MARINE RESOURCES ASSESSMENT FOR THE NORTHEAST OPERATING AREAS: ATLANTIC CITY, NARRAGANSETT BAY, AND BOSTON

FINAL REPORT

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APPENDICES

APPENDIX A: INTRODUCTION

Appendix A-1. Data confidence and NE OPAREAs geographic information system (GIS) maps

The level of data confidence is dependent upon three factors: precision, accuracy, and currency. Each of these three factors are affected by all the variables involved in obtaining data and putting the data into a GIS to display the data on a map. Following is a brief description of the three main factors and some of the subsequent variables that figure into overall level of confidence.

- ***Precision***—Refers to whether or not the description of the data is specific or non-specific. It is possible to have data recorded very precisely but with very low accuracy. In other words we may say that 2 + 2 = 5.12546732, where the sum is given very precisely but inaccurately. Global positioning systems (GPS) offer the highest level of precision for recording locations.

- ***Accuracy***—Refers to how well the data reflect reality. There may be 10 sightings of harbor porpoises in an area, but they may actually have been common dolphins. Even if the locations were precisely recorded, the data are still not accurate. Some variables that affect accuracy are who originally recorded the data (source reliability), how many people have processed/altered the data since it originated (number of iterations), and the method used to record the data.

- ***Currency***—Refers to how recently the data were obtained. Because recent developments in equipment and methods have improved precision and accuracy, confidence is higher for data that have been recorded more recently.

NE OPAREAs MRA Map Examples	Description of Map Data	Confidence Level
Bathymetry, Bottom Sediments, Sea Surface Temperature, Chlorophyll *a*, Seagrass/Salt Marsh, Occurrence Maps for Species of Concern, Essential Fish Habitat (minority of the maps), and Marine Managed Areas	Data from original/reliable source. Provided in a digital format with geographic coordinates given. Identified as "*source data*" in map captions.	**High** 79 maps (60% of total number of maps)
Artificial Habitats and Essential Fish Habitat (majority of the maps)	First- or second-hand data sources. Locations obtained through scanning geo-referenced* maps. Identified as "*source map(s) scanned*" in map captions.	**Medium** 42 maps (32% of total number of maps)
Surface Currents, Migration Maps, and Fisheries Maps	First- or second-hand data sources. Locations obtained by digitizing from written descriptions with no coordinate data or by altering and/or interpreting raw data. Identified respectively as "*source information*" or "*map adapted from*" in map captions.	**Low** 10 maps (8% of total number of maps)

*Geo-referenced–Refers to data, maps, and images with points that can be matched to real world coordinates so that the data can be accurately positioned in a GIS.

Appendix A-2. Map projections

Since understanding the role map projections play in the creation of valid and usable maps is so critical, further explanation of this issue is provided. A geographic reference system (such as latitude and longitude) is based on the angles measured from the earth's center. A planar coordinate system, on the other hand, is based on measurements on the surface of the earth. To meaningfully transfer real world coordinates (in three dimensions) to planar coordinate (two dimensions), a transformation process has to be applied. This transformation process is called a projection. Such a transformation involves the distortion of one or more of the following elements: shape, area, distance, and/or direction. The user typically dictates the choice of a projection type to ensure the least distortion to one or more of the four elements. Choice of a particular projection is dictated by issues such as the location of the place on Earth, purpose of the project, user constraints, and others.

The length of one degree of longitude will vary depending on what latitude on Earth the measurement is taken. The geographic coordinate system measures the angles of longitude from the center of the Earth and not distance on the Earth's surface. One degree of longitude at the equator measures 111 kilometers versus zero kilometers at the poles. Using a map projection mitigates this difference or seeming distortion when using geographic coordinates. However, when multiple data sources with multiple projection systems are used, the most flexible system to standardize the disparate data is to keep all data unprojected. Thus, the maps in this marine resource assessment (MRA) are untransformed, meaning they are shown unprojected on the map figures and their associated geographic data are delivered unprojected.

Since the measurement units for unprojected, geographic coordinates are not associated with a standard length, they cannot be used as an accurate measure of distance. Since the maps in the MRA Reports are in geographic coordinates, the map figures should not be used for measurement and the scale information only provides approximate distances. The map scales and reference datum used on all maps in this MRA are presented in nautical miles.

Appendix A-3. Overview of research efforts that provide occurrence information for marine mammals and sea turtles in the study area for the NE OPAREAs

To determine the seasonal occurrence patterns of marine mammals and sea turtles in the NE OPAREAs study area and vicinity, available data records were compiled of aerial and shipboard survey sightings, strandings, incidental fisheries bycatch, taggings, haulout locations (for pinnipeds), and miscellaneous encounters. The following narrative is intended as a review of the many research efforts conducted and/or sponsored by federal, state, and academic agencies or institutions, with the express goal of obtaining data on protected marine mammal and sea turtle species in the study area. Since the data acquisition efforts for this study area were concentrated on obtaining broad-scale, comprehensive survey datasets, all of the data sources represented below are not included in this MRA; a large number of datasets, however, were collected and are represented in this report (Table A-1).

Aerial and Shipboard Surveys

Records from aerial and shipboard surveys constitute the majority of the data collected for this MRA. Henwood and Epperly (1999) and Forney (2002) provide brief descriptions of how aerial and shipboard surveys are conducted. Aerial or shipboard observers collect line-transect data during daylight hours, weather permitting (i.e., no rain, Beaufort sea state <4). Surveys are conducted along pre-designated transect lines following established sampling protocols. Any animal sightings that occur while the observation platform (e.g., ship or plane) is traveling along the transect line and observers are actively searching for animals are noted as "on-effort" sightings and can be included when estimating abundances and/or densities for that sampled area. Any animal sightings that occur while the observation platform is diverted from or in transit to the transect line are recorded as "off-effort" sightings. While off-effort sightings may not be used for abundance and/or density estimates, they are nonetheless useful since they can provide additional sighting records for a species in areas where occurrence patterns may not be well known. It should be noted that aerial and shipboard surveys have been conducted over a large portion of the study area's continental shelf (Figures A-1 through A-5), with extensive survey effort having been expended during summer (Figure A-3). During the other three seasons, however, and in waters off the continental shelf, survey coverage is much less extensive (Figures A-1, A-2, A-4, and A-5). Of the three Northeast OPAREAs, the Boston OPAREA has received the greatest amount of survey effort for all seasons (refer to Figure 7-1). Only sighting effort from line-transect and "platforms-of-opportunity" (POP) surveys meeting a set of minimum standards were used to determine the seasonal occurrence patterns for marine mammals and sea turtles (Figure A-6).

➢ Aerial Surveys

The typical goal of an aerial survey is to estimate the overall density or abundance of a given marine mammal or sea turtle population. Aerial surveys are appropriate when little is known about the distribution and abundance of a population or species over relatively large areas. Such surveys help identify "hot spots" for future studies. Surveys can then be conducted to monitor trends in seasonal or annual variations in distribution and abundance patterns. Aircraft are also used in fine-scale surveys over a subregion of a study area.

- For the past two decades, the National Marine Fisheries Service-Northeast Fisheries Science Center (NMFS-NEFSC) has been sponsoring NOAA Twin Otter Surveys to observe marine mammals and sea turtles along the northeast U.S. coast.
    - The **1991** survey was conducted between 11 and 24 October over waters of the Gulf of Maine and Massachusetts Bay. The objectives of this line-transect survey were to determine the fall distribution of harbor porpoises as well as the distribution and density of pilot whales during a time when mass strandings were occurring on Cape Cod (Quintal and Smith 1999).

Table A-1. Inventory of the marine mammal and sea turtle data sources included in the marine resource assessment of the NE OPAREAs.

DATA SOURCE	RECORD DATES	SPUE CALCULATION SOURCES
NMFS-NEFSC Aerial Surveys		
NOAA Twin Otter Surveys	1991, 1995, 1998, 2002	√
NMFS-SEFSC Aerial Surveys		
Mid-Atlantic *Tursiops* Surveys (MATS)	1994-1995	
NMFS-NEFSC Shipboard Surveys		
Abel-J 91-02	1991	√
Abel-J 92-01	1992	√
Abel-J 95-01	1995	√
Abel-J 95-02	1995	√
Abel-J 97-01	1997	√
Abel-J 98-01	1998	
Abel-J 98-02	1998	√
Albatross IV 02-05	2002	√
Chapman 90-05	1990	
Chapman 91-03	1991	
Delaware II 92-05	1992	
Delaware II 97-05	1997	
Delaware II 98-04	1998	
Delaware II 98-08	1998	√
Delaware II 99-03	1999	
Delaware II 99-08	1999	√
Delaware II 00-07	2000	√
Delaware II 01-08	2001	√
Delaware II 02-06	2002	√
Delaware II 02-07	2002	√
Delaware II 03-07	2003	√
Pelican 95-01	1995	√
Pelican 95-02	1995	
NMFS-SEFSC Shipboard Surveys		
Oregon II 99-05	1999	
Gordon Gunter 02-01, Mid-Atlantic Cetacean Survey (MACS)	2002	
Strandings		
Northeast Regional Marine Mammal Stranding Network	1993-2003	
Incidental Fisheries Bycatch		
NMFS-NEFSC Fishery Bycatch (all fisheries)	1989-2004	
NMFS-SEFSC Longline Fishery Bycatch and Logbook Sightings	1992-1999	
Taggings		
Harbor Porpoise Tracking Program – Duke University Marine Lab	1995-2002	
Mixed/Miscellaneous Data Sources		
North Atlantic Right Whale Consortium (NARWC) Database	1762-2004	√
Right Whale Sighting Advisory System (SAS)	2002-2004	
Massachusetts Water Resources Authority Water Quality Surveys	1997-2002	
North Atlantic Finback Whale Catalogue–Allied Whale	1977-1991	
North Atlantic Humpback Whale Catalog–College of the Atlantic	1976-2000	
NMFS-NEFSC Sea Turtle Mapping and Information System	1963-1997	

Table A-1. Inventory of the marine mammal and sea turtle data sources included in the marine resource assessment of the NE OPAREAs (cont'd).

DATA SOURCE	RECORD DATES	SPUE CALCULATION SOURCES
Published Literature and Reports		
Mitchell and Kozicki	1975	
Katona et al.	1978	
Zarriello and Steadman	1987	
Katona et al.	1988	
Parker	1995	

- Performed between 04 August and 20 September, the **1995** survey included both inshore and offshore waters extending north from the mid-Atlantic through Georges Bank, the Gulf of Maine, and into Canadian waters up to the Gulf of St. Lawrence. The goal of this line-transect survey was to determine the distribution, abundance, and seasonal movements of harbor porpoises and other marine mammals in and around the Gulf of Maine region (Quintal and Smith 1999).

- In **1998**, the NMFS-NEFSC surveyed nearshore waters from the coastline to the 73 m isobath from Cape Hatteras, NC to Cape Breton Island, Nova Scotia (with additional blocks in La Have/Emerald Basin and Emerald/Western Banks). This line-transect survey took place between 18 July and 21 August and was flown in conjunction with shipboard surveys being conducted aboard the R/V Abel-J. The goal of this aerial survey was to record sightings of marine mammals, sea turtles, fishes, and boats in the survey area (NMFS-NEFSC 1998a).

- The **2002** survey, which occurred between 19 July and 16 August, spanned waters of the study area from 40°N (just south of Long Island, NY) to the Bay of Fundy (just north of St. John, New Brunswick) and out to 64.5°W. The primary objective of this survey was to estimate the abundance of cetaceans and turtles in the survey area using a circle-back method (NMFS-NEFSC 2002a).

- In 1994 and 1995, the National Marine Fisheries Service-Southeast Fisheries Science Center (NMFS-SEFSC) conducted the **Mid-Atlantic *Tursiops* Surveys (MATS)** along the U.S. Atlantic coast. The purpose of these surveys was to examine the distribution and estimate an index of relative abundance for Atlantic bottlenose dolphins inhabiting the nearshore coastal waters of the MAB and SAB. Sighting data presented in this report include records of loggerhead and leatherback sea turtles collected during the MATS 1994 and records of all sea turtle species collected during the MATS 1995.

  - The **MATS 1994** was a pilot study conducted from 12 July to 14 August 1994 along the shore from Long Island, NY to Vero Beach, FL. These were primarily bottlenose dolphin surveys; however, sightings of other cetaceans, sea turtles, and fishes were also recorded. This pilot study involved two types of aerial surveys: 1) surveys counting dolphins within approximately one km of shore and 2) line-transect surveys with randomly placed transects (Blaylock 1995).

  - The **MATS 1995** consisted of three replicate line-transect surveys from mid-July to mid-August 1995, which occurred over waters between Sandy Hook, NJ and Cape Hatteras, NC (Palka et al. 2001). Transects ran from 6.8 km from the shore to 76.3 km offshore. The main goal was to estimate abundance of bottlenose dolphins, although sea turtle and fish sightings were also collected.

➢ **Shipboard Surveys**

Shipboard surveys are designed to collect data to address many informational needs. To meet the mandate established in Section 117 of the amended MMPA, the NMFS must prepare, in consultation with regional Scientific Review Groups, stock assessment reports for each marine mammal stock that occurs in U.S. waters. These stock assessment reports contain several items, including a description of the stock and its distribution, as well as a minimum population estimate (Wade and Angliss 1997). One of the primary ways the NMFS collects marine mammal population data to use in stock assessments is from shipboard surveys.

The NMFS is also responsible for assessing and monitoring sea turtle stocks, which requires distribution and population estimates for determination of the status of stocks in relation to past and future human activities. While shipboard surveys are not the optimal survey technique to gain sea turtle population data, sighting data from shipboard surveys often provide valuable information that can be used to calculate turtle stocks. The NMFS-NEFSC conducts the majority of all shipboard surveys conducted in the study area for the NE OPAREAs. Sea turtle surveys are often "piggybacked" onto marine mammal, fish, and oceanographic surveys in this region, as it is a cost-effective means for conducting multiple surveys on the same platform.

- ***NMFS-NEFSC Shipboard Surveys***

  - The ***Abel-J* 91-02** survey was conducted from 22 July to 30 August 1991. The goal of this line-transect survey was to estimate the abundance and spatial distribution of harbor porpoises and other cetaceans in the Gulf of Maine - Bay of Fundy - Nova Scotia area. The study area, covering approximately 13,300 NM^2, was from Port Clyde, ME to St. John, New Brunswick over to the Nova Scotian coast, and up to Liverpool, Nova Scotia (NMFS-NEFSC 1991).

  - The ***Abel-J* 92-01** cruise was a series of line-transect surveys performed between 29 July and 06 September 1992. The objective of this cruise was to estimate the abundance and relative distribution of harbor porpoises and other cetaceans in the Gulf of Maine - Bay of Fundy - Scotian shelf area. The study area, covering approximately 13,300 NM^2, was from Portland, ME to St. John, New Brunswick over to Port Joli, Nova Scotia on the southeast side of Nova Scotia (NMFS-NEFSC 1992a).

  - The ***Abel-J* 95-01** cruise was undertaken from 09 July to 02 August 1995 in order to investigate the distribution of cetaceans (principally species designated as strategic) in Gulf Stream and slope water habitats. The area of operation for this cruise included Gulf Stream and continental slope waters between Chesapeake Bay and southern New England. Line-transect surveys were used to sight cetaceans during this cruise (NMFS-NEFSC 1995a).

  - The ***Abel-J* 95-02** survey, which ran from 06 August to 05 September 1995, was a line-transect survey to estimate the abundance and relative distribution of harbor porpoises and other cetaceans in the Gulf of Maine - Bay of Fundy - Scotian shelf area. The study area, which covered approximately 12,600 NM^2, included the area bounded by Portland, ME to St. John, New Brunswick to the southern tip of Nova Scotia (NMFS-NEFSC 1995b).

  - The ***Abel-J* 97-01** cruise, conducted from 22 August to 05 September 1997, incorporated the use of line-transect surveys to determine the spatial distribution and relative abundance of all marine mammals that inhabit the sea mount habitat off the northeast U.S. coast. The study area was the New England Sea Mounts from southern Georges Bank to 38ºN 60ºW (NMFS-NEFSC 1997a).

  - The ***Abel-J* 98-01** survey of 06 July to 04 August 1998 was a large-scale effort to estimate the abundance of pelagic dolphins and whales, especially strategic species, in Gulf Stream-

associated waters between Cape Cod, MA and Virginia. The study area in which line-transect surveys were performed included waters between the 100 m depth contour and the eastern boundary of the Gulf Stream (NMFS-NEFSC 1998b).

- The ***Abel-J* 98-02** cruise occurred between 08 August and 06 September 1998. Scientists and observers aboard this line-transect survey were charged with estimating the abundance of pelagic dolphins and whales and sighting strategic species in Gulf Stream-associated waters from Cape Cod, MA to Halifax, Nova Scotia. The study area included waters between the 100 m depth contour and the eastern boundary of the Gulf Stream (NMFS-NEFSC 1998b).

- The ***Albatross IV* 02-05** survey, conducted from 29 April to 17 May 2002, used line-transect surveys to record marine mammal observations and determine cetacean distributions in nearshore waters out to the Gulf Stream and throughout the Gulf of Maine. The study area for this survey was bounded by Cashes Ledge and Platts Bank (northwestern Gulf of Maine) to the north, the Great South Channel to the south, and Cultivator and Georges Shoals (northwest Georges Bank) to the east (NMFS-NEFSC 2002b).

- The ***Chapman* 90-05** cruise of 5 to 18 August 1990 was an attempt to determine the summer distribution and habitat utilization of marine mammals along the Gulf Stream Wall, the shelf edge break, and the waters between the two through collection of line-transect survey data. The study area ranged from the shelf edge break to the Gulf Stream Wall from Cape Hatteras, NC to Lydonia Canyon on Georges Bank (NMFS-NEFSC 1990).

- The ***Chapman* 91-03** survey lasted from 8 June to 16 July 1991. This was the NMFS' first systematic line-transect survey of marine mammals in shelf-edge waters off the northeastern U.S. The survey was designed to document the distribution and habitat use of marine mammals in the shelf break region and to provide an estimate of cetacean abundance. The study area for this cruise extended from Georges Bank to Cape Hatteras, NC and included primarily shelf-edge waters between the 183 and 1,829 m isobaths (Waring 1998).

- The ***Delaware II* 92-05** survey, which took place from 16 March to 02 April 1992, was a line-transect survey designed to investigate the fine scale distribution of marine mammals, particularly delphinid species, in the vicinity of Atlantic mackerel fishing areas and submarine canyons. The study area encompassed offshore mid-Atlantic and southern New England waters between the 55 and 1,829 m isobaths (NMFS-NEFSC 1992b).

- The ***Delaware II* 97-05** survey was a two-week cruise from 5 to 19 March 1997 with the objectives of determining the spatial distribution and relative abundance of harbor porpoises, bottlenose dolphins, and other cetacean species in the mid-Atlantic region and determining stock boundaries of the coastal bottlenose dolphin stock. The study area for this line-transect survey included mid-Atlantic waters from Long Island Sound to just south of Cape Hatteras, NC (NMFS-NEFSC 1997b).

- The ***Delaware II* 98-04** cruise, performed from 09 through 27 March 1998, was a line-transect survey to determine the spatial distribution and relative abundance of harbor porpoises, bottlenose dolphins, and other cetacean species in the mid-Atlantic region and to determine stock boundaries of bottlenose dolphins and other strategic stocks. The study area included mid-Atlantic waters from Long Island Sound to just south of Cape Lookout, NC (NMFS-NEFSC 1998c).

- The ***Delaware II* 98-08** large whale biology survey was conducted between 4 and 21 August 1998. This line-transect survey was designed to assess the distribution of large baleen whales on the Scotian Shelf and to sample the oceanographic conditions found in present and historic large whale habitats. Toothed whale sightings were also recorded during this survey. The study area encompassed offshore waters from Georges Bank to Sable Island

Bank, with most of the survey effort focusing on the western Scotian Shelf (NMFS-NEFSC 1998d).

- The ***Delaware II* 99-03** cruise was developed for the purposes of monitoring the impacts of the Harbor Porpoise Take Reduction Plan. Occurring from 22 February to 12 March 1999, this cruise incorporated line-transect surveys to assess fish biomass, fishing activity, and marine mammal occurrence in the Gulf of Maine. A secondary objective of the cruise was to gather information on right whales in the Jeffrey's Ledge area. The study area encompassed the western Gulf of Maine (NMFS-NEFSC 1999a).

- The ***Delaware II* 99-08** survey began on 26 July and lasted until 03 September 1999. This two-part line-transect survey was implemented to assess the distribution of large baleen whales on the Scotian Shelf and sample the oceanographic conditions found in present and historic large whale habitats. Several toothed whales were also sighted during this survey. The study area encompassed offshore waters from Georges Bank to the Bay of Fundy, and east along the Scotian Shelf to the Gully and French Bank (NMFS-NEFSC 1999b).

- The ***Delaware II* 00-07** cruise, from 07 July to 03 August 2000, was a satellite-tagging effort designed to document the fall emigration of North Atlantic right whales from the summer feeding grounds and to discover the species' wintering grounds. Secondary objectives included examining right whale diving behavior and characterizing right whale habitat. Cruise operations, which included line-transect and predetermined station surveys, were conducted concurrently with NMFS-NEFSC aerial surveys and other right whale research being performed at that time. The study area encompassed offshore waters from Georges Bank to the Bay of Fundy, and over Roseway Basin on the Scotian Shelf (NMFS-NEFSC 2000).

- The ***Delaware II* 01-08** cruise ran from 07 to 31 August 2001. It was a broad-scale oceanographic and marine mammal survey designed to characterize right whale habitat, examine right whale diving behavior, and assess the reaction of right whales to vessel approaches. Cruise operations included line-transect surveys that were conducted concurrently with NMFS-NEFSC aerial surveys and other right whale research being performed at that time. The study area included offshore waters from Wilkinson Basin to the Bay of Fundy, and over Roseway Basin on the Scotian Shelf (NMFS-NEFSC 2001).

- The ***Delaware II* 02-06** cruise was conducted from 16 July to 02 August 2002 in the vicinity of Bear Seamount and along the continental slope south of Georges Bank. Scientists aboard this cruise collected information on the distributional relationship between cetaceans, namely beaked and sperm whales, oceanographic features, and potential prey. Sea turtle and seabird observations were also recorded. Marine mammal surveys were conducted along pre-determined tracklines, using line-transect survey techniques, during only part of the cruise period. During the remaining time at sea, surveying was conducted in association with daytime trawling (NMFS-NEFSC 2002c).

- The ***Delaware II* 02-07** large whale survey spanned 05 to 28 August 2002. This survey attempted to document the distribution of large whales on the Scotian Shelf, notably in areas where little to no dedicated survey effort had been expended previously. The study area included waters from Browns Bank east to the Laurentian Channel (which separates northern Nova Scotia from southern Newfoundland), and out to the shelf break. Survey tracks were not designed to sample the area randomly, but were based upon rather sparse past records of whale sightings. Strict line-transect survey protocols were not used since the objective was to find concentrations of whales, not to estimate abundance (NMFS-NEFSC 2002d).

- The ***Delaware II* 03-07** cruise took place between 05 and 28 August 2003. This cruise was designed to assess the distribution of large whales on the Scotian Shelf, notably in areas that had previously been the subject of little or no dedicated survey effort. Another objective was to gather information on marine mammal utilization and prey abundance in a portion of the

study area where an abnormal die-off of humpback whales was reported. The study area covered continental shelf waters from Browns Bank to the Laurentian Channel. Survey tracks were based upon sparse past records of whale sightings, as well as assumptions concerning bathymetric characteristics of probable large whale habitats. Like the *Delaware II* 02-07 cruise, strict line-transect survey protocols were not used since the objective was to find concentrations of whales, not to estimate abundance (NMFS-NEFSC 2003).

- The ***Pelican* 95-01** cruise was the first leg in a large-scale line-transect survey effort designed to determine the spatial distribution and estimate the abundance of marine mammals in continental shelf and slope waters of the mid-Atlantic. The dates for this cruise ran from 09 July to 03 August 1995. The study area, covering approximately 39,200 NM^2, ran from waters 10 NM inshore of the 91 m isobath to waters 10 NM offshore of the 1.829 m isobath from Chesapeake Bay, VA to Cape Cod, MA (NMFS-NEFSC 1995c).

- The ***Pelican* 95-02** marine mammal survey conducted between 06 August and 07 September 1995 was aimed at investigating the distribution of cetaceans on the southern portion of Georges Bank and its relation to oceanographic features. The study area encompassed Georges Bank and associated waters east of Cape Cod. Offshore waters between the 55 m isobath and an imaginary line 10 NM beyond the 1,829 m isobath were surveyed using line-transect survey protocols (NMFS-NEFSC 1995d).

- ***NMFS-SEFSC Shipboard Surveys***

  - The ***Oregon II* 99-05 (236)** marine mammal survey was performed between 04 August and 30 September 1999. This line-transect survey was designed to evaluate the abundance, distribution, diversity, and stock structure of cetaceans in Atlantic Ocean waters off the southeast coast of the U.S. The ultimate objective of this cruise was to calculate the potential biological removal of marine mammal species as is required under the 1994 amendments to the Marine Mammal Protection Act. The cruise consisted of three legs of survey effort conducted between the 10 m isobath and an imaginary line 185 km offshore. The study area ranged from Cape Canaveral, FL north to Delaware Bay (NMFS-SEFSC 1999).

