facilities Engineering Command, Atlantic; Attention: Code EV22SA (Navy Cherry Point EIS/OEIS PM); 6506 Hampton Blvd; Norfolk, VA 23508-1278. Fax: (757) 322-4894.
Website: http://www.navycherrypointrangecomplexeis.com
Please submit comments by October 27, 2008