  - The ***Gordon Gunter* 02-01** cruise, also known as the Mid-Atlantic Cetacean Survey, occurred from 10 February to 08 April 2002. This cruise was a winter/early spring survey of the continental shelf and inner continental slope waters of the U.S. Atlantic extending from Cape Canaveral, FL to Delaware Bay. Requested by the Navy, this line-transect survey attempted to determine the distribution and abundance of marine mammals, as well as sea turtles, seabirds, and other marine life, in the mid-Atlantic region (Garrison et al. 2003).

Strandings

- Marine mammal stranding networks are under the jurisdiction of NMFS and are nominally based on the administrative regions of the NMFS (Geraci and Lounsbury 1993). Wilkinson and Worthy (1999) discuss the genesis of marine mammal stranding networks in the U.S. Legal authority for U.S. stranding networks is contained in the MMPA. In the Marine Mammal Health and Stranding Response Act (in the 1992 Amendments to the MMPA), Congress made it a national policy to monitor the various factors affecting the health of marine mammal populations; collection and analyses of stranded marine mammals have contributed much to what is known about each species (Becker et al. 1994). The **Northeast Regional Marine Mammal Stranding Network**, which is coordinated and managed by the NMFS, responds to all cetacean and pinniped strandings in the vicinity of the NE OPAREAs. Manatee strandings near the study are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). The Northeast Regional Marine Mammal Stranding Network includes the following institutions (and the states in which they are responsible for strandings): College of the Atlantic (ME), New England Aquarium (NH and MA), Mystic Aquarium (RI and CT), Riverhead Foundation for Marine Research (NY), Marine Mammal Stranding Center (NJ), and the Virginia Institute of Marine

Science (VA). The network was established in 1977 with the primary goal of collecting and archiving stranding data (Early and McKenzie 1991).

- Sea turtle stranding records collected from 1963 through 1997 are included as part of the NMFS-Northeast Regional Office's comprehensive geographic database for sea turtles called the **Sea Turtle Mapping and Information System (STMIS)** (NMFS-NEFSC 1999d). This project centralized sea turtle data in the northeast region to allow for the evaluation of real-time information on commercial fisheries and sea turtle interactions for use in management decisions under Section 7 of the ESA. Three categories of information are included in this database: incidental captures in fishing gear; observations from scientific cruises and aerial surveys; and stranding records. The geographic coverage of this database extends from the Gulf of Maine south to approximately Onslow Bay, NC.

Incidental Fisheries Bycatch

- **NMFS-NEFSC fishery bycatch (all fisheries)**—Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet activities off the northeast coast of the U.S. A fishery observer program, which has collected fishery data and information on incidental bycatch of marine mammals, was established in 1977 with the implementation of the Magnuson-Stevens Fishery Conservation and Management Act of 1976. Effort has been primarily directed towards Atlantic mackerel and squid fisheries. The NMFS is required to collect scientific, management, compliance, and economic data about fisheries through observers placed aboard domestic and foreign fishing vessels. This is conducted via the NMFS Observer Program. Observers routinely record the number of marine mammals and sea turtles taken incidentally by fishing activities. Observers are required to complete sighting forms, document the circumstances of capture, and obtain biological data (e.g., measurements) on incidentally captured marine mammals and sea turtles. Additionally, when feasible, incidentally caught marine mammals are frozen whole, brought ashore, and later examined by researchers at the Smithsonian Institution. Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, and pelagic trawl fisheries (e.g., Waring et al. 1990; Waring et al. 2002). Incidental bycatch data from 1989 through May 2004 are included in this MRA.

- **NMFS-SEFSC longline fishery bycatch and logbook sightings**—The Pelagic Longline Observer Program began in 1992, when systematic sampling by scientific observers on board U.S. pelagic longline vessels (permitted to land and sell swordfish) was mandated by 1991 amendments to the U.S. Fishery Management Plan for Swordfish (Yeung 2001). Since October 1995, the NMFS-SEFSC has fully assumed the implementation and data management of the observer program for the entire Atlantic longline fishery, which was previously shared with the NMFS-NEFSC (Yeung 2001). The focus is on the pelagic longline fishery operating in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. The target species are swordfish and tuna. Bycatch and incidental catch of undersized swordfish, Atlantic billfish (marlins and sailfish), sea turtles, marine mammals, and other non-target species by pelagic longline gear has been a major concern for several years. The program's mission is to collect data on effort, directed catch and bycatch quantity, morphometrics, biological characteristics, and interactions with marine mammals, sea turtles, and birds (Scott and Brown 1997). Longline fisheries are known to cause injury and/or mortality to loggerhead and leatherback turtles (Epperly et al. 2001), as well as small numbers of other turtle species.

Taggings

- Duke University Marine Lab's **North Atlantic Harbor Porpoise Tracking Program** monitors harbor porpoise movements in the Gulf of Maine by equipping animals with satellite-linked transmitters. All harbor porpoises were obtained from herring weirs on the island of Grand Manan, New Brunswick during the summer months (July to September). Positional data were obtained via the ARGOS satellite system.

Mixed/Miscellaneous Data Sources

- In 1986, a cooperative research program, the **North Atlantic Right Whale Consortium (NARWC)**, was initiated to focus on North Atlantic right whales (Kenney 2001). Every organization and agency conducting right whale surveys submits their data for inclusion in this database, which is supported by the NMFS. The database contains over 20,000 sightings of right whales as well as more than 70 other species including other whales, dolphins, seals, manatees, sea turtles, sharks, rays, and other fishes for a total of 214,000 sightings (Kenney 2001). Most of the sightings occur between Florida and Nova Scotia. The NARWC attempts to include any marine mammal survey data for the U.S. Atlantic. Effort sources are either dedicated or opportunistic (IWC 2001). Opportunistic sightings are those coming from observers on aircraft and vessels of opportunity (such as the U.S. Coast Guard and NMFS shipboard and aerial surveys). Listed below are some of the data sources within the NARWC database that provide occurrence records for the NE OPAREAs study area.

  - Between 1966 and 1972, personnel at the **Blandford whaling station** in Nova Scotia kept a database of whale sightings and landings. Search effort for this operation encompassed an area from St. Margaret's Bay, Nova Scotia to the shelf break, including Emerald Bank and Basin, Western Bank, and LaHave Bank and Basin (NMFS-NEFSC 2002c).

  - From October 1978 through January 1982, the University of Rhode Island conducted systematic seasonal surveys (principally aerial) during the **Cetacean and Turtle Assessment Program (CETAP)**. These surveys covered waters of the U.S. continental shelf (from the coast to 9.26 km seaward of the 2,000 m isobath) from Cape Hatteras, NC to the northern Gulf of Maine. The purpose of these surveys, sponsored by the Department of Interior, Bureau of Land Management (now the Minerals Management Service), was to provide data on the distribution and abundance of whales, dolphins, and sea turtles inhabiting the northeast shelf so that more informed decisions could be made regarding offshore oil and gas resource development in the region. The CETAP was a large-scale sampling effort designed and implemented to estimate the spatio-temporal distributions and abundances of the many cetacean and sea turtle species occurring in the waters over the eastern U.S. Outer Continental Shelf (CETAP 1982; Scott and Gilbert 1982; Shoop and Kenney 1992). Data collected during the CETAP comprise the largest component of the NARWC database. The CETAP surveys occurred over a large portion of the study area for the NE OPAREAs (Figure A-5).

  - From May 1980 through December 1988, a second set of large-scale surveys was conducted in the study area. **The Cetacean and Seabird Assessment Program**, conducted by the Manomet Bird Observatory, placed dedicated observers aboard scientific research cruises in order to provide the NMFS-NEFSC, the sponsor of the program, with a near-continuous assessment of cetacean, seabird, and, to a lesser extent, sea turtle populations in shelf and shelf-edge waters of the northeastern U.S. (generally <200 m, but as deep as 910 m) (Payne et al. 1984; Manomet Bird Observatory 1987; Payne et al. 1990; Smith et al. 1996). The Manomet surveys were conducted between Cape Hatteras and Nova Scotia, Canada; the study area was similar, but slightly smaller in size compared to the CETAP study area. The extent of cetacean sighting effort (spatial and temporal coverage) and the stratified random component of the NMFS-NEFSC cetacean surveys were dependent entirely on the design of the NMFS-NEFSC fisheries/oceanographic surveys.

  - In the spring of 1987, the **Minerals Management Service** again sponsored aerial surveys for cetaceans off the northeast U.S. coast. Those surveys focused primarily on sighting right whales in the Great South Channel.

  - Between 1988 and 1991, the University of Rhode Island continued its research on North Atlantic right whales and other cetaceans by conducting the **South Channel Ocean Productivity Experiment (SCOPEX)**. SCOPEX was a multidisciplinary program to investigate springtime aggregations of right whales in the southern Gulf of Maine, the interactions between these whales

and their main prey, the copepod *Calanus finmarchicus*, and physical processes influencing these biological interactions (Kenney et al. 1995). Field sampling for this project was carried out during late spring in 1988 and 1989. The study area for the SCOPEX surveys was a rectangular region off Cape Cad encompassing Wilkinson Basin, the Great South Channel, Nantucket Shoals, and the western portion of Georges Bank.

- Since 1986, **East Coast Ecosystems (ECE),** in collaboration with the **New England Aquarium**, has been conducting summer shipboard surveys in the Bay of Fundy and on the southern Scotian Shelf (including the Roseway Basin) to study the seasonal distribution, abundance, and behavior of right whales. From 1998 through 2001, ECE also implemented a summer aerial survey program for right whales over the Bay of Fundy, Northeast Channel, and Western Bank. ECE has collected observer data from summer whale watching cruises in the eastern Bay of Fundy as well.
- In 1990, the **Canadian Department of Fisheries and Oceans (DFO)** began to amass incidental sighting records of marine mammals that were noted by observers during seismic surveys and other vessel-based activities. Records from 1998 to 2000 are the only DFO data included in the NARWC database.
- During the winter and spring, the Center **for Coastal Studies (CCS)** conducts regular aerial and shipboard surveys for right whales in Cape Cod Bay and surrounding waters (CCS 2004). The CCS has also conducted surveys of all known humpback whale habitats in the Gulf of Maine, including Stellwagen Bank National Marine Sanctuary, the Great South Channel, Jeffrey's Ledge, Georges Bank, and many other ledges and banks off New Hampshire, Maine, and western Nova Scotia. In addition to performing surveys, the CCS collects data from observers aboard commercial whale watching vessels. Some of the data are available in the NARWC and some are not; current data are no longer being submitted to the NARWC.
- Dedicated marine mammal research has also been conducted in the NE OPAREAs study area by **Dalhousie University**, the **International Fund for Animal Welfare**, the **Nova Scotia Offshore Petroleum Board**, and **Woods Hole Oceanographic Institute (WHOI)**—all of which have submitted their data at one time to the NARWC.

➢ In an effort to reduce ship collisions with the critically endangered right whale, The Northeast Right Whale Early Warning System (EWS), presently called **Right Whale Sighting Advisory System (SAS)**, was developed in late 1996. The SAS provides real-time right whale sighting information to the commercial shipping industry and other marine traffic from aerial and shipboard surveys conducted by several agencies and organizations and from verified opportunistic sightings. In 1998, the NMFS, the U.S. Coast Guard, the CCS, the Massachusetts Division of Marine Fisheries, WHOI, the International Wildlife Coalition, the Whale Center of New England, several whale watch companies, and a high speed ferry company, began contributing sighting reports to the SAS. In the years since its inception, there have been a wide variety of reporting sources due to the expanding awareness of the plight of right whales and their vulnerability to collisions with ships and entanglement in fishing gear.

Right Whale SAS aerial surveys are currently being flown over a broad-scale region of the western North Atlantic Ocean from just south of Long Island, NY up to the U.S./Canada border and out to the 200 NM Exclusive Economic Zone (NOAA and MDMF 1998; Kenney 2004). The Cape Cod Bay and Great South Channel critical habitats receive the greatest amounts of survey coverage, primarily from January to early July (the peak period of right whale residency in these waters) (NMFS-NEFSC 2004). Verified opportunistic sightings are received primarily in the July to December period, when fewer right whale-dedicated aerial surveys are being performed. Over the past several years, however, SAS aerial survey effort has increased in geographic scale and has begun to span a greater portion of the year. SAS surveys now cover areas outside known right whale high-use habitats and are now flown during months that are outside the peak of right whale residency (Kenney 2004). Current SAS surveys are being conducted in order to refine estimates of when right whales arrive and

depart from high-use habitats and other areas outside the critical habitats and conservation zones (Knowlton et al. 2002).

- Since 1995, the **Massachusetts Water Resources Authority (MWRA)** has included marine mammal observers on monitoring surveys to verify the presence and absence of right whales in Massachusetts and Cape Cod Bays (McLeod et al. 2003). The MWRA boat-based surveys are being conducted as part of the long-term Harbor and Outfall Monitoring Project designed to verify compliance with the discharge permit and to assess the potential environmental impact of treated sewage effluent discharge into Massachusetts Bay. Marine mammal observers were included in response to a NMFS request that the MWRA provide observational data and set a positive example by using observers to minimize the chances of collision with a right whale. In addition to looking for right whales, observers conduct observations for other marine mammals. On surveys where observers are not present, the chief scientist and field crew document any incidental sightings of cetaceans and/or pinnipeds.

- The **North Atlantic Finback Whale Catalogue**, managed by Allied Whale, is a sightings-based, life history data set of individual finback whales, inhabiting the northwestern Atlantic Ocean. Established in 1986 as a collaborative repository for several independent collections of photographically identified finback whales, the catalogue is comprised of photographic sightings, referenced by a whale identifying number, and the date and location of the sighting. Individual identifications are based on morphological variations in dorsal fin shape, body pigment, and patterns of scarring which provide a matrix of characters on which to qualify the identification. The majority of the catalogue sightings are obtained from coastal waters of the Gulf of Maine, during summer months from 1977 to present, aboard both opportunistic and directed survey vessels.

- The data within the College of the Atlantic's **North Atlantic Humpback Whale Catalog** represent sighting locations and dates for humpback whales individually identified by natural markings on the ventral surface of the flukes. The North Atlantic Humpback Whale Catalog is a collaborative, centralized curation facility for identification photographs of humpback whale flukes, and a database of sighting histories for these whales. Fluke photographs collected from throughout the North Atlantic Ocean are submitted to the catalog. They are then are systematically compared to those previously submitted in order to identify re-sightings. The collection now contains 18,770 photographs representing 5,307 whales. Collection is not systematic, so there is considerable spatial and temporal variability in effort, and a substantial bias towards the western North Atlantic.

- The NMFS-Northeast Regional Office undertook the development of a comprehensive geographic database for sea turtles within its jurisdiction called the **Sea Turtle Mapping and Information System (STMIS)** (NMFS-NEFSC 1999d). The project goals included centralizing sea turtle data in the northeast region to allow for the evaluation of real-time information on commercial fisheries and sea turtle interactions for use in management decisions under Section 7 of the ESA. The database includes data recorded from 1963 to 1997. Three categories of information are included in this database: incidental captures in fishing gear; observations from scientific cruises and aerial surveys; and stranding records. The geographic coverage of this database extends from the Gulf of Maine south to approximately Onslow Bay, NC.

- **Dr. James Gilbert** of the University of Maine has surveyed harbor seal haulouts for the NMFS-NEFS from 1981 through the present. Dr. Gilbert and his staff have delineated the haulout sites where harbor seals come ashore along the Maine coast. These data are in GIS format through 1987 and encompass the entire coastline of the state of Maine.

Published Literature and Reports

Oftentimes published papers and reports are the most useful media for presenting opportunistic sightings, strandings, and even whaling catches. The occurrence data contained within the following documents were especially useful for species that are not frequently seen during dedicated surveys (e.g., killer

whales), that are not easily distinguished to species (e.g., beaked whales), or for which there is little information regarding their occurrence in the study area (e.g., bottlenose whales, smaller sea turtles).

- **Mitchell and Kozicki (1975)** collected biological data from a male northern bottlenose whale that stranded in the Bay of Fundy in October 1969. The authors also summarized nine other North American occurrences of northern bottlenose whales, seven of which were recorded in close proximity to the study area. From these records the authors concluded that northern bottlenose whales undertake winter migrations to waters offshore of Massachusetts and Rhode Island.

- **Katona et al. (1978)** detailed the observation of a female white-sided dolphin that was found floating with its beak out of the water on Jeffrey's Ledge in July 1976. Analysis of the animal's injuries indicated that it had likely become entangled in a gillnet and drowned, after which it was then freed or discarded during hauling of the net. The authors indicated that schools of white-sided dolphins were unusually common in the Gulf of Maine in 1976, concurrent with the presence of many gillnets in the area.

- **Katona et al. (1988)** examined 177 killer whale sightings and strandings from the Bay of Fundy to the Equator from 1817 to 1987. Their report is a summary of all available information on the occurrence of killer whales in this region of the northwestern Atlantic Ocean. From the data collected, the majority of which came from published literature and unpublished data files, the authors deduced that a small seasonally-migrating population of killer whales likely exists along the U.S. eastern seaboard.

- **Parker (1995)** depicted the locations of several pelagic-stage hawksbill turtles stranding encounters off the U.S. east and Gulf coasts. The northernmost of these encounters occurred off the coast of Massachusetts in November 1989.

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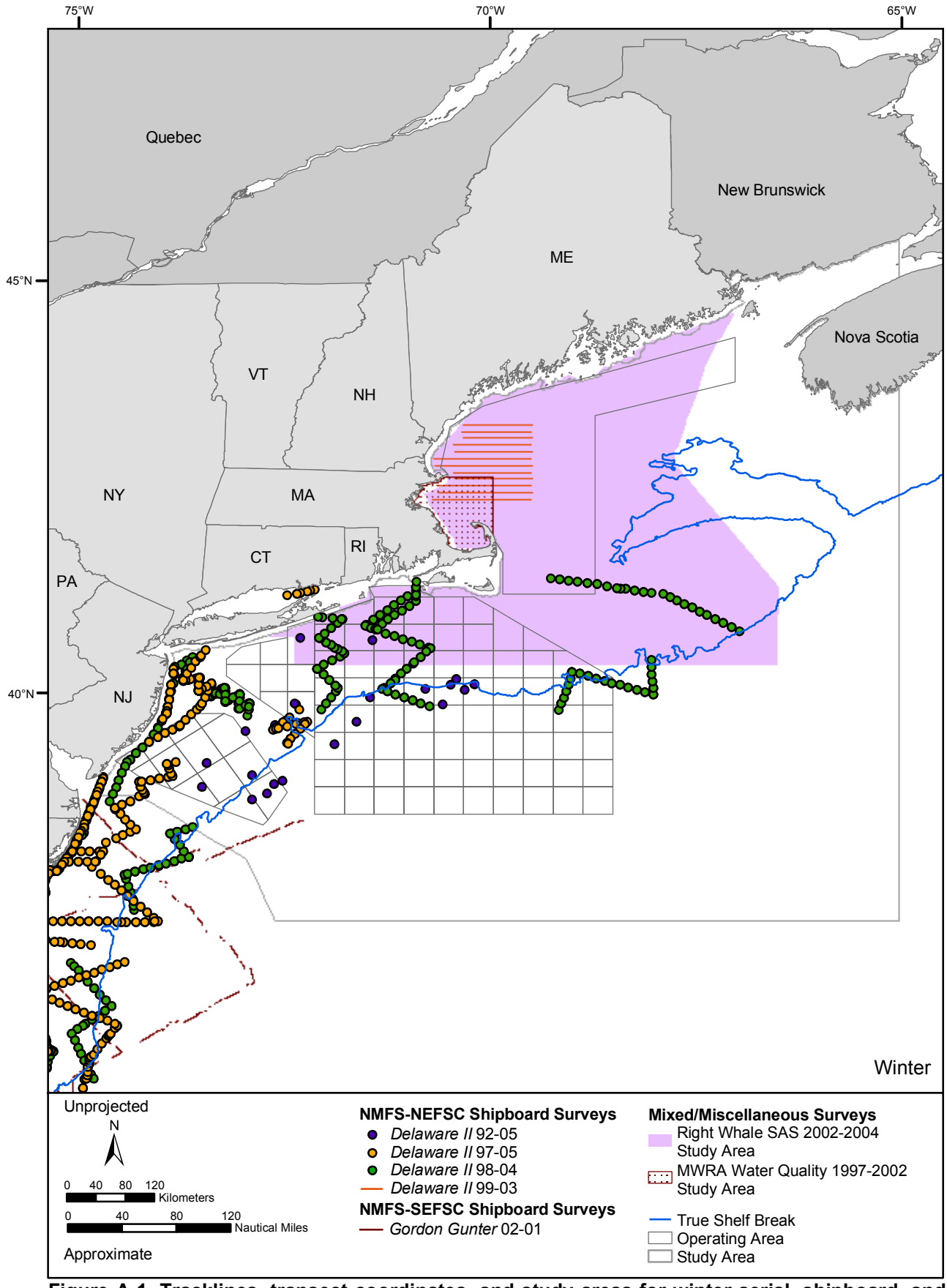

Figure A-1. Tracklines, transect coordinates, and study areas for winter aerial, shipboard, and mixed/miscellaneous surveys conducted in the study area for the NE OPAREAs. Source data: NMFS-NEFSC and NMFS-SEFSC. Map adapted from: NOAA and MDMF (1998), Wennemer et al. (1998), McLeod (1999, 2001, 2002), and McLeod et al. (2000, 2003).

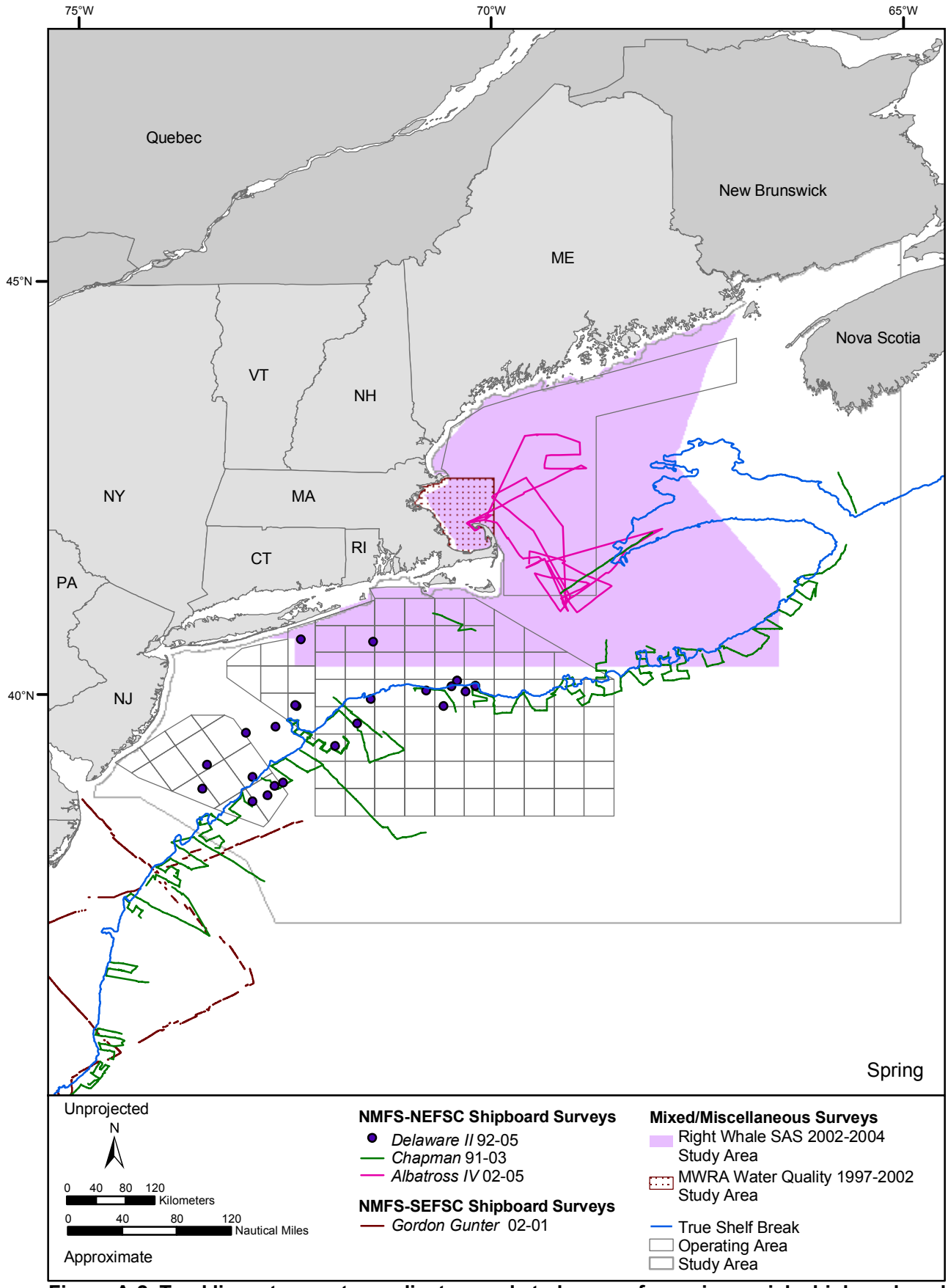

Figure A-2. Tracklines, transect coordinates, and study areas for spring aerial, shipboard, and mixed/miscellaneous surveys conducted in the study area for the NE OPAREAs. Source data: NMFS-NEFSC and NMFS-SEFSC. Map adapted from: NOAA and MDMF (1998), Wennemer et al. (1998), McLeod (1999, 2001, 2002), and McLeod et al. (2000, 2003).

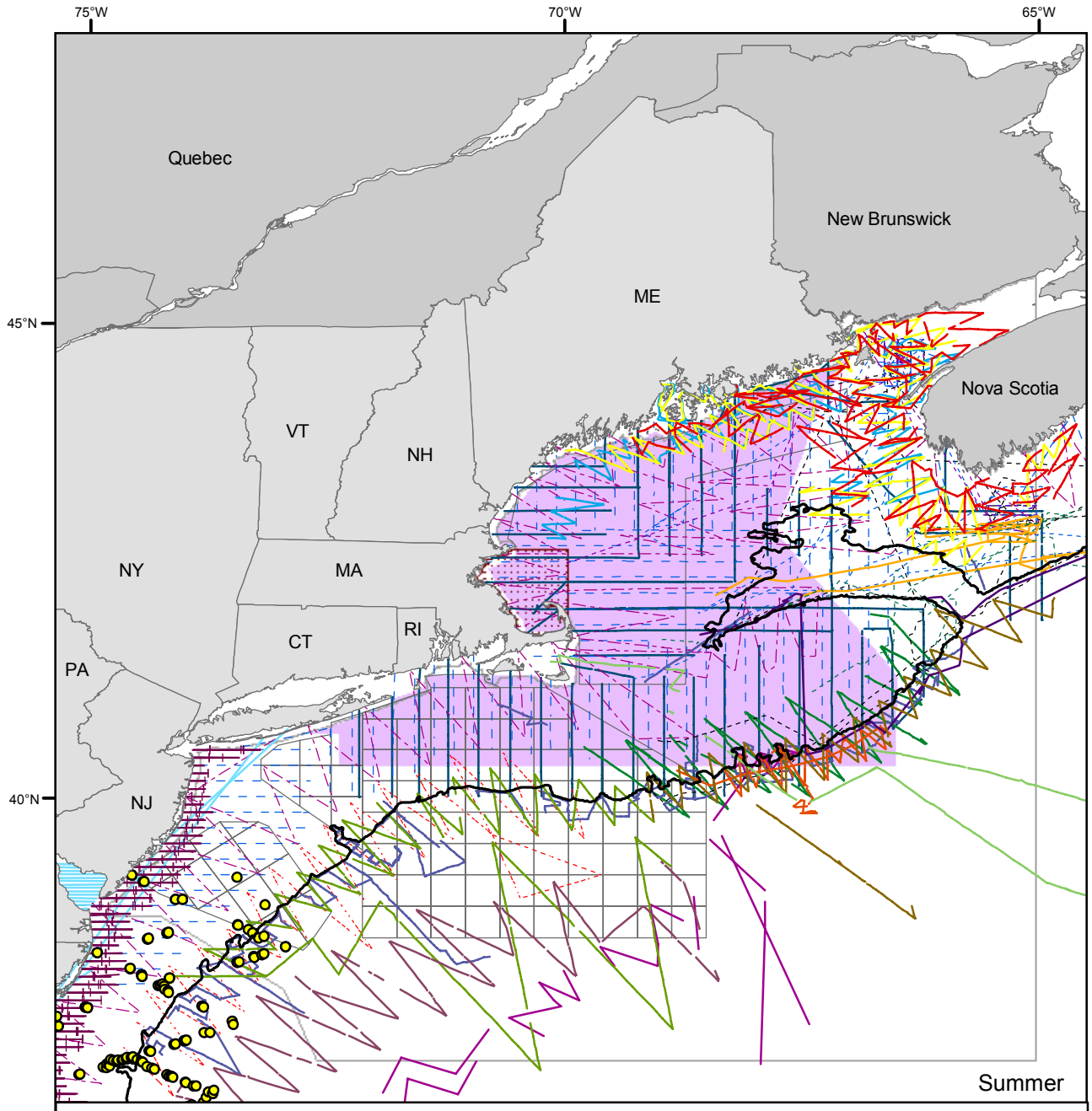

Figure A-3. Tracklines, transect coordinates, and study areas for summer aerial, shipboard, and mixed/miscellaneous surveys conducted in the study area for the NE OPAREAs. Source data: NMFS-NEFSC and NMFS-SEFSC. Map adapted from: NOAA and MDMF (1998), Wennemer et al. (1998), McLeod (1999, 2001, 2002), and McLeod et al. (2000, 2003).

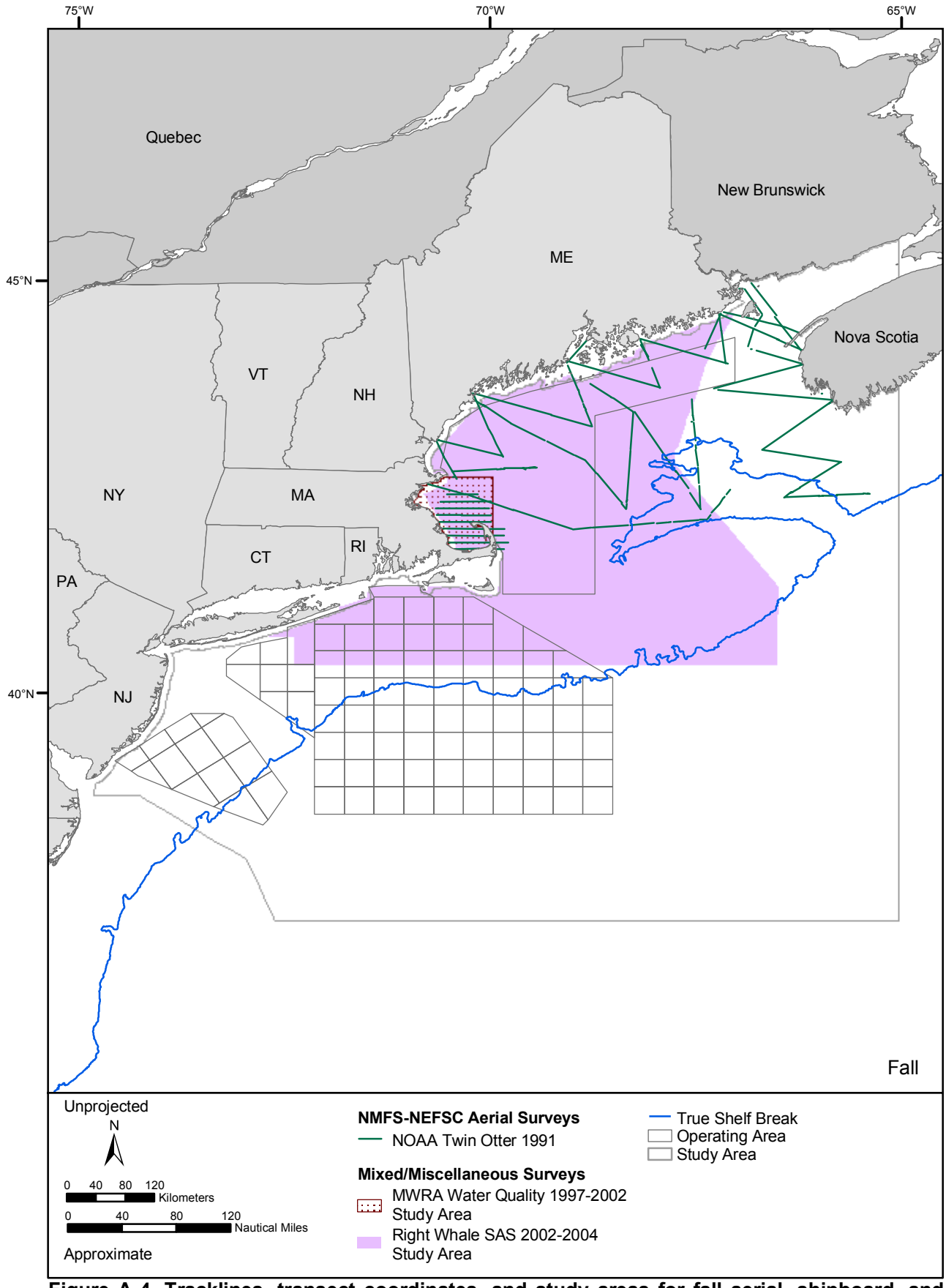

Figure A-4. Tracklines, transect coordinates, and study areas for fall aerial, shipboard, and mixed/miscellaneous surveys conducted in the study area for the NE OPAREAs. Source data: NMFS-NEFSC. Map adapted from: NOAA and MDMF (1998), Wennemer et al. (1998), McLeod (1999, 2001, 2002), and McLeod et al. (2000, 2003).

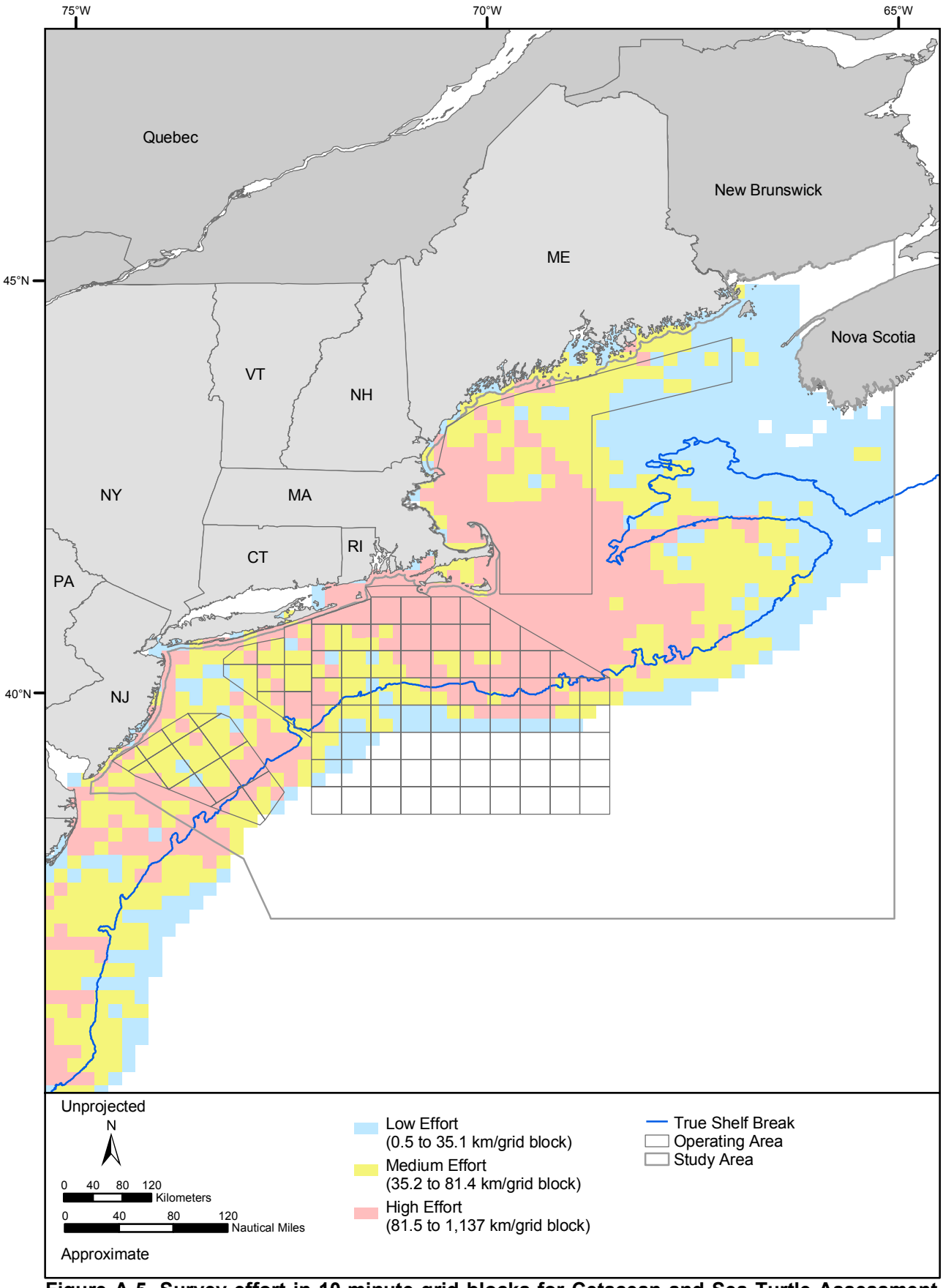

Figure A-5. Survey effort in 10-minute grid blocks for Cetacean and Sea Turtle Assessment Program (CETAP) aerial and shipboard surveys conducted in the study area for the NE OPAREAs. Source map (scanned): Shoop and Kenney (1992); used with permission of R.D. Kenney.

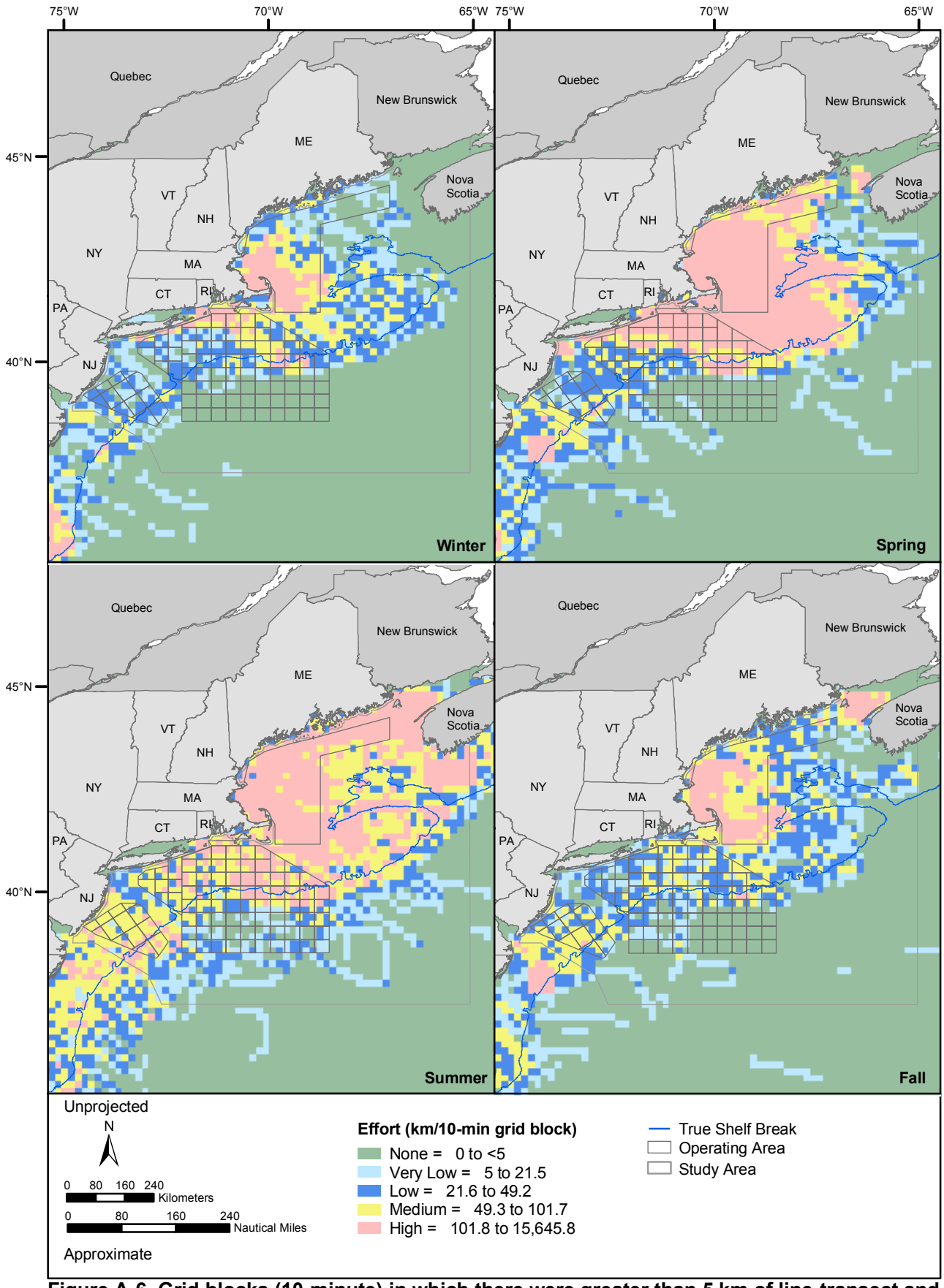

Figure A-6. Grid blocks (10-minute) in which there were greater than 5 km of line-transect and platform of opportunity survey effort in the study area for the NE OPAREAs. Source data: refer to Table A-1.

Table A-2. Quartile model-output values of the predicted sightings-per-unit-effort (SPUE) (in units of animals per 1,000 km) for each species of marine mammal and sea turtle.

Species	4th Quartile	3rd Quartile	2nd Quartile	1st Quartile	
Marine Mammals					
Endangered whales	0.01	49.43	98.87	148.30	197.75
North Atlantic right whale	0.01	21.14	42.27	63.41	84.56
Humpback whale	0.01	13.85	27.71	41.56	55.43
Sei whale	0.00	17.27	34.54	51.80	69.07
Fin whale	0.00	16.45	32.89	49.34	65.79
Sperm whale	0.01	49.26	98.52	147.77	197.04
Minke whale	0.00	4.66	9.33	13.99	18.65
Beaked whales	0.02	12.07	24.14	36.21	48.30
Bottlenose dolphin	0.03	278.81	557.63	836.44	1,115.28
Spotted dolphin	0.45	143.57	287.15	430.72	574.75
Striped dolphin	0.02	376.97	753.93	1,130.90	1,507.89
Common dolphins	0.00	464.07	928.15	1,392.22	1,856.30
White-beaked dolphin	0.00	3.17	6.34	9.51	12.68
Atlantic white-sided dolphin	0.00	265.21	530.42	795.63	1,060.85
Risso's dolphin	0.00	503.63	1,007.25	1,510.88	2,014.50
Pilot whale	0.01	271.42	542.85	814.27	1,085.70
Harbor porpoise	0.00	162.36	324.73	487.09	649.46
Harbor seal	0.01	65.84	131.68	197.53	263.37
Gray seal	0.00	4.22	8.45	12.67	16.90
Sea turtles					
All sea turtles	0.00	47.25	94.50	141.74	189.00
Leatherback turtle	0.00	3.46	6.92	10.38	13.84
Loggerhead turtle	0.00	47.27	94.54	141.81	189.08
Kemp's ridley sea turtle	0.00	8.98	17.97	26.95	35.93

Table A-3. Measured and predicted sightings-per-unit-effort (SPUE) values by season for all occurrence model outputs of marine mammal and sea turtle species and the associated mean standard error.

Species /Season	Measured SPUE Values (animals per 1,000 km)			Predicted SPUE Values (animals per 1,000 km)			Mean Standard Error
	Min.	Max.	Mean	Min.	Max.	Mean	
Endangered whales	*0.00*	*2,758.26*	*13.62*	*-0.96*	*197.75*	*7.73*	*27.98*
Winter	0.00	618.17	4.95	-0.95	34.58	2.34	14.81
Spring	0.00	883.04	16.42	-0.96	105.54	9.19	24.57
Summer	0.00	2,758.26	20.25	-0.95	197.75	13.31	54.15
Fall	0.00	441.35	8.64	-0.95	100.53	4.30	18.39
North Atlantic right whale	*0.00*	*445.15*	*1.75*	*-0.98*	*84.56*	*0.64*	*6.20*
Winter	0.00	62.92	0.48	-0.98	17.66	-0.17	1.55
Spring	0.00	179.52	2.29	-0.95	36.16	0.93	5.51
Summer	0.00	445.15	2.32	-0.95	84.56	1.25	10.31
Fall	0.00	441.35	1.44	-0.95	53.64	0.34	7.43
Humpback whale	*0.00*	*235.32*	*2.22*	*-0.97*	*55.43*	*0.92*	*5.33*
Winter	0.00	56.16	0.41	-0.95	4.05	-0.21	1.67
Spring	0.00	235.32	2.74	-0.96	55.43	1.19	5.88
Summer	0.00	169.45	3.10	-0.97	48.42	1.76	7.96
Fall	0.00	234.29	1.96	-0.96	39.75	0.64	5.79
Sei whale	*0.00*	*546.02*	*0.94*	*-0.96*	*69.07*	*0.15*	*4.85*
Winter	0.00	161.80	0.15	-0.95	8.95	-0.35	2.42
Spring	0.00	546.02	2.71	-0.95	69.07	1.16	12.39
Summer	0.00	198.37	0.71	-0.96	23.22	0.15	4.01
Fall	0.00	26.61	0.07	-0.96	2.73	-0.41	0.56
Fin whale	*0.00*	*883.04*	*4.03*	*-0.96*	*65.79*	*2.00*	*11.43*
Winter	0.00	618.17	2.14	-0.95	30.71	0.76	11.56
Spring	0.00	883.04	4.85	-0.96	65.79	2.41	13.90
Summer	0.00	371.25	4.73	-0.95	40.09	2.84	10.77
Fall	0.00	241.20	3.79	-0.95	41.70	1.64	9.48
Sperm whale	*0.00*	*2,758.26*	*4.11*	*-0.96*	*197.04*	*2.06*	*18.64*
Winter	0.00	290.31	1.43	-0.95	16.81	0.36	7.34
Spring	0.00	641.76	3.08	-0.96	52.29	1.39	12.11
Summer	0.00	2,758.26	8.77	-0.95	197.04	5.60	48.82
Fall	0.00	237.83	0.86	-0.95	16.03	0.03	6.29
Minke whale	*0.00*	*158.41*	*1.01*	*-0.97*	*18.65*	*0.20*	*2.40*
Winter	0.00	18.03	0.07	-0.97	1.32	-0.40	0.49
Spring	0.00	118.31	1.59	-0.95	18.65	0.52	3.75
Summer	0.00	158.41	1.46	-0.95	14.10	0.64	3.11
Fall	0.00	64.89	0.58	-0.95	6.82	-0.13	2.26
Beaked whales	*0.00*	*376.45*	*0.90*	*-0.96*	*48.30*	*0.13*	*3.47*
Winter	0.00	61.57	0.07	-0.96	3.09	-0.40	0.91
Spring	0.00	104.94	0.31	-0.95	8.63	-0.23	1.87
Summer	0.00	376.45	2.43	-0.95	48.30	1.30	9.92
Fall	0.00	57.06	0.08	-0.96	3.63	-0.40	1.16

Table A-3. Measured and predicted sightings-per-unit-effort (SPUE) values by season for all occurrence model outputs of marine mammal and sea turtle species and the associated mean standard error (cont'd).

Species / Season	Measured SPUE Values (animals per 1,000 km)			Predicted SPUE Values (animals per 1,000 km)			Mean Standard Error
	Min.	Max.	Mean	Min.	Max.	Mean	
Bottlenose dolphin	0.00	15,736.08	40.92	-0.96	1,115.28	23.99	132.19
Winter	0.00	7,679.18	35.86	-0.95	1,115.28	19.64	118.86
Spring	0.00	3,551.87	34.74	-0.95	372.16	19.81	103.62
Summer	0.00	4,208.84	42.14	-0.96	344.47	28.09	132.44
Fall	0.00	15,736.08	50.07	-0.95	864.53	27.04	173.84
Spotted dolphin	0.00	11,376.45	7.02	-1.00	574.75	3.85	61.99
Winter	0.00	0.00	0.00	-1.00	0.00	-0.44	0.22
Spring	0.00	995.54	2.68	-0.95	83.57	1.12	23.81
Summer	0.00	11,376.45	17.67	-0.95	574.75	11.76	193.95
Fall	0.00	1,913.54	2.49	-0.95	95.13	0.95	29.99
Striped dolphin	0.00	17,682.06	29.92	-391.72	1,507.89	18.07	151.11
Winter	0.00	4,449.61	9.59	-0.95	248.57	4.84	72.83
Spring	0.00	6,788.01	14.64	-0.95	338.75	8.19	118.75
Summer	0.00	17,682.06	71.40	-0.95	972.39	47.72	367.56
Common dolphins	0.00	21,732.03	83.94	-0.96	1,856.30	49.21	447.68
Winter	0.00	20,904.50	92.32	-0.96	1,856.30	50.39	405.95
Spring	0.00	21,732.03	117.49	-0.95	1,711.64	67.75	594.30
Summer	0.00	19,451.52	49.70	-0.95	1,449.61	32.91	331.95
Fall	0.00	19,904.67	89.97	-0.95	1,298.32	48.81	458.52
White-beaked dolphin	0.00	118.55	0.06	-1.00	12.68	-0.37	0.60
Winter	0.00	118.55	0.10	-1.00	12.68	-0.38	0.22
Spring	0.00	84.76	0.15	-0.95	5.02	-0.33	1.61
Summer	0.00	12.62	0.01	-0.97	1.04	-0.32	0.32
Fall	0.00	0.00	0.00	-0.99	0.00	-0.45	0.23
Atlantic white-sided dolphin	0.00	14,280.75	45.17	-0.96	1,060.85	26.48	141.19
Winter	0.00	1,123.21	5.42	-0.96	161.06	2.57	23.95
Spring	0.00	5,260.14	62.09	-0.96	598.78	36.09	106.73
Summer	0.00	11,338.47	57.37	-0.95	1,060.85	38.20	205.14
Fall	0.00	14,280.75	43.95	-0.95	826.70	23.47	228.95
Risso's dolphin	0.00	12,826.16	24.94	-458.05	2,014.50	14.42	123.26
Winter	0.00	5,389.51	11.20	-0.96	509.87	5.86	31.51
Spring	0.00	7,245.12	20.60	-0.96	581.87	11.75	135.24
Summer	0.00	5,752.05	34.07	-0.96	565.86	22.54	130.28
Fall	0.00	12,826.16	28.34	-458.05	2,014.50	14.84	196.01
Pilot whale	0.00	7,108.86	33.54	-0.95	1,085.70	19.52	131.26
Winter	0.00	3,281.32	10.54	-0.95	199.64	5.32	57.80
Spring	0.00	5,430.41	46.34	-0.95	564.04	26.49	151.80
Summer	0.00	4,037.82	29.49	-0.95	420.99	19.45	124.51
Fall	0.00	7,108.86	45.46	-0.95	1,085.70	24.70	190.95

Table A-3. Measured and predicted sightings-per-unit-effort (SPUE) values by season for all occurrence model outputs of marine mammal and sea turtle species and the associated mean standard error (cont'd).

Species / Season	Measured SPUE Values (animals per 1,000 km)			Predicted SPUE Values (animals per 1,000 km)			Mean Standard Error
	Min.	Max.	Mean	Min.	Max.	Mean	
Harbor porpoise	0.00	2,508.61	18.66	-0.95	649.46	11.24	43.96
Winter	0.00	2,508.61	27.60	-0.95	649.46	18.13	70.23
Spring	0.00	330.80	5.65	-0.95	77.05	2.89	10.18
Summer	0.00	2,508.61	27.60	-0.95	649.46	18.13	70.23
Fall	0.00	1,555.64	7.01	-0.95	259.00	3.43	25.19
Harbor seal	0.00	2,463.90	3.27	-0.95	263.37	1.56	24.29
Winter	0.00	930.80	2.48	-0.95	66.60	0.94	18.42
Spring	0.00	2,463.90	3.01	-0.95	133.81	1.34	32.35
Summer	0.00	1,874.38	5.56	-0.95	263.37	3.44	36.85
Fall	0.00	504.24	0.96	-0.95	50.28	0.08	9.55
Gray seal	0.00	229.67	0.14	-1.00	16.90	-0.32	1.99
Winter	0.00	0.13	0.00	-1.00	0.02	-0.44	0.22
Spring	0.00	169.77	0.16	-0.95	11.63	-0.33	2.17
Summer	0.00	209.69	0.18	-0.95	16.90	-0.21	2.78
Fall	0.00	229.67	0.18	-0.95	13.21	-0.35	2.80
All sea turtles	0.00	760.93	7.24	-0.99	189.00	3.91	12.41
Winter	0.00	231.12	1.97	-0.95	74.72	0.65	4.49
Spring	0.00	760.93	10.70	-0.96	189.00	5.85	19.56
Summer	0.00	603.33	10.23	-0.99	185.70	6.54	15.58
Fall	0.00	388.80	3.82	-0.95	74.44	1.66	10.02
Leatherback turtle	0.00	120.83	0.42	-0.99	13.84	-0.15	1.43
Winter	0.00	8.29	0.01	-0.99	1.13	-0.43	0.25
Spring	0.00	64.93	0.16	-0.96	3.63	-0.32	1.35
Summer	0.00	120.83	1.05	-0.96	13.84	0.37	3.08
Fall	0.00	51.24	0.15	-0.96	3.05	-0.36	1.03
Loggerhead turtle	0.00	760.93	6.16	-0.99	189.08	3.27	11.21
Winter	0.00	119.06	1.29	-0.95	46.81	0.27	3.00
Spring	0.00	760.93	10.37	-0.96	189.08	5.66	19.34
Summer	0.00	371.28	7.87	-0.99	141.87	4.95	12.99
Fall	0.00	388.80	3.45	-0.95	74.42	1.45	9.52
Kemp's ridley turtle	0.00	235.12	0.33	-0.99	35.93	-0.21	1.50
Winter	0.00	56.55	0.30	-0.95	18.15	-0.28	1.14
Spring	0.00	0.00	0.00	-0.98	0.00	-0.41	0.21
Summer	0.00	235.12	0.82	-0.98	35.93	0.22	4.43
Fall	0.00	0.00	0.00	-0.99	0.00	-0.45	0.23

APPENDIX B: MARINE MAMMALS

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APPENDIX B: MARINE MAMMALS (cont'd)

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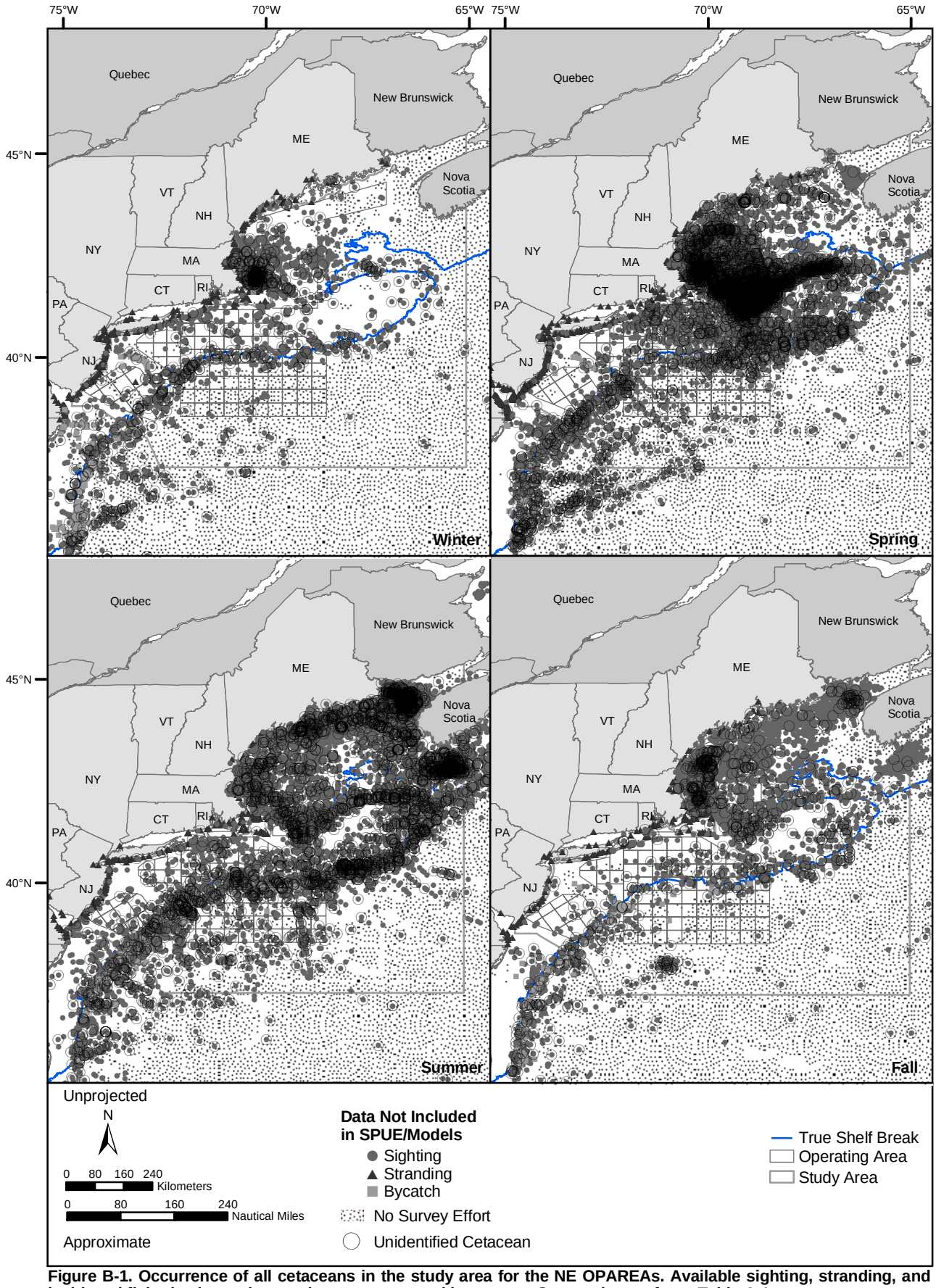

Figure B-1. Occurrence of all cetaceans in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

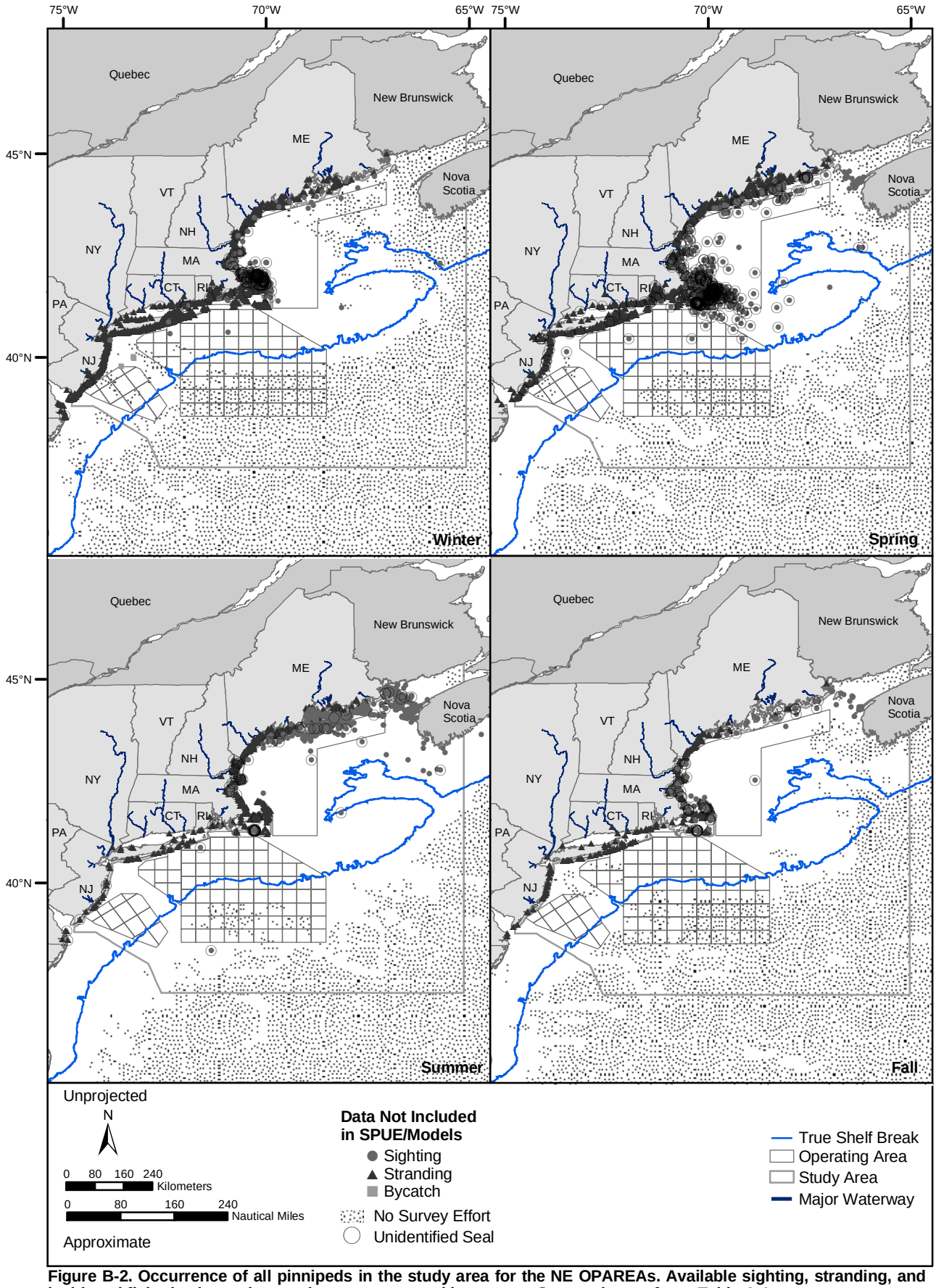

Figure B-2. Occurrence of all pinnipeds in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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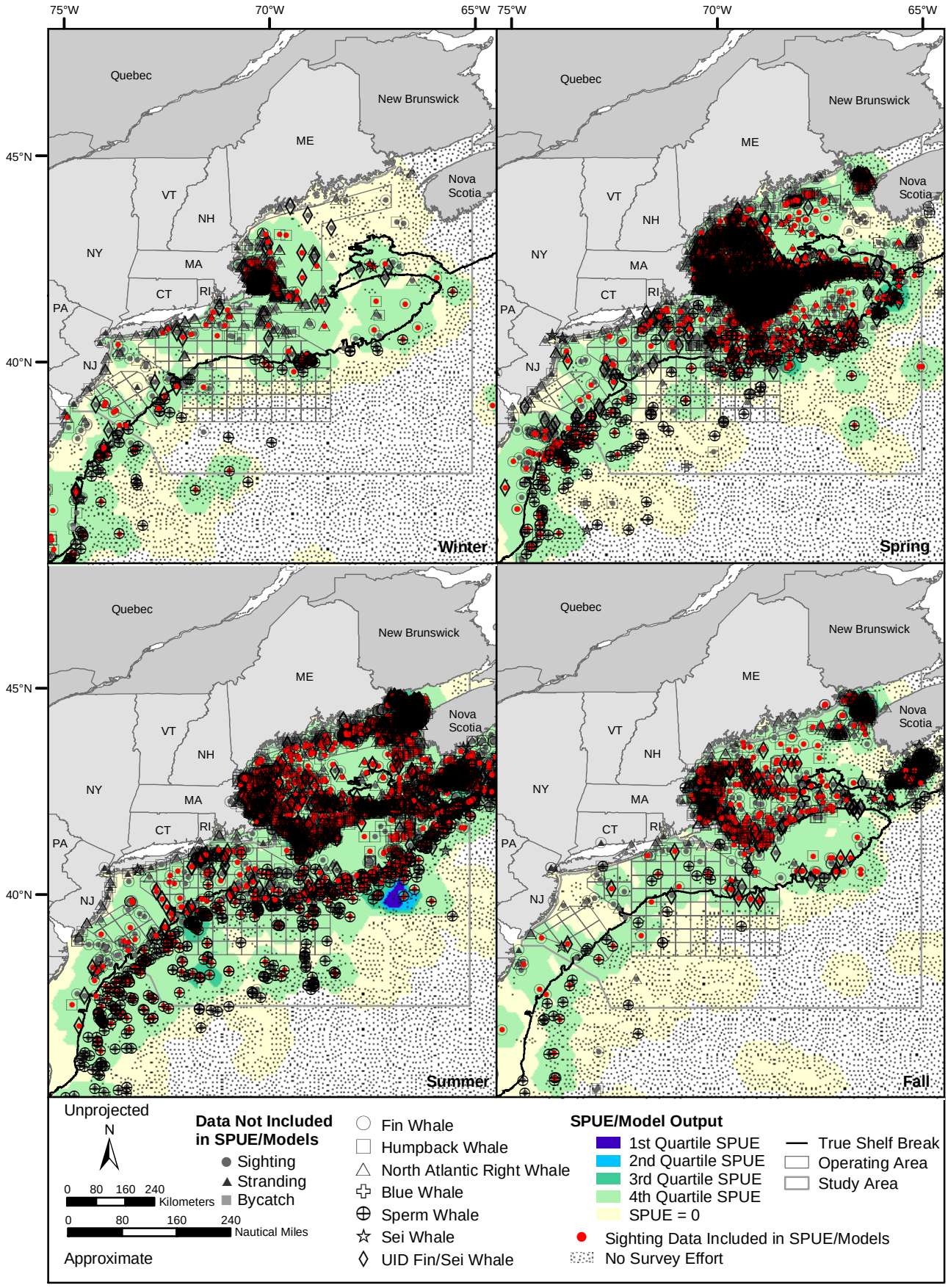

Figure B-3a. Occurrence of endangered marine mammals in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

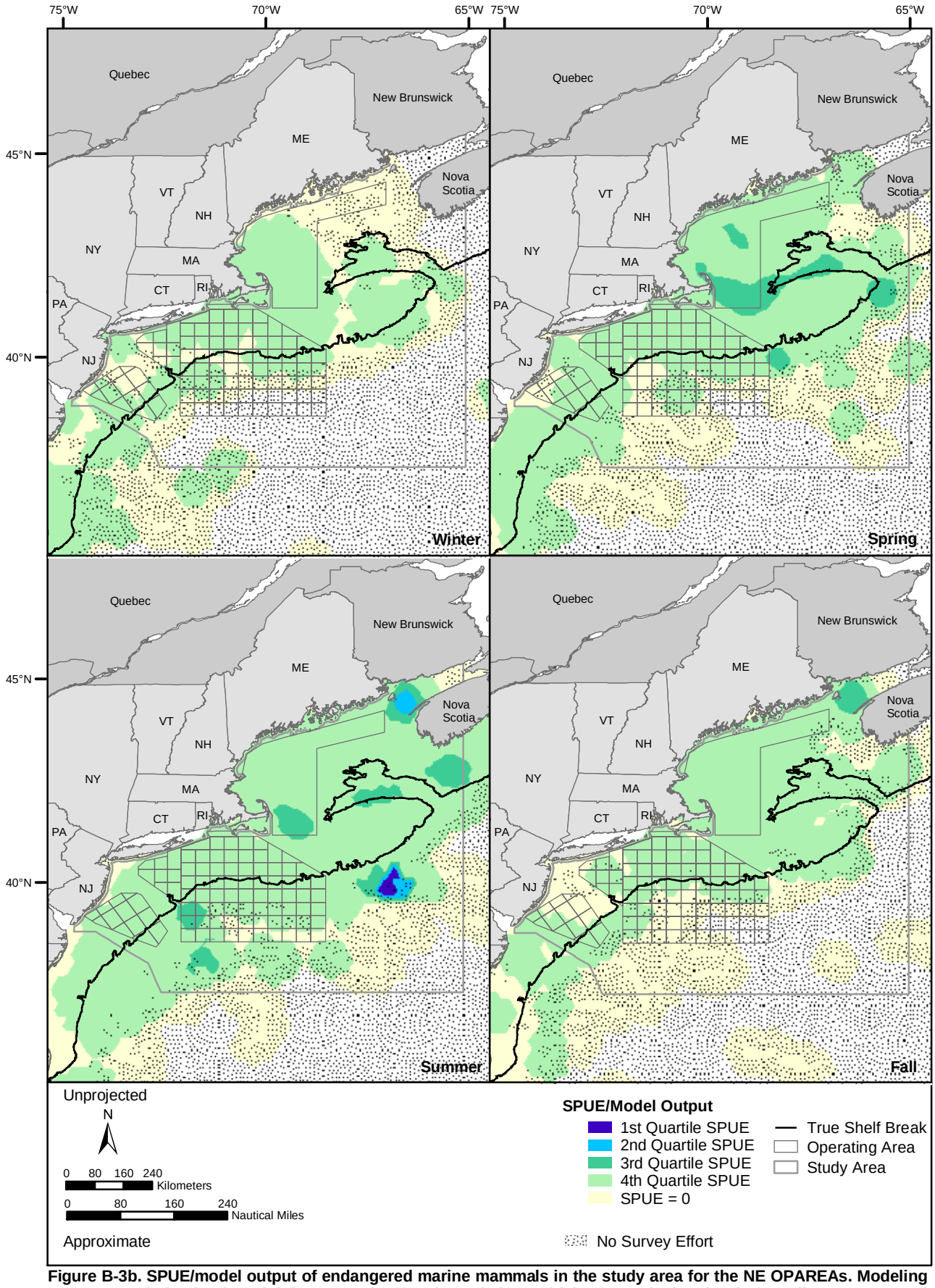

Figure B-3b. SPUE/model output of endangered marine mammals in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

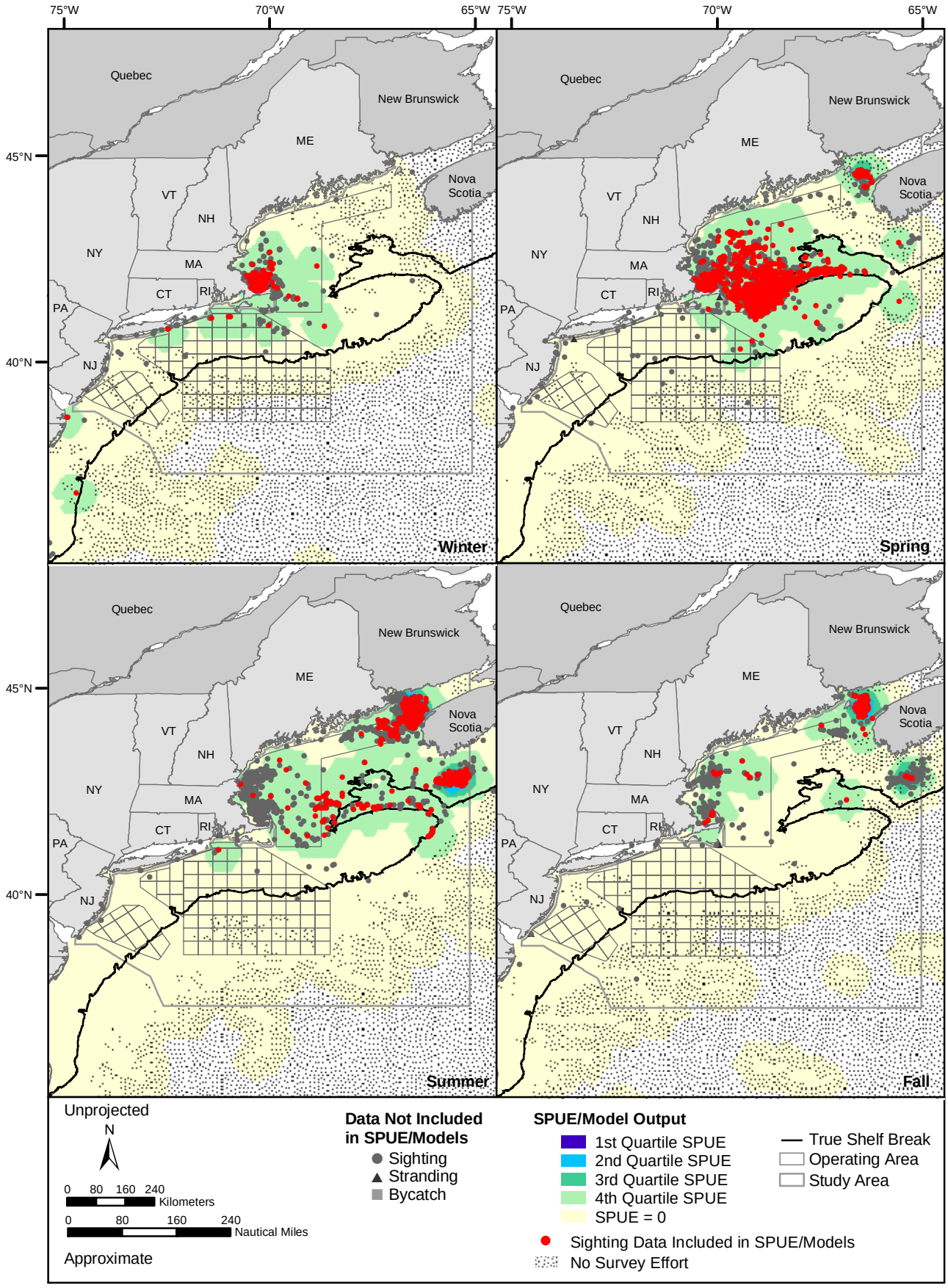

Figure B-4a. Occurrence of the North Atlantic right whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

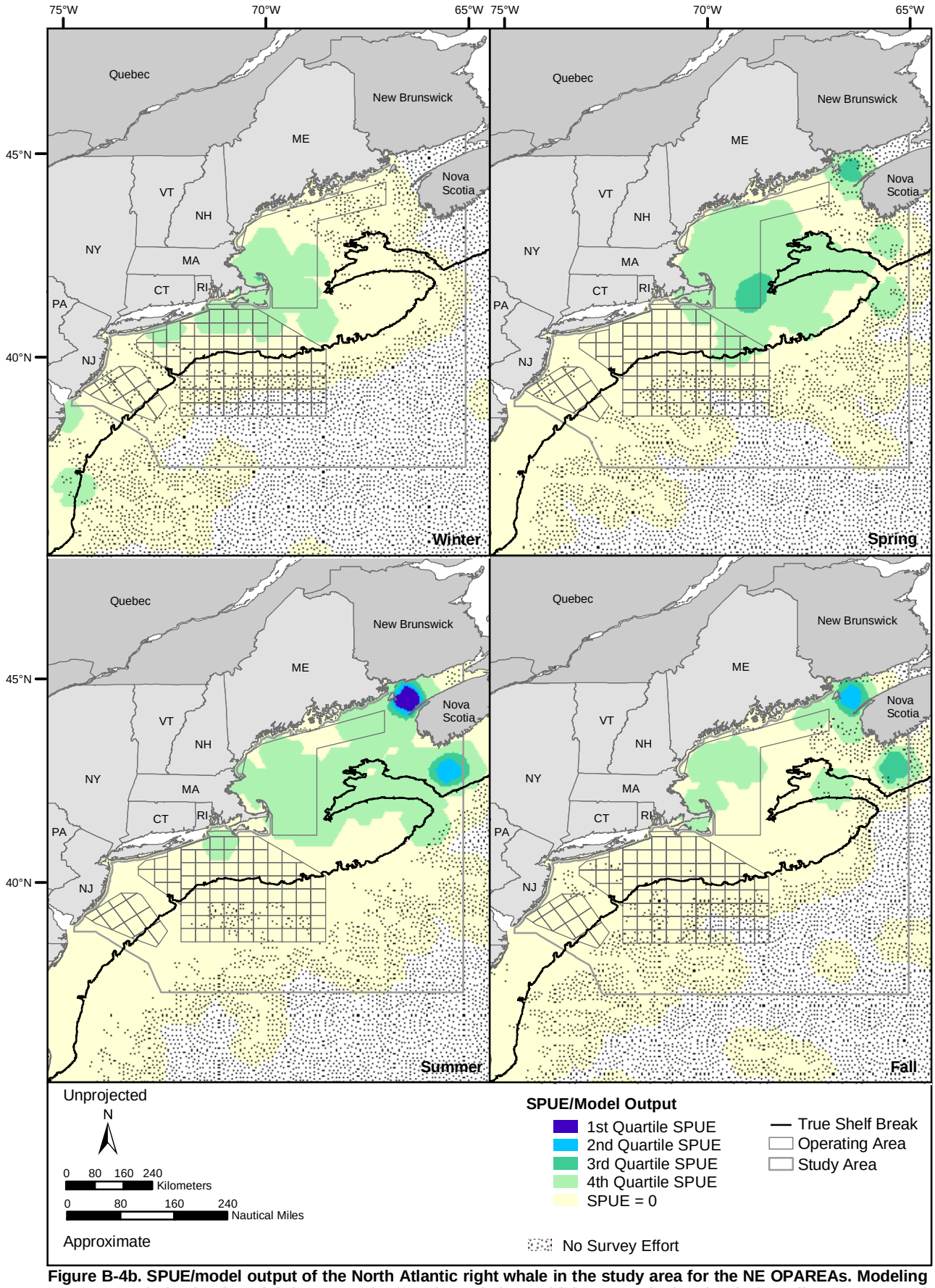

Figure B-4b. SPUE/model output of the North Atlantic right whale in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

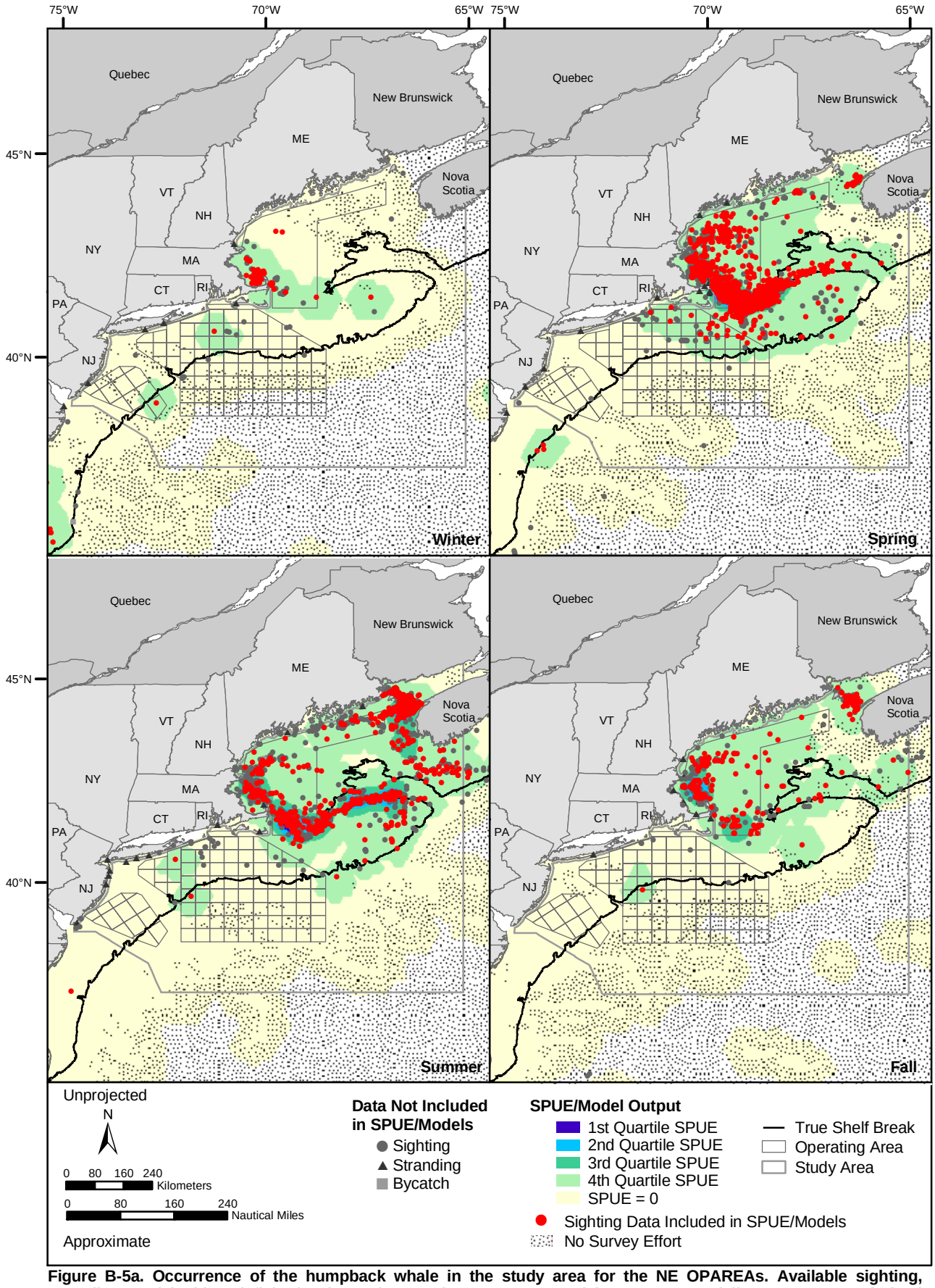

Figure B-5a. Occurrence of the humpback whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

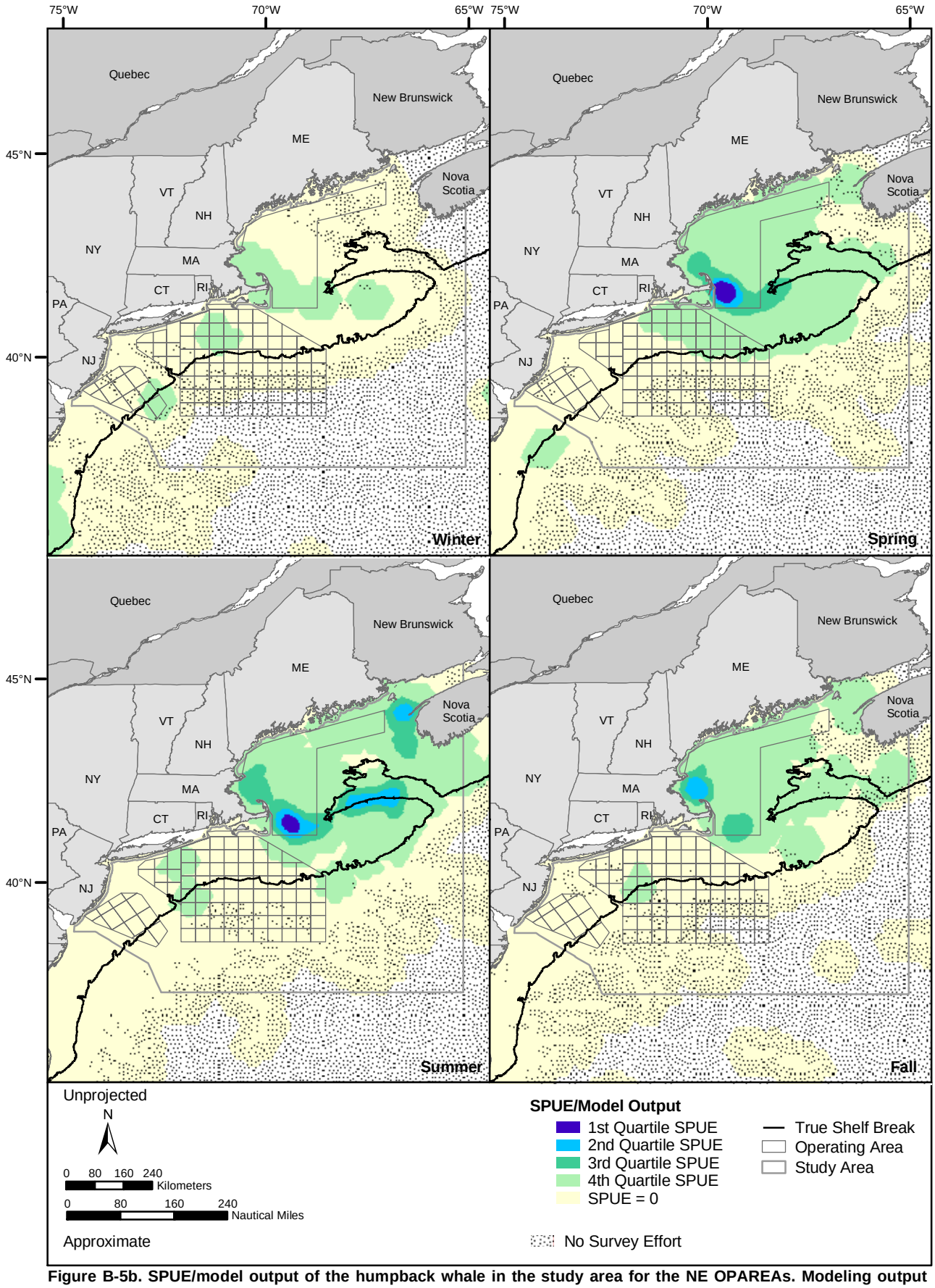

Figure B-5b. SPUE/model output of the humpback whale in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

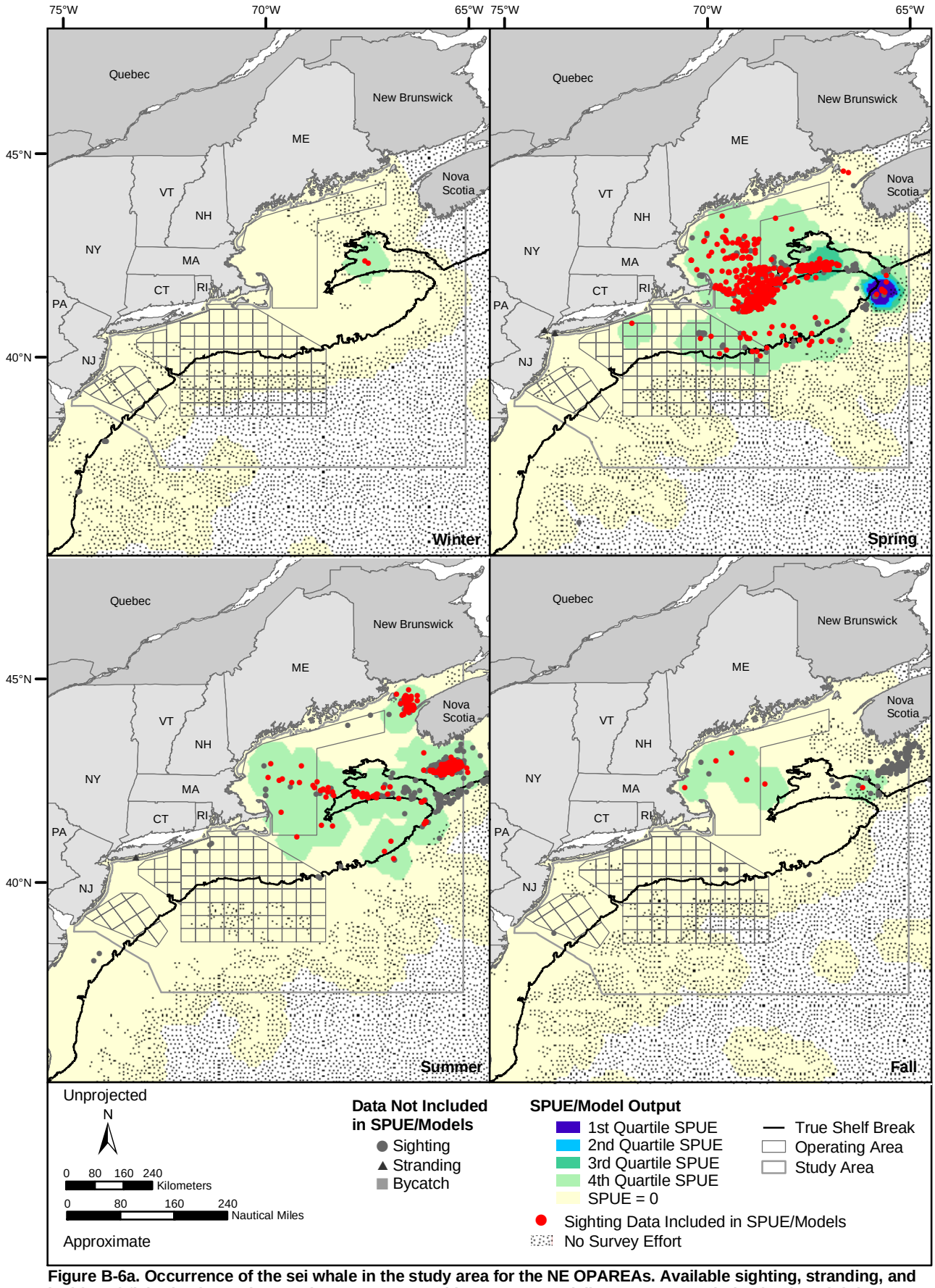

Figure B-6a. Occurrence of the sei whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

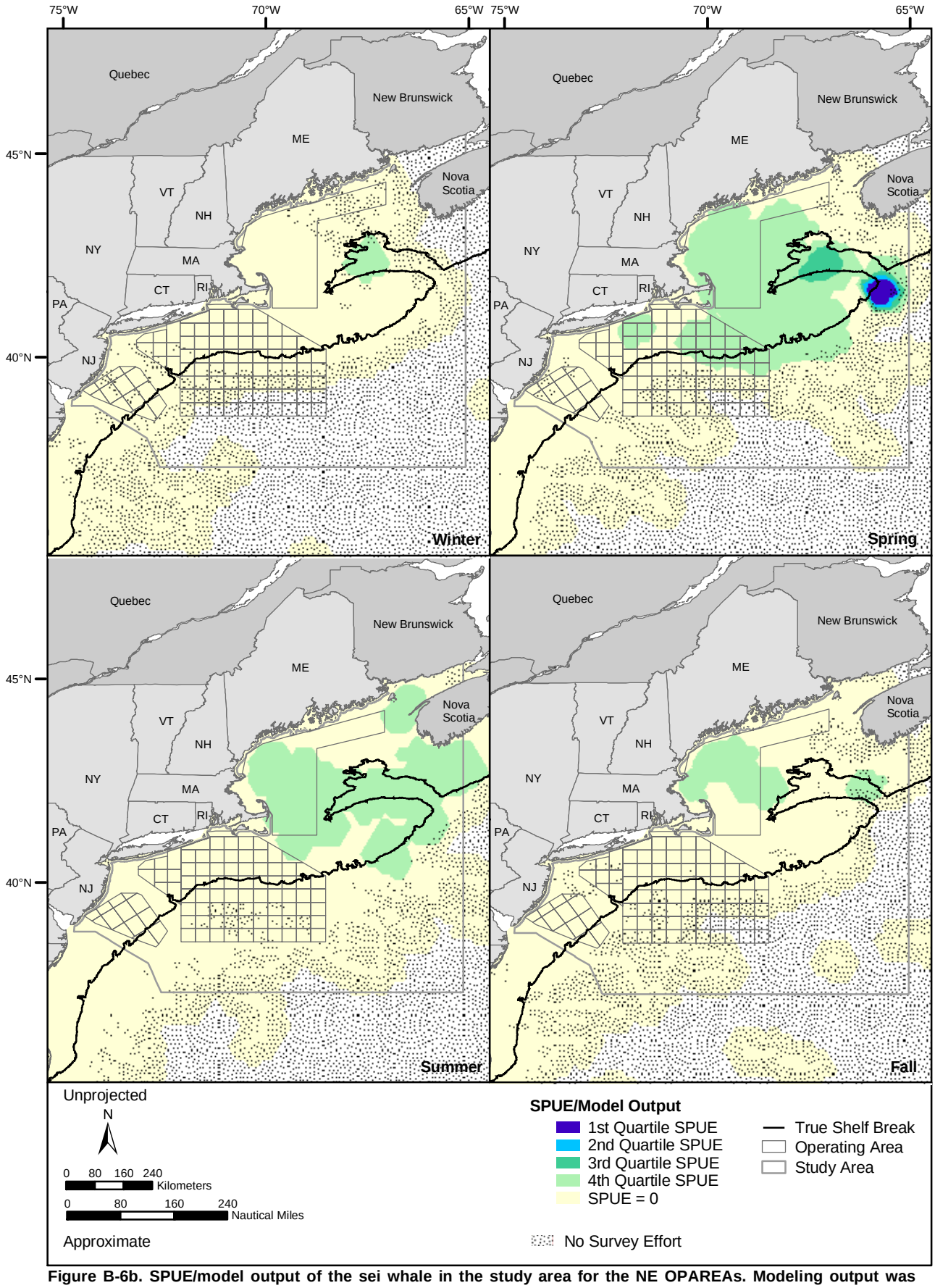

Figure B-6b. SPUE/model output of the sei whale in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

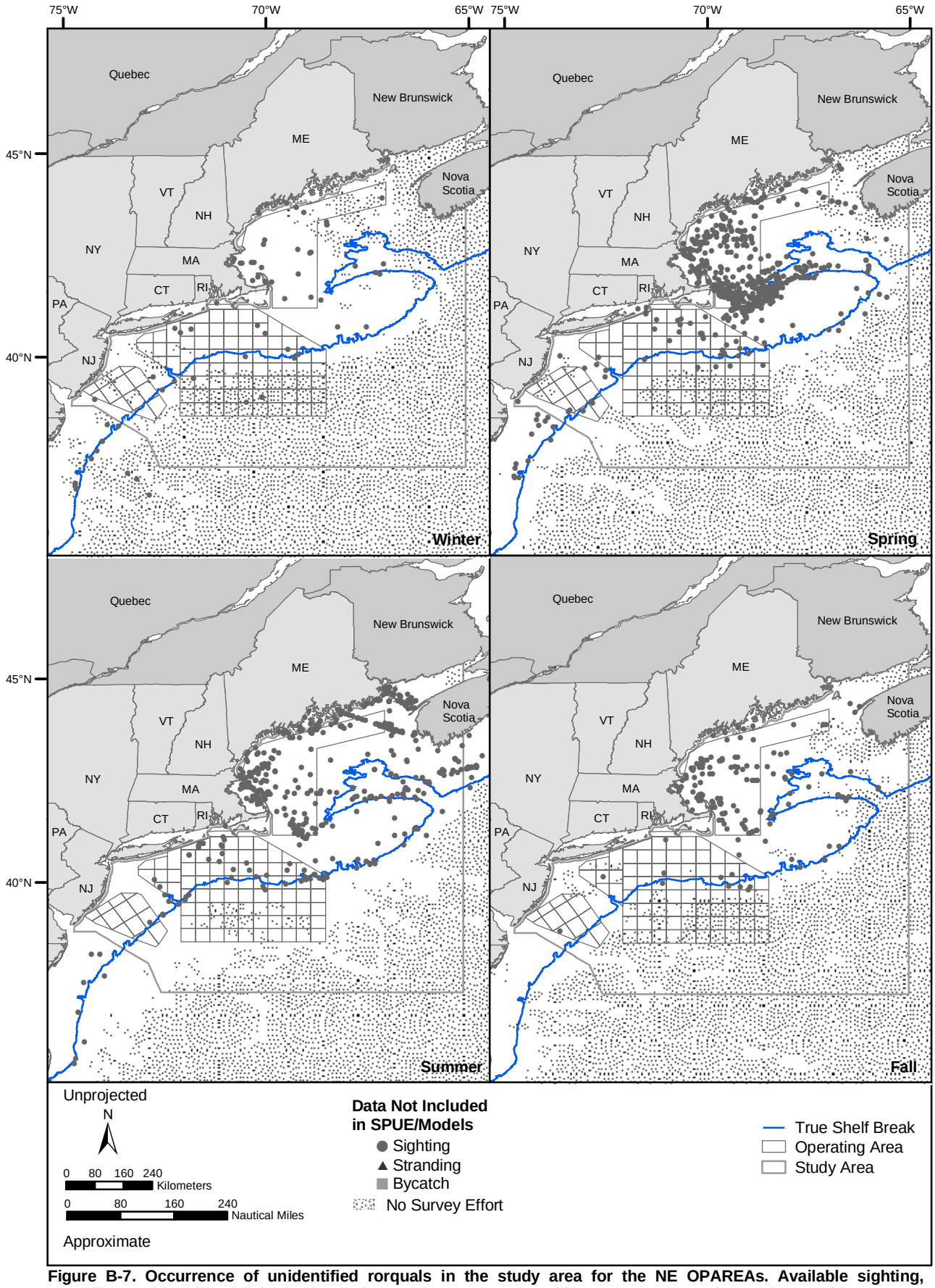

Figure B-7. Occurrence of unidentified rorquals in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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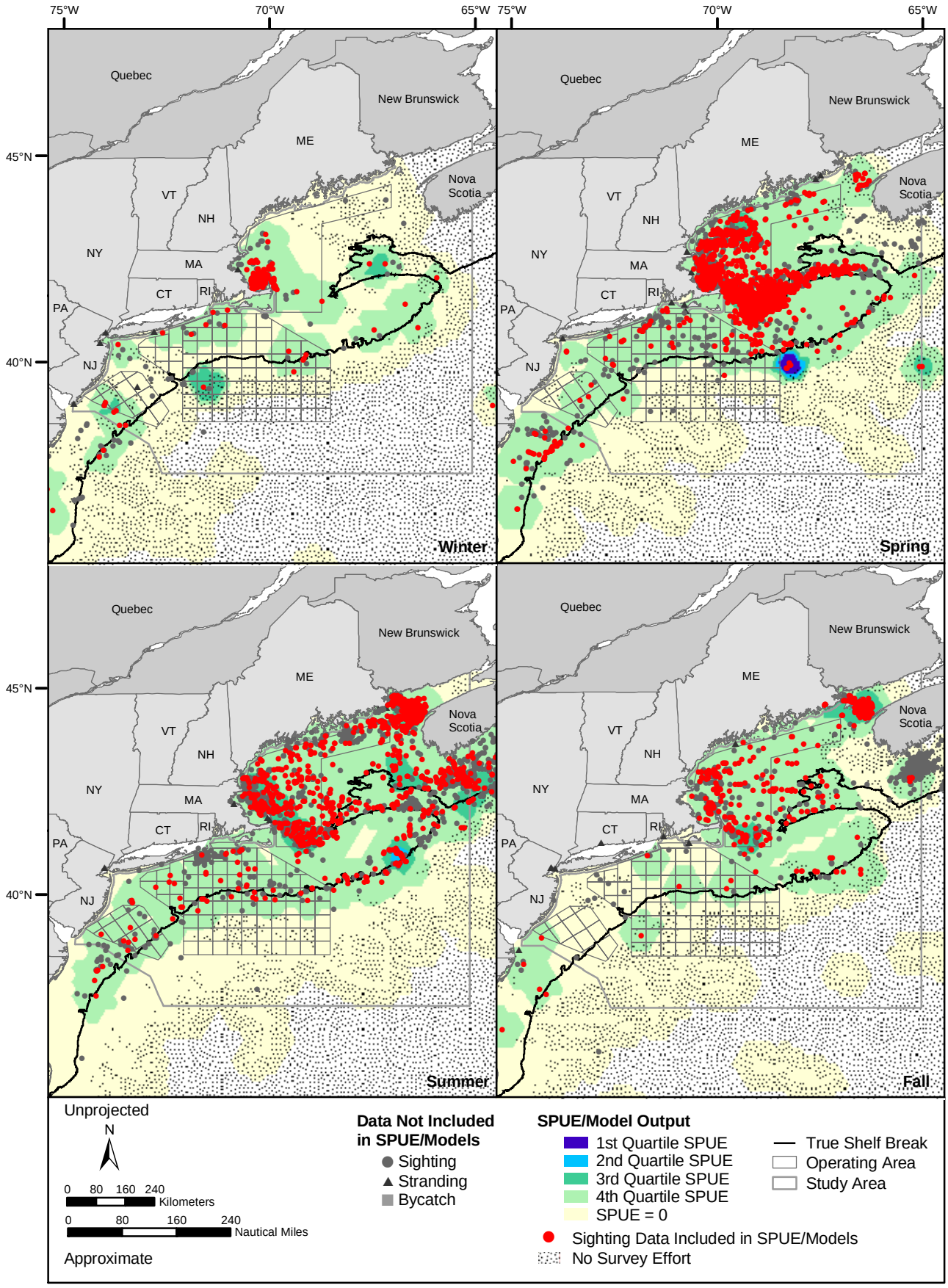

Figure B-8a. Occurrence of the fin whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

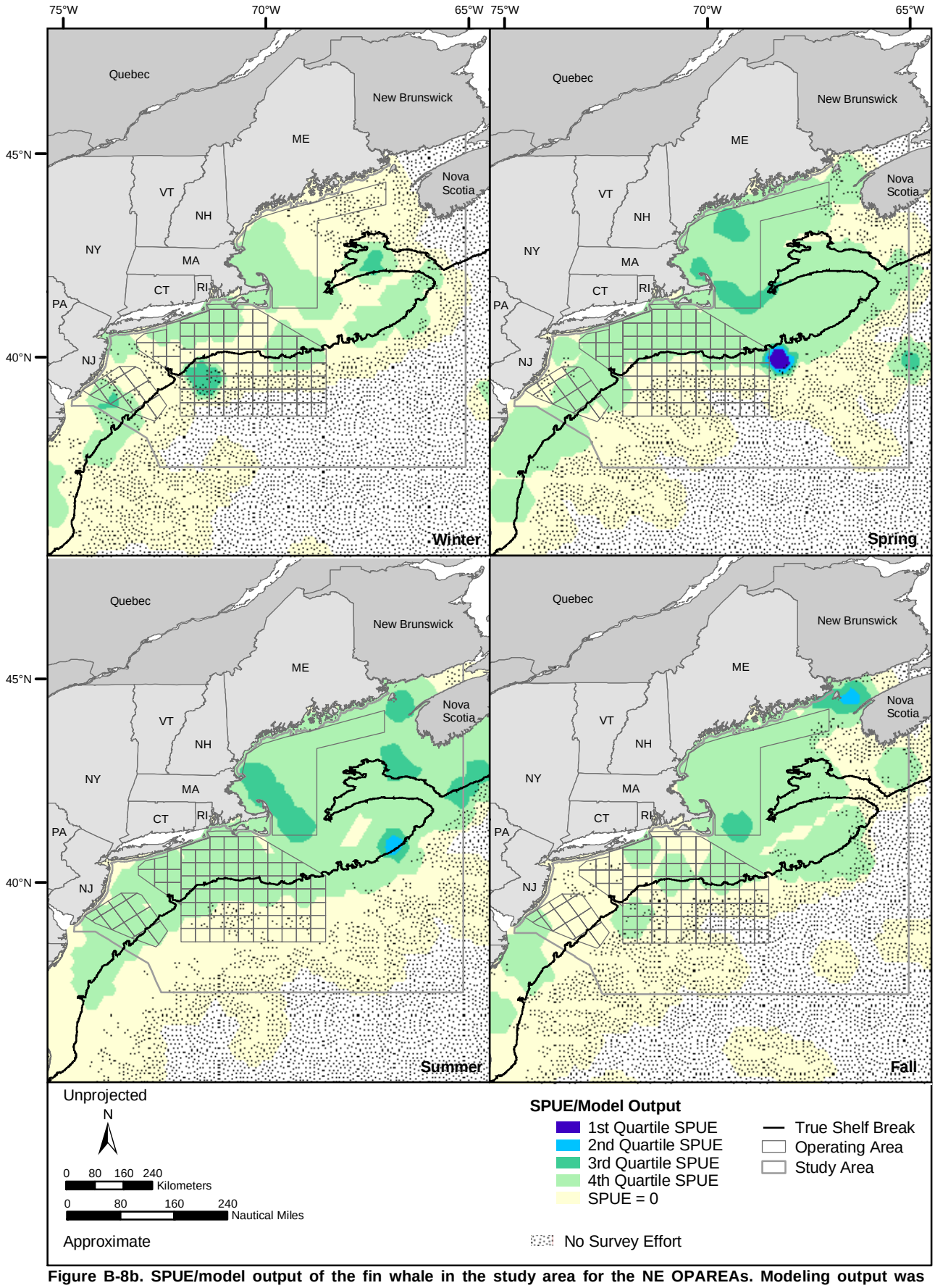

Figure B-8b. SPUE/model output of the fin whale in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

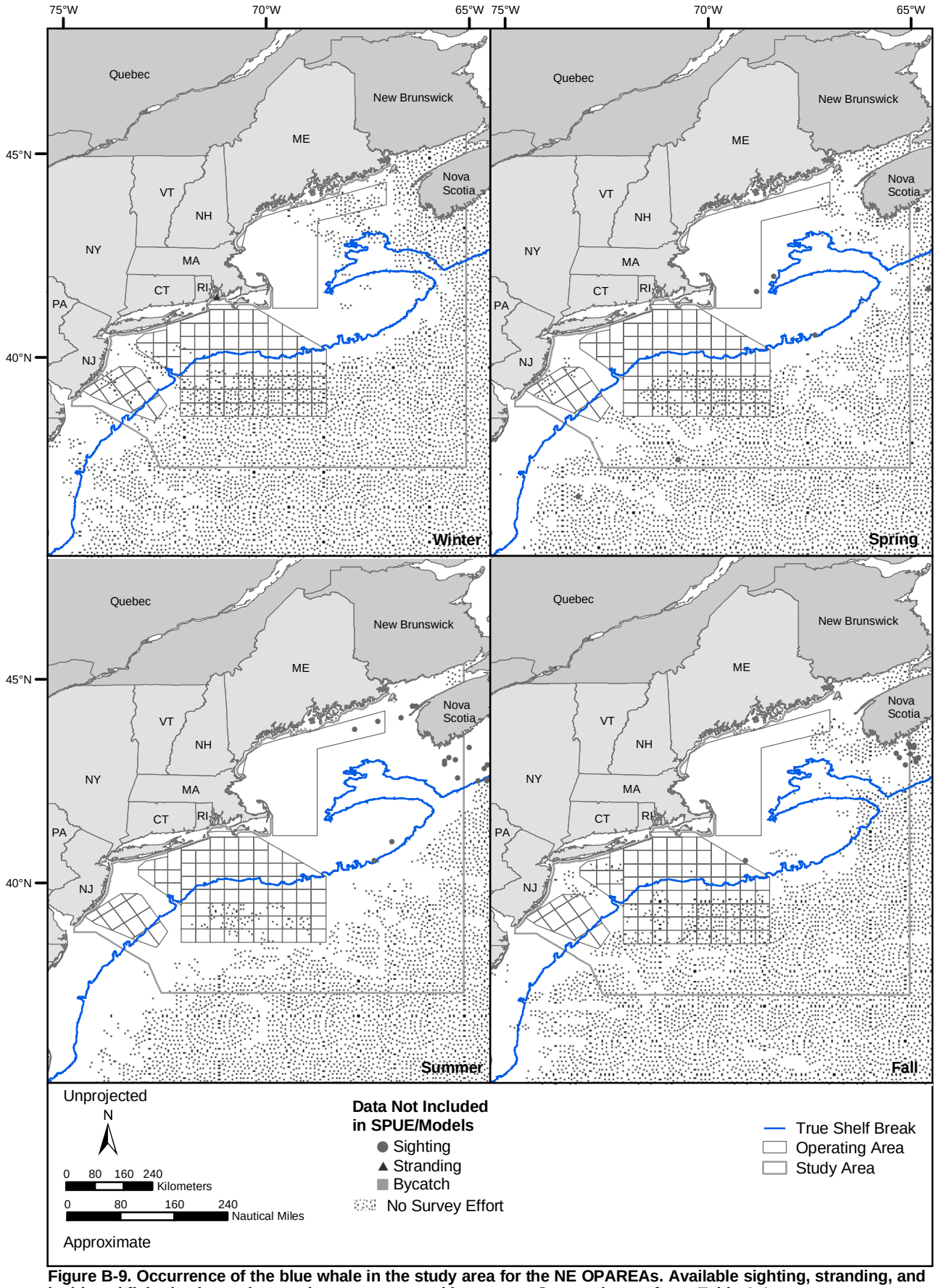

Figure B-9. Occurrence of the blue whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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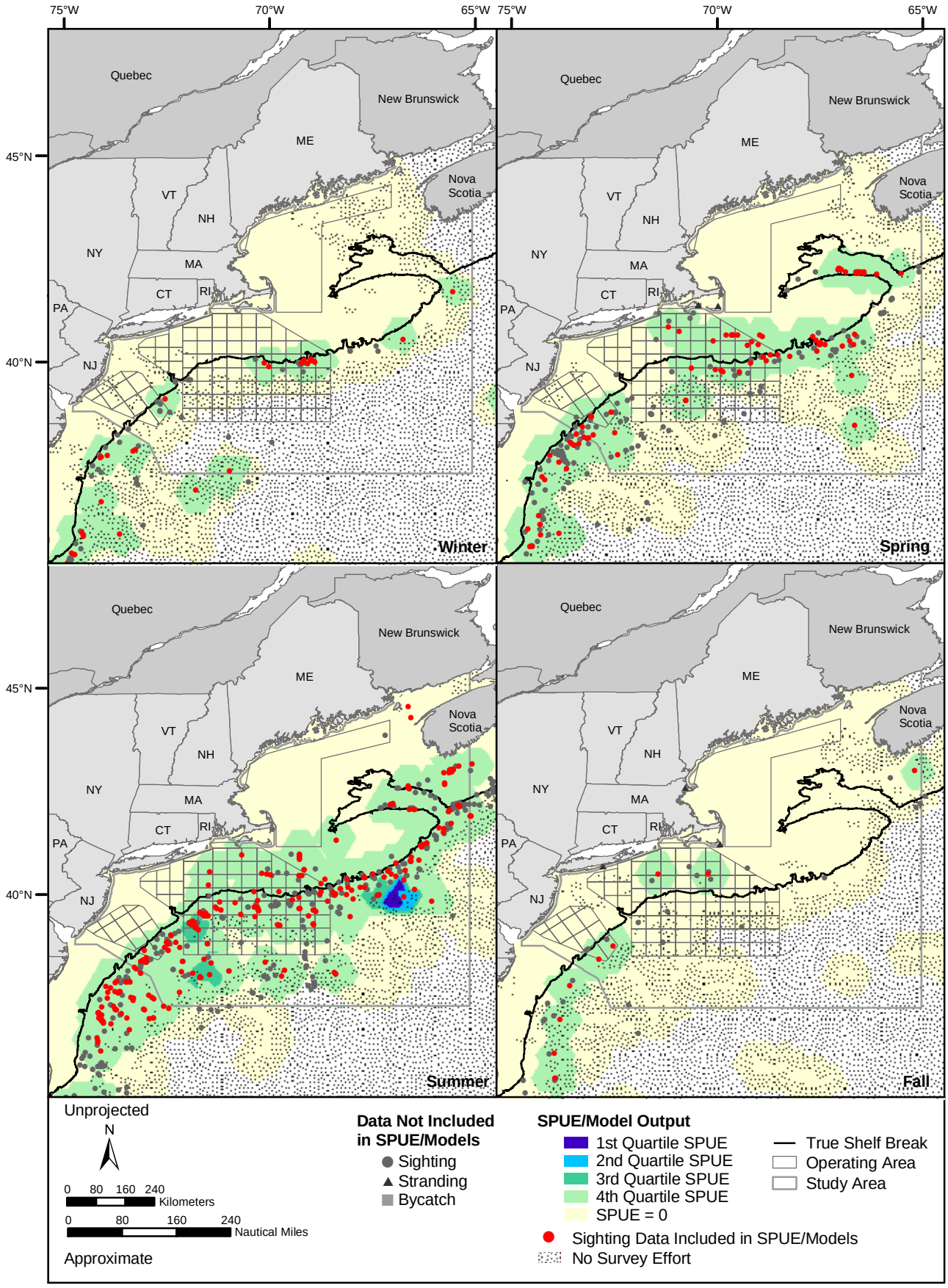

Figure B-10a. Occurrence of the sperm whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

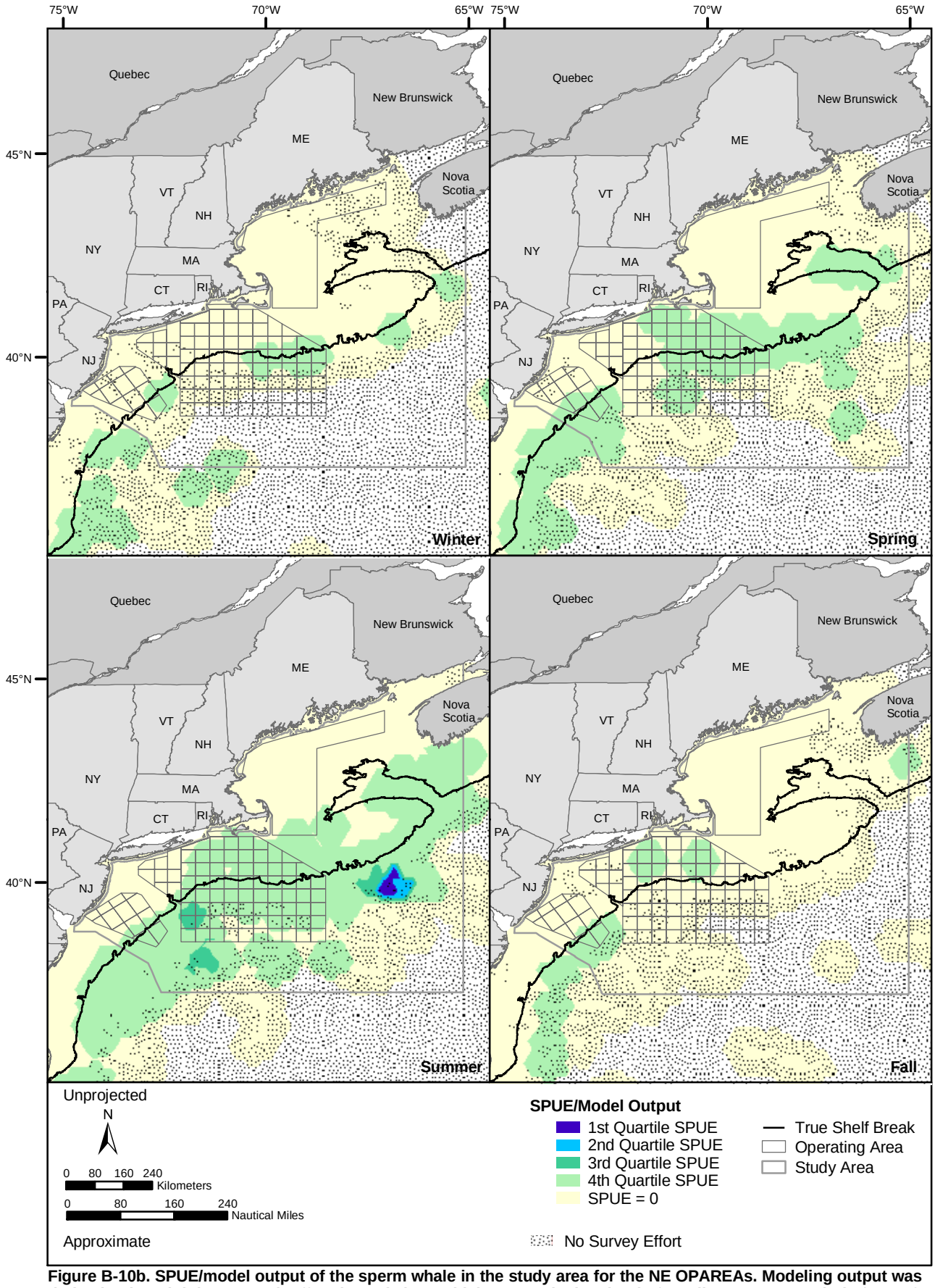

Figure B-10b. SPUE/model output of the sperm whale in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

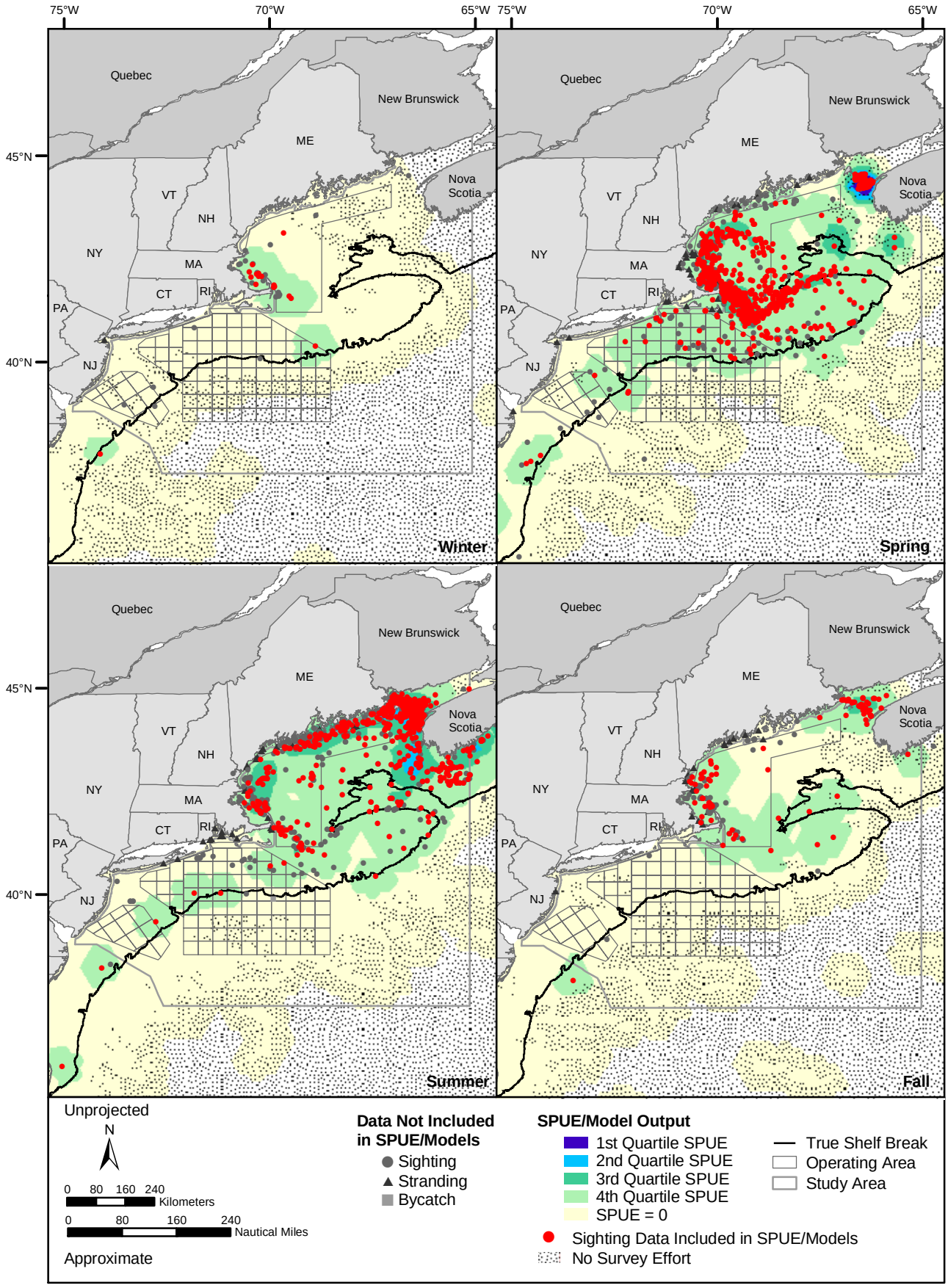

Figure B-11a. Occurrence of the minke whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

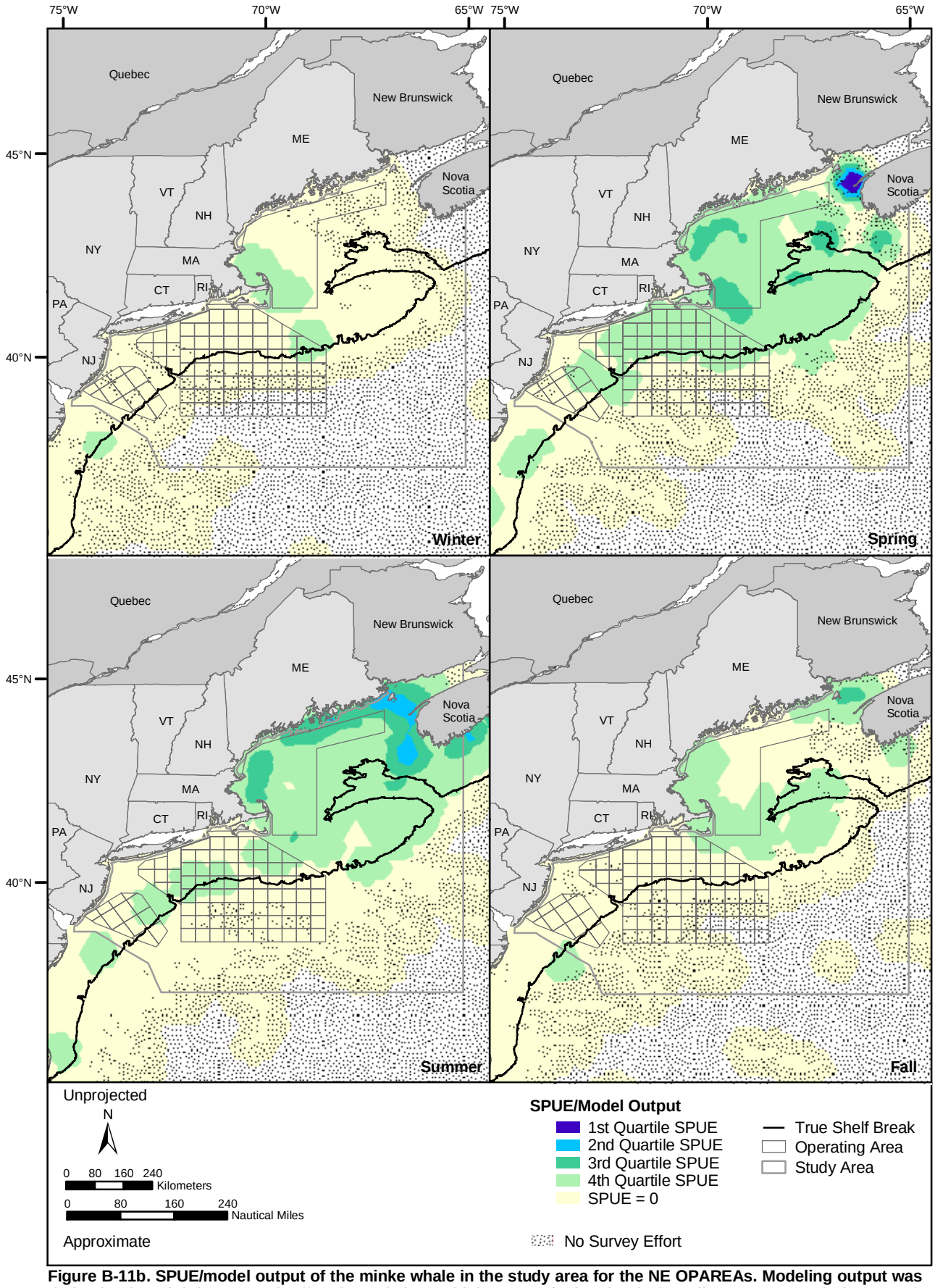

Figure B-11b. SPUE/model output of the minke whale in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

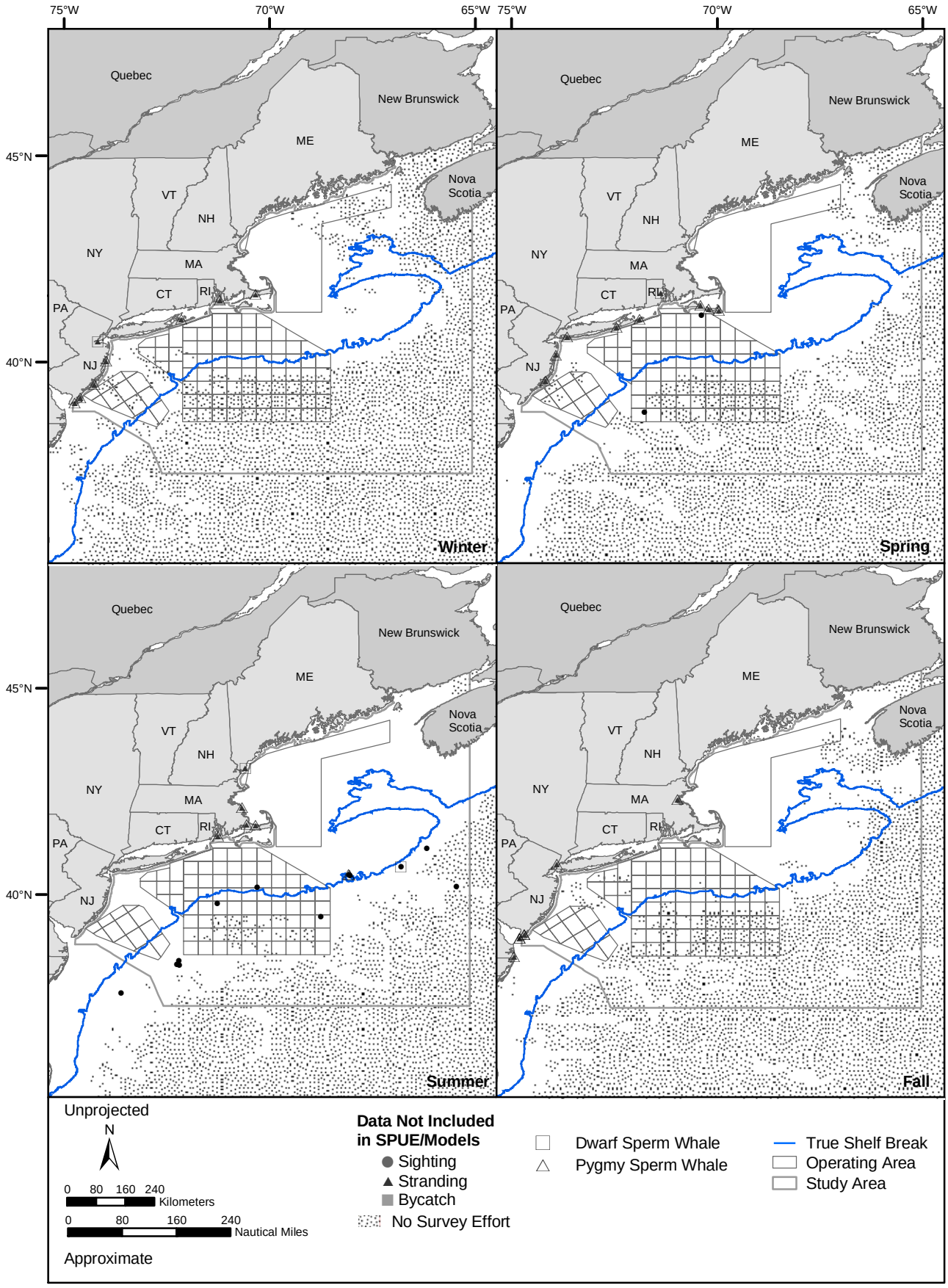

Figure B-12. Occurrence of *Kogia* spp. in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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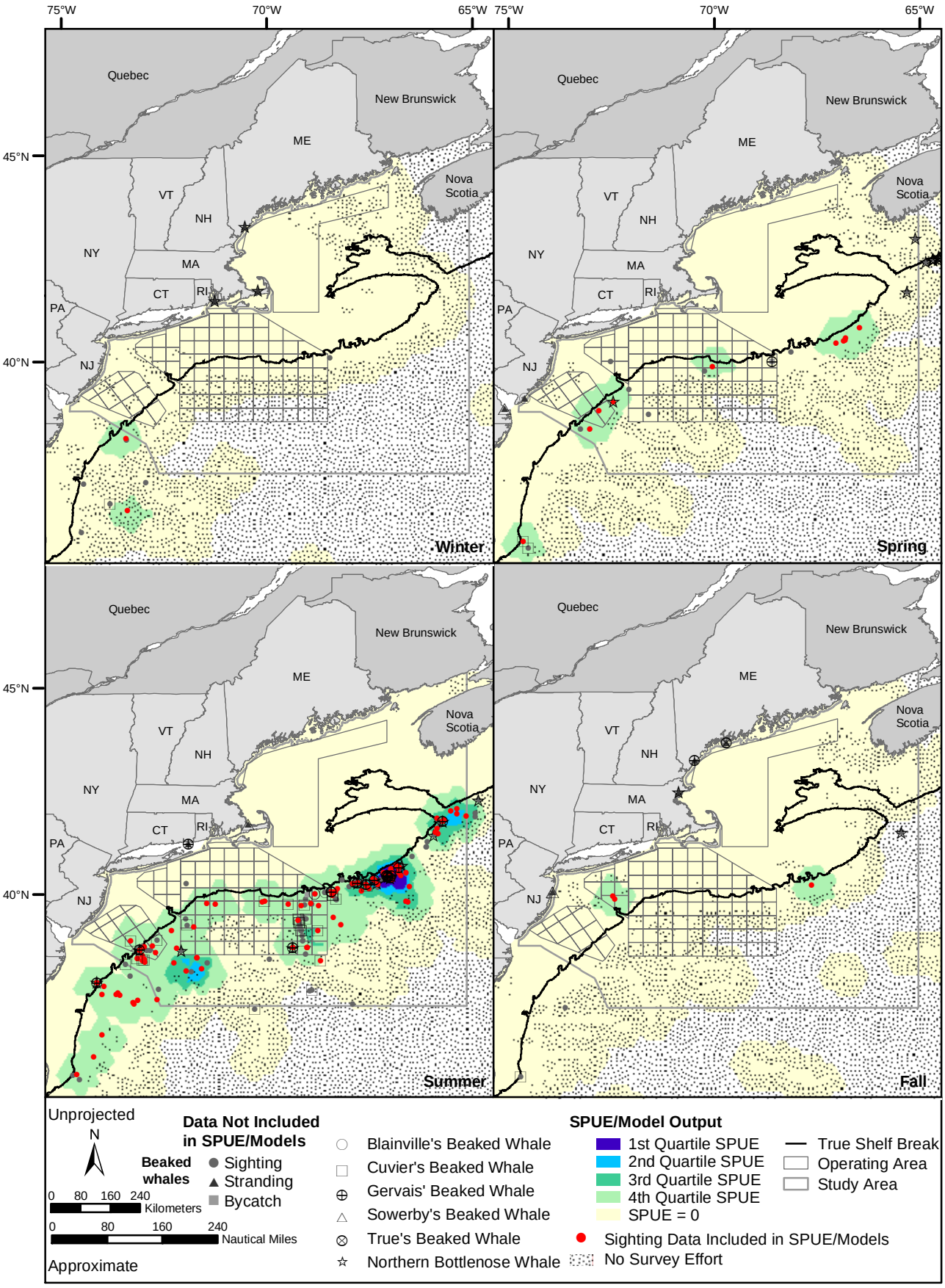

Figure B-13a. Occurrence of beaked whales in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

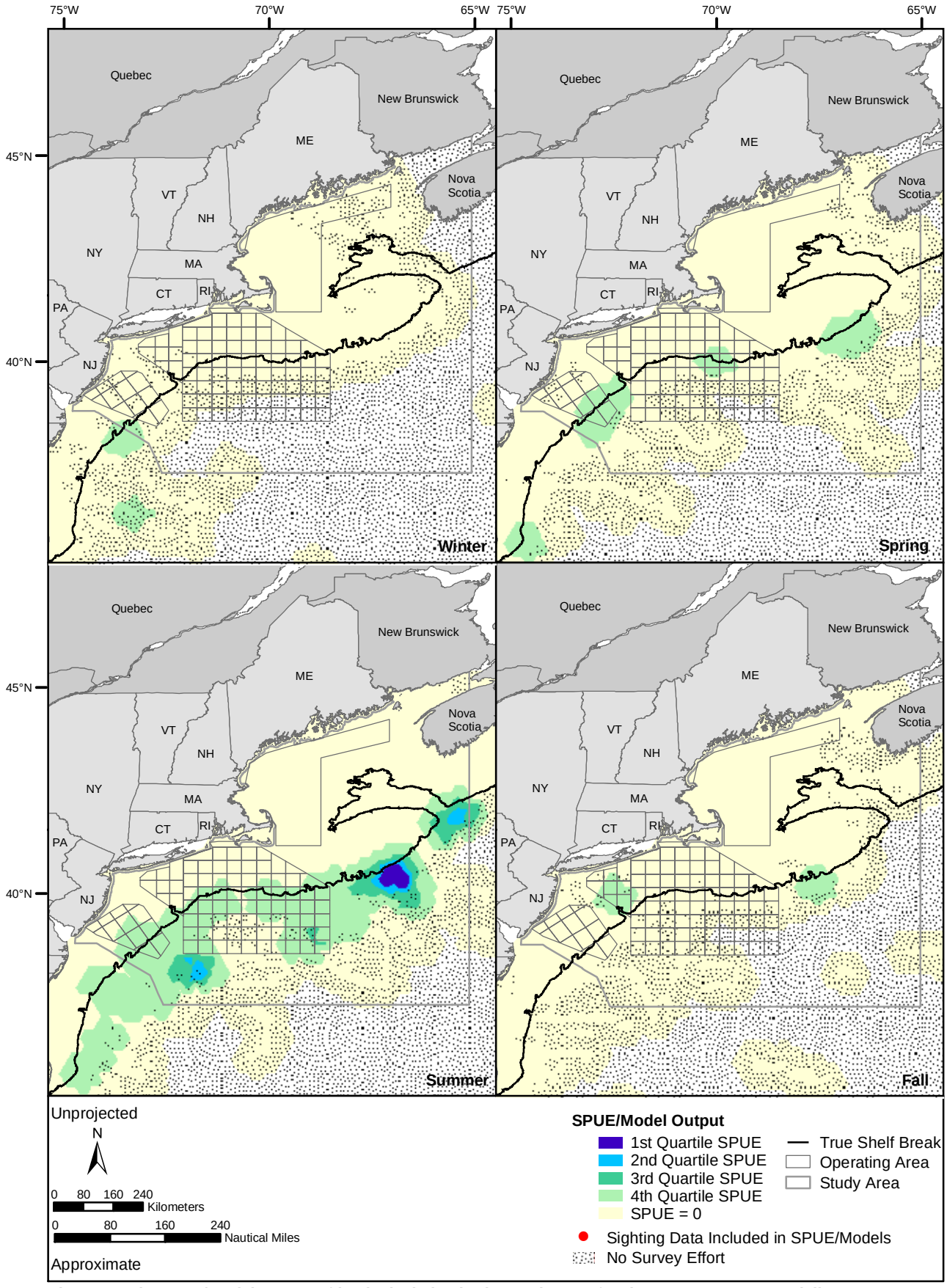

Figure B-13b. SPUE/model output of beaked whales in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

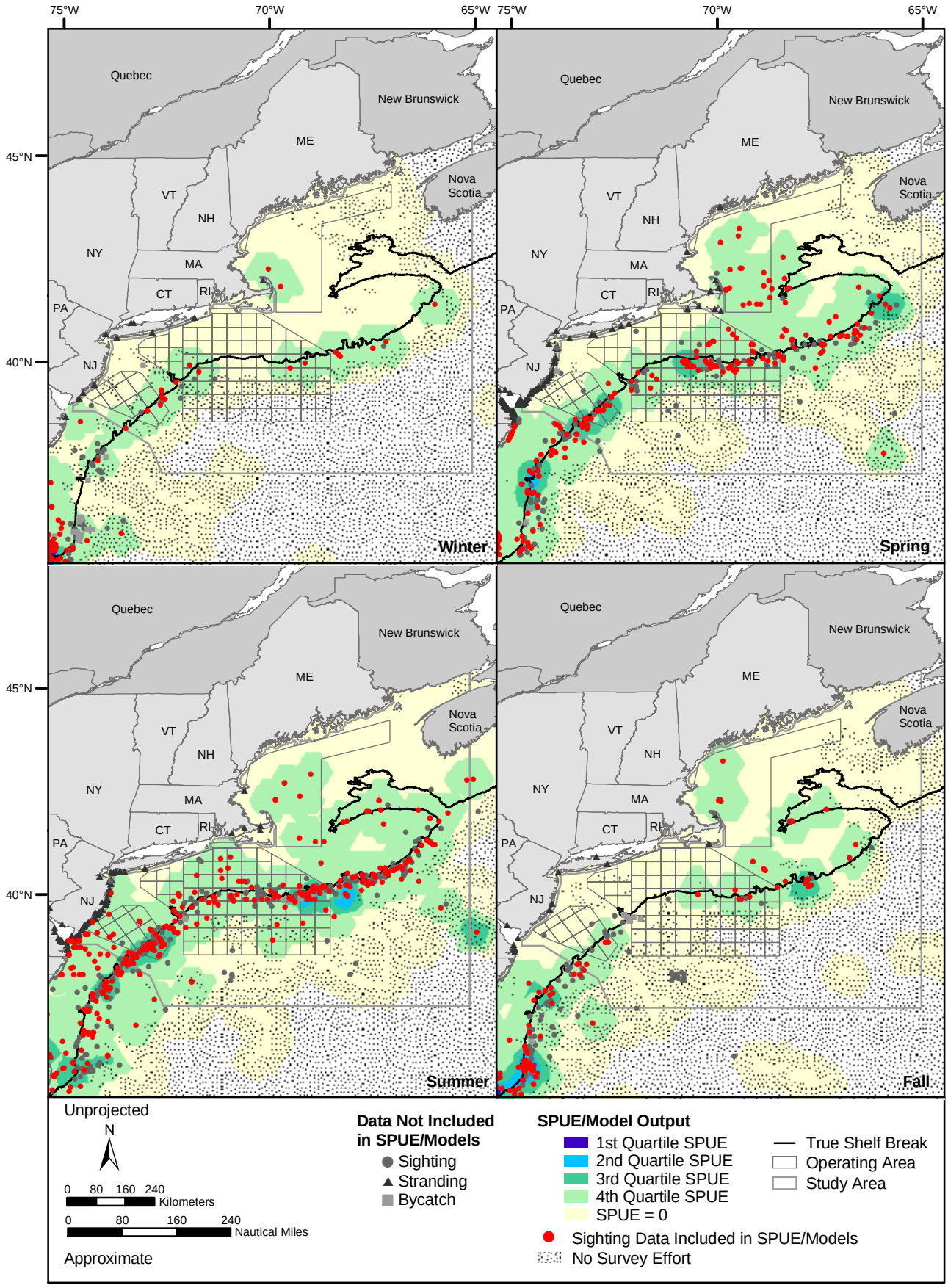

Figure B-14a. Occurrence of the bottlenose dolphin in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

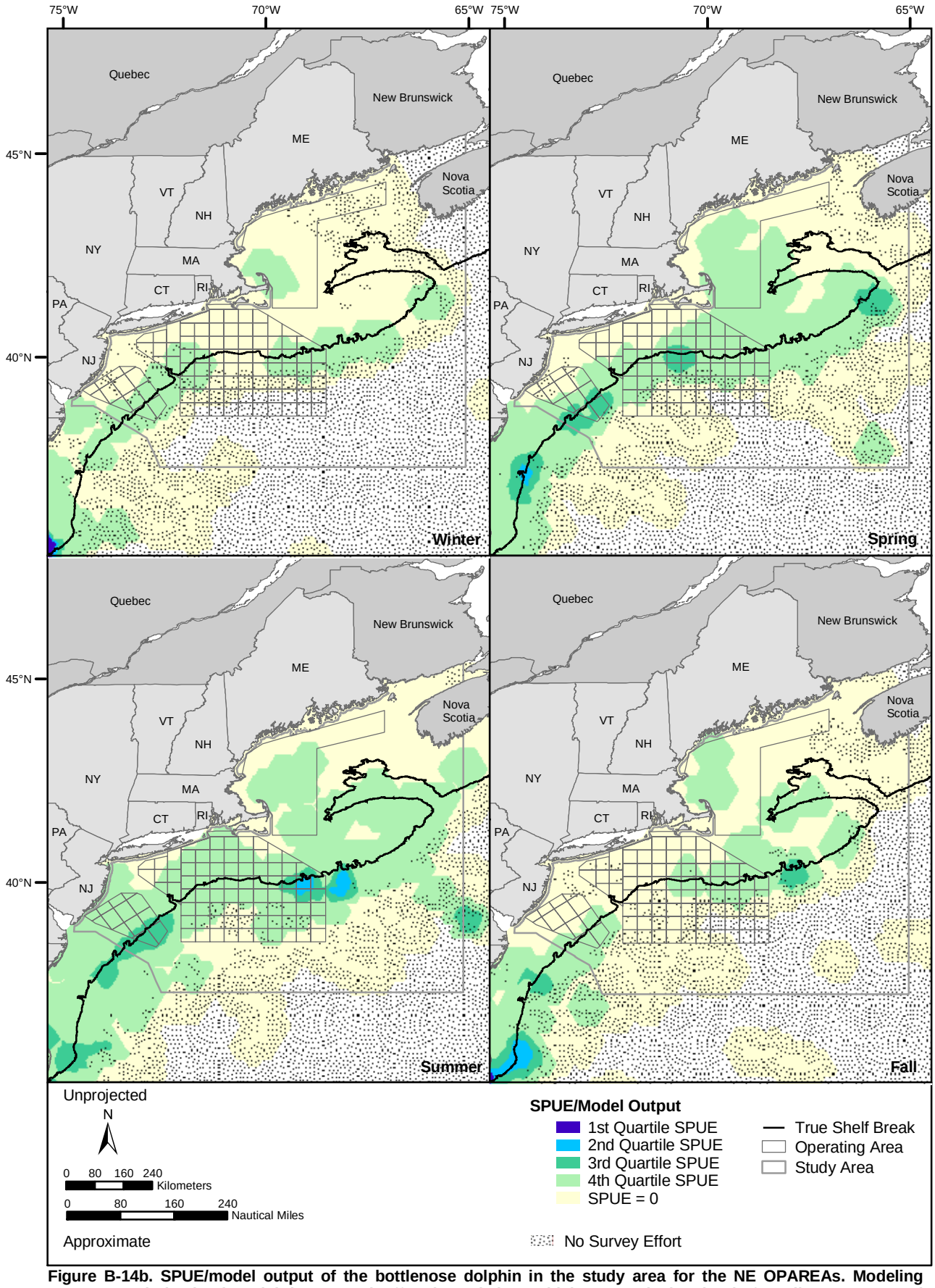

Figure B-14b. SPUE/model output of the bottlenose dolphin in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

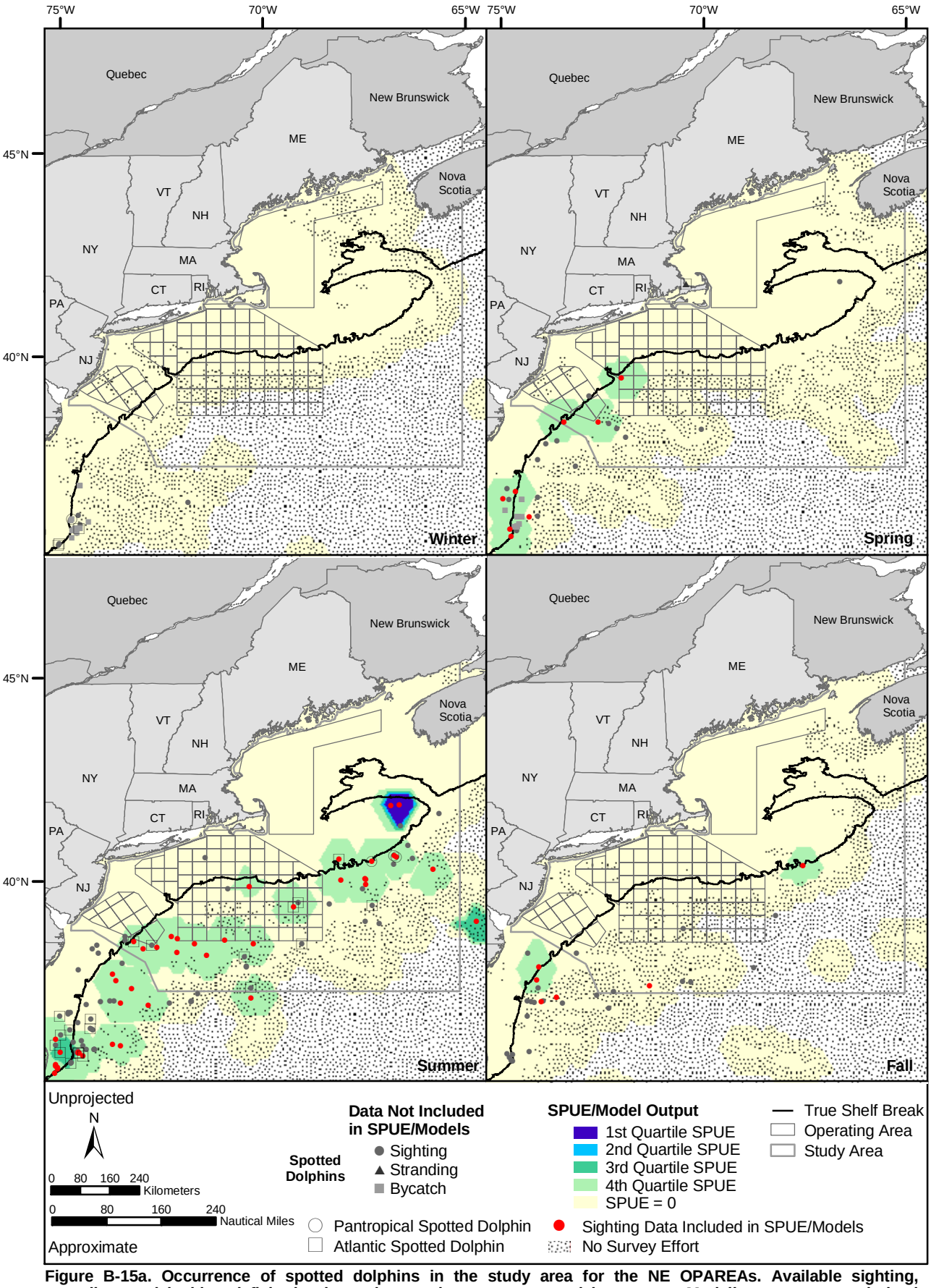

Figure B-15a. Occurrence of spotted dolphins in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

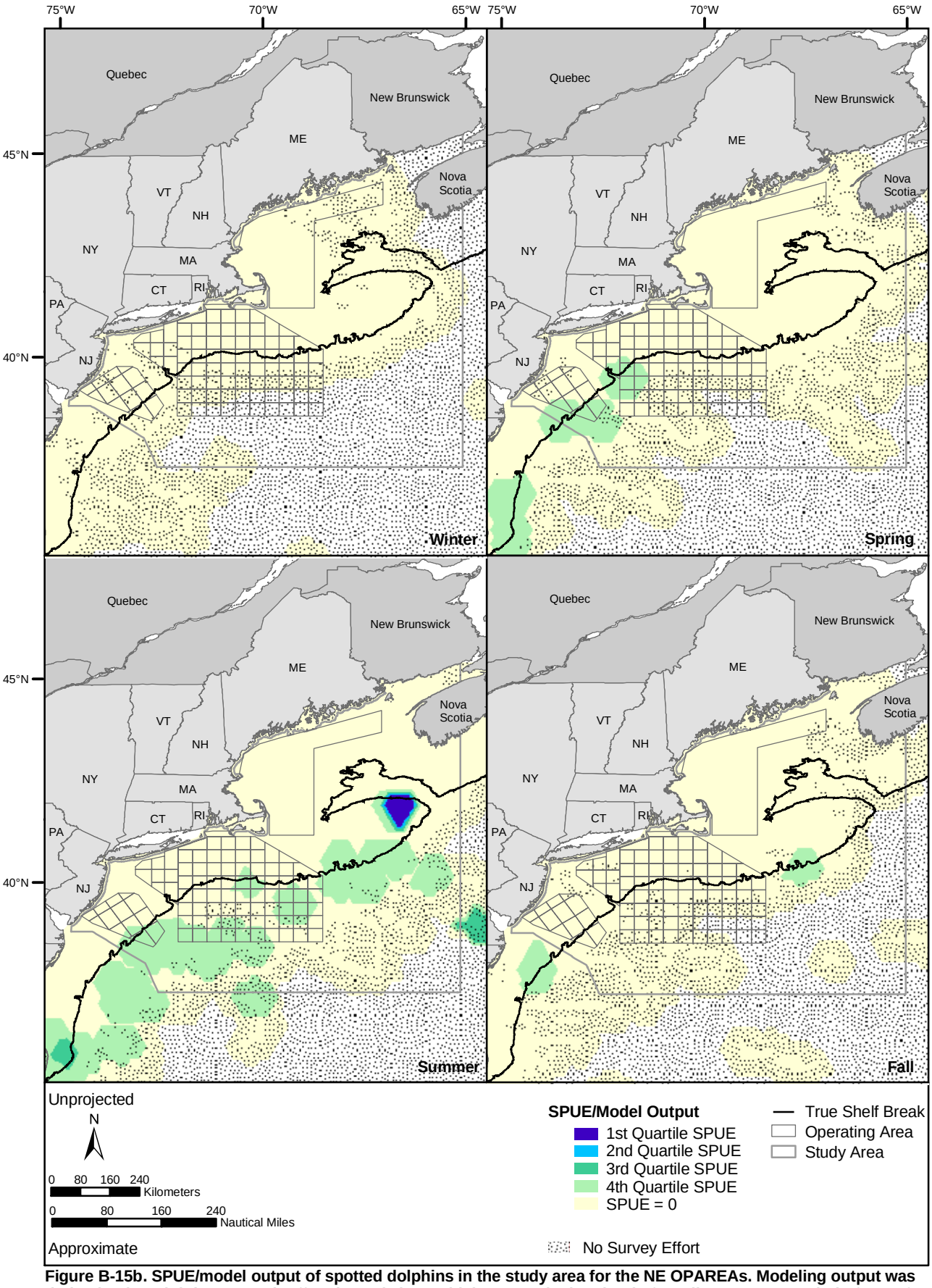

Figure B-15b. SPUE/model output of spotted dolphins in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

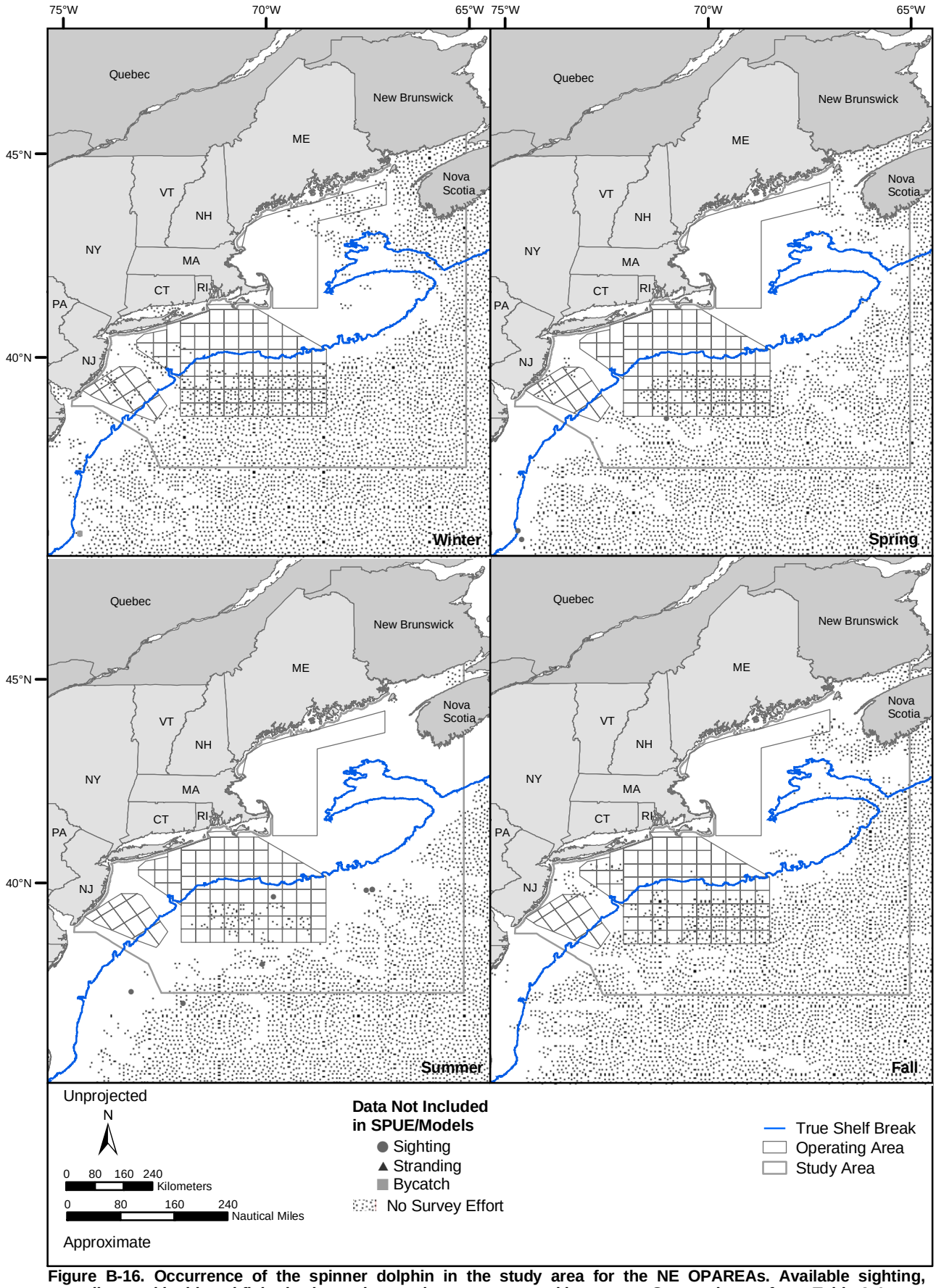

Figure B-16. Occurrence of the spinner dolphin in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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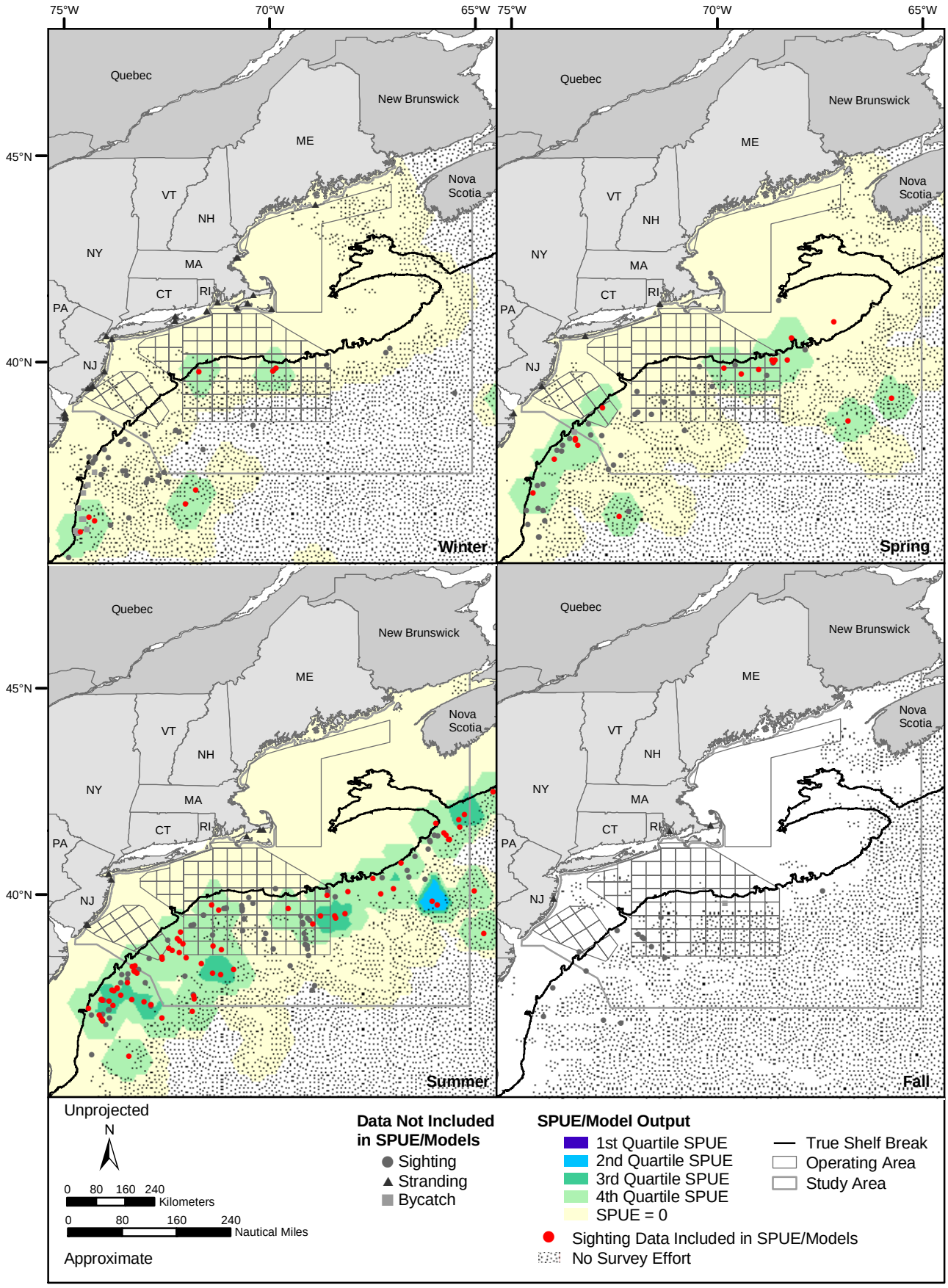

Figure B-17a. Occurrence of the striped dolphin in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

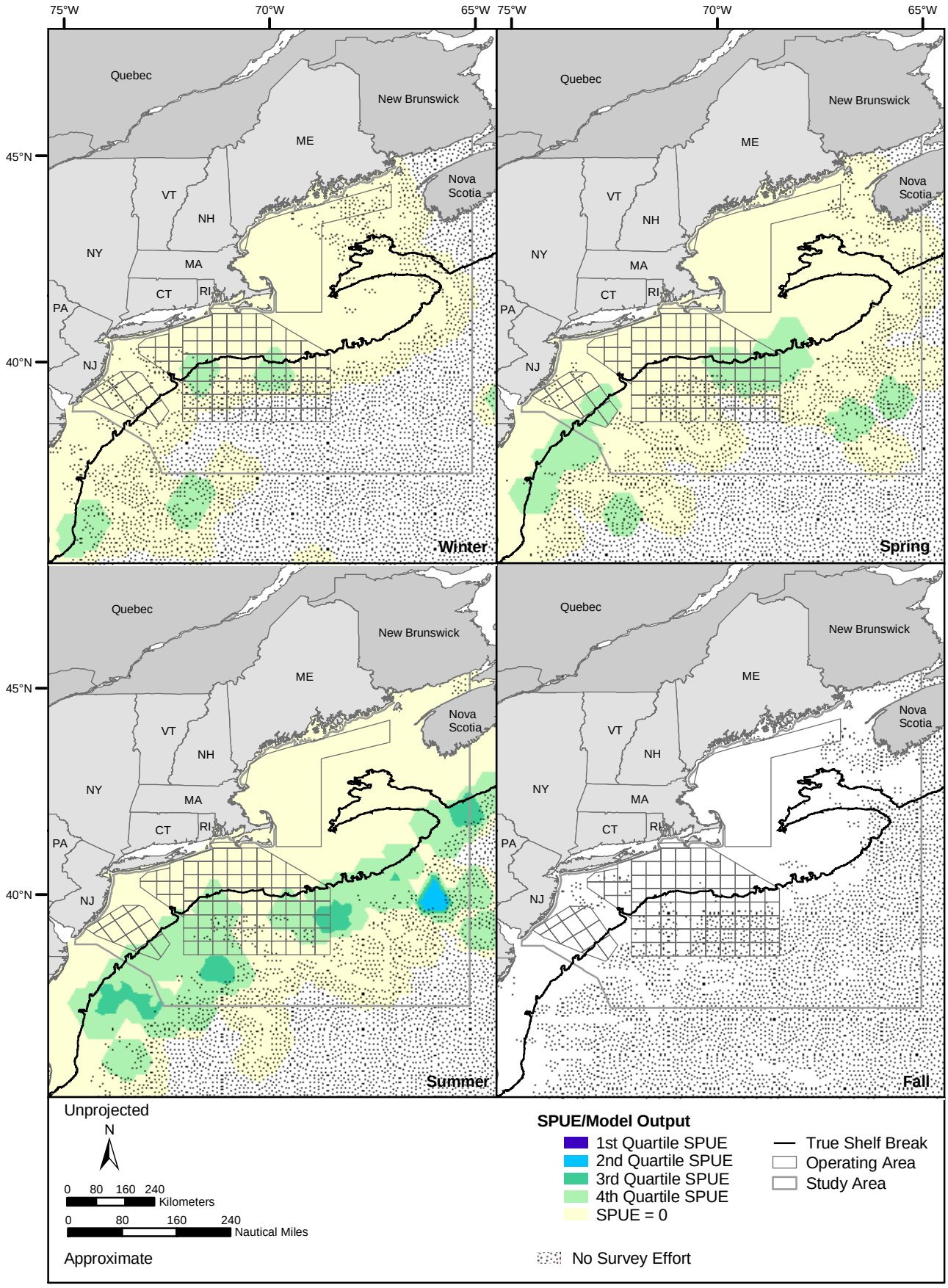

Figure B-17b. SPUE/model output of the striped dolphin in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

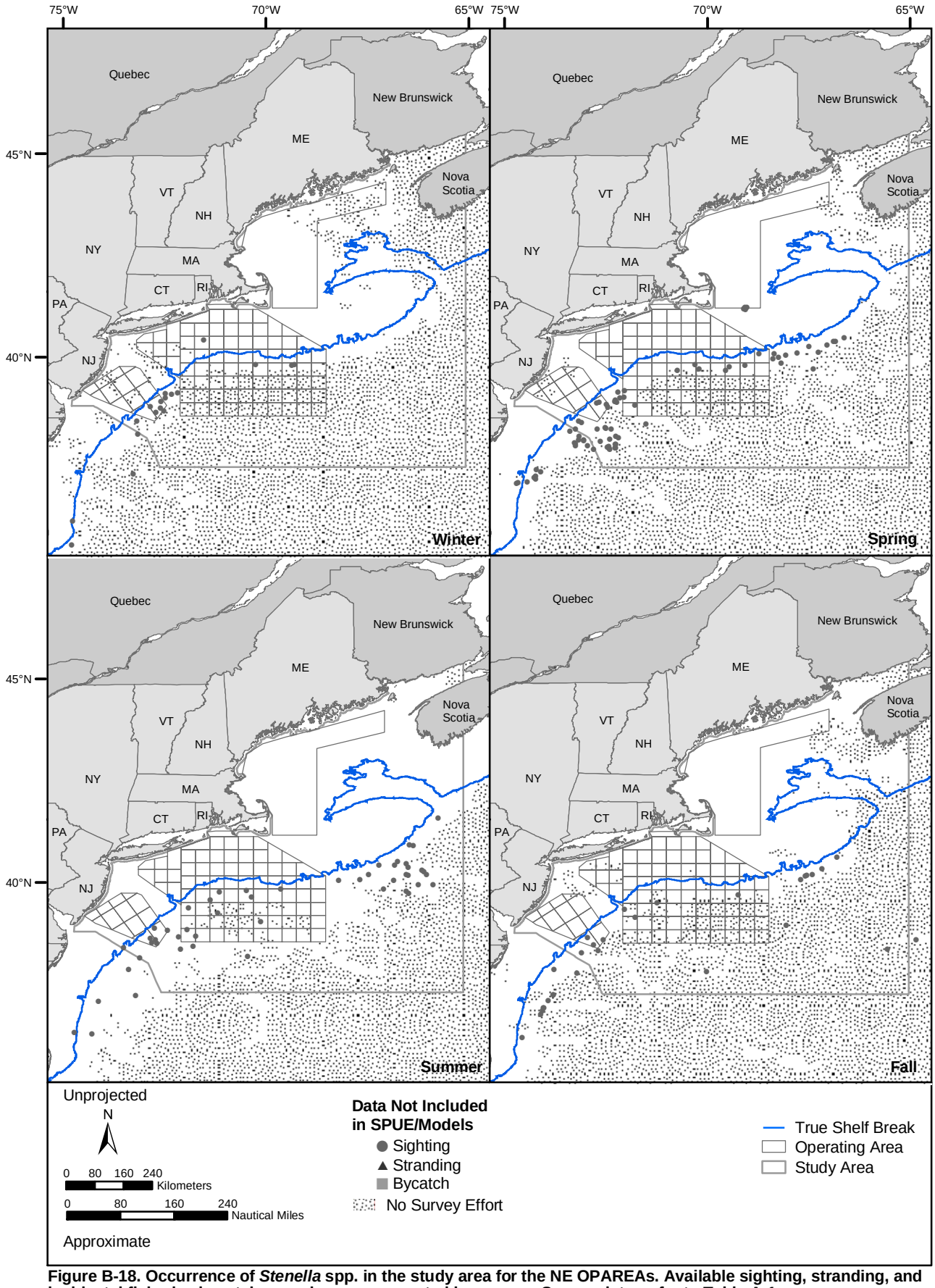

Figure B-18. Occurrence of *Stenella* spp. in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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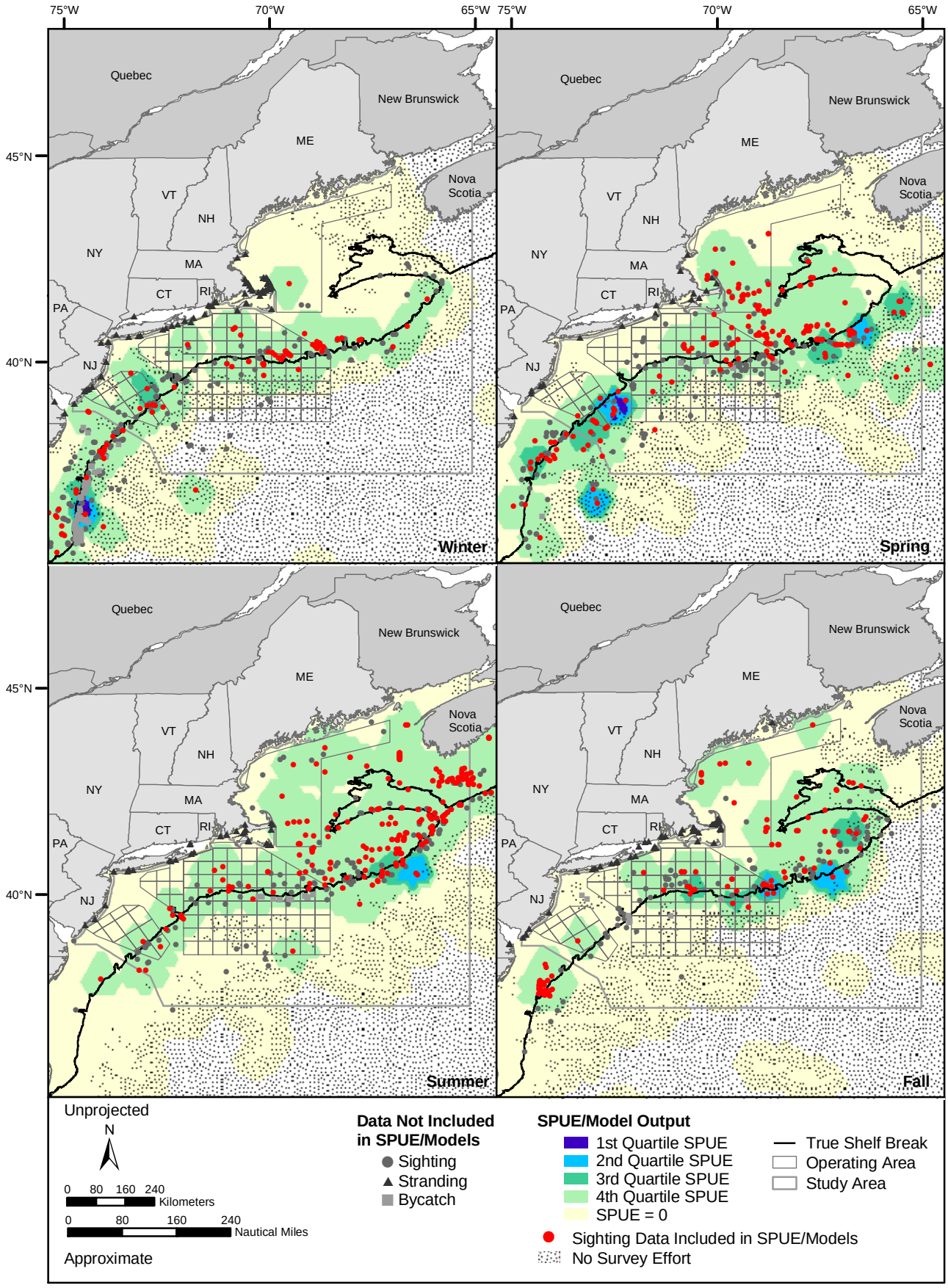

Figure B-19a. Occurrence of common dolphins in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

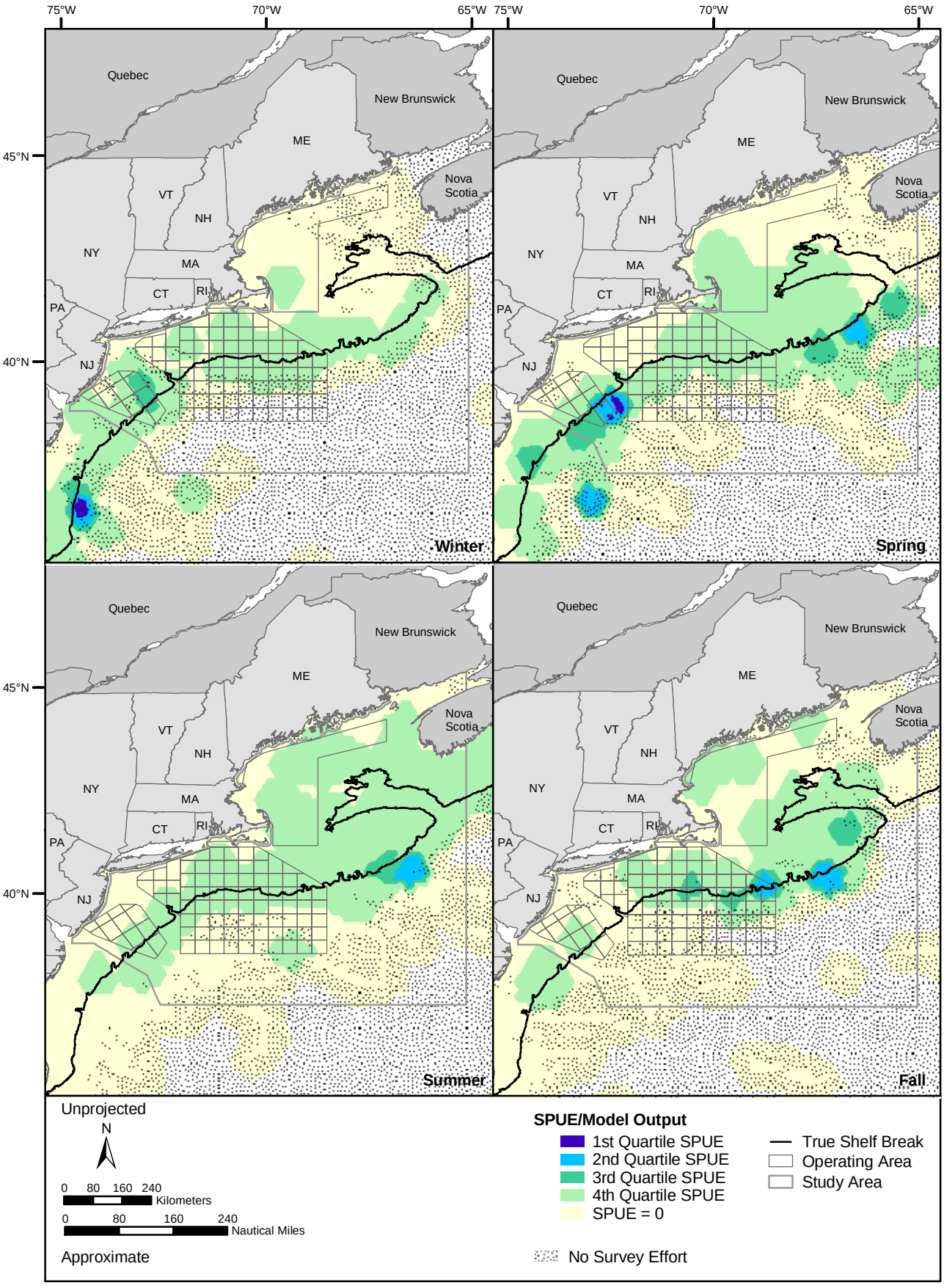

Figure B-19b. SPUE/model output of common dolphins in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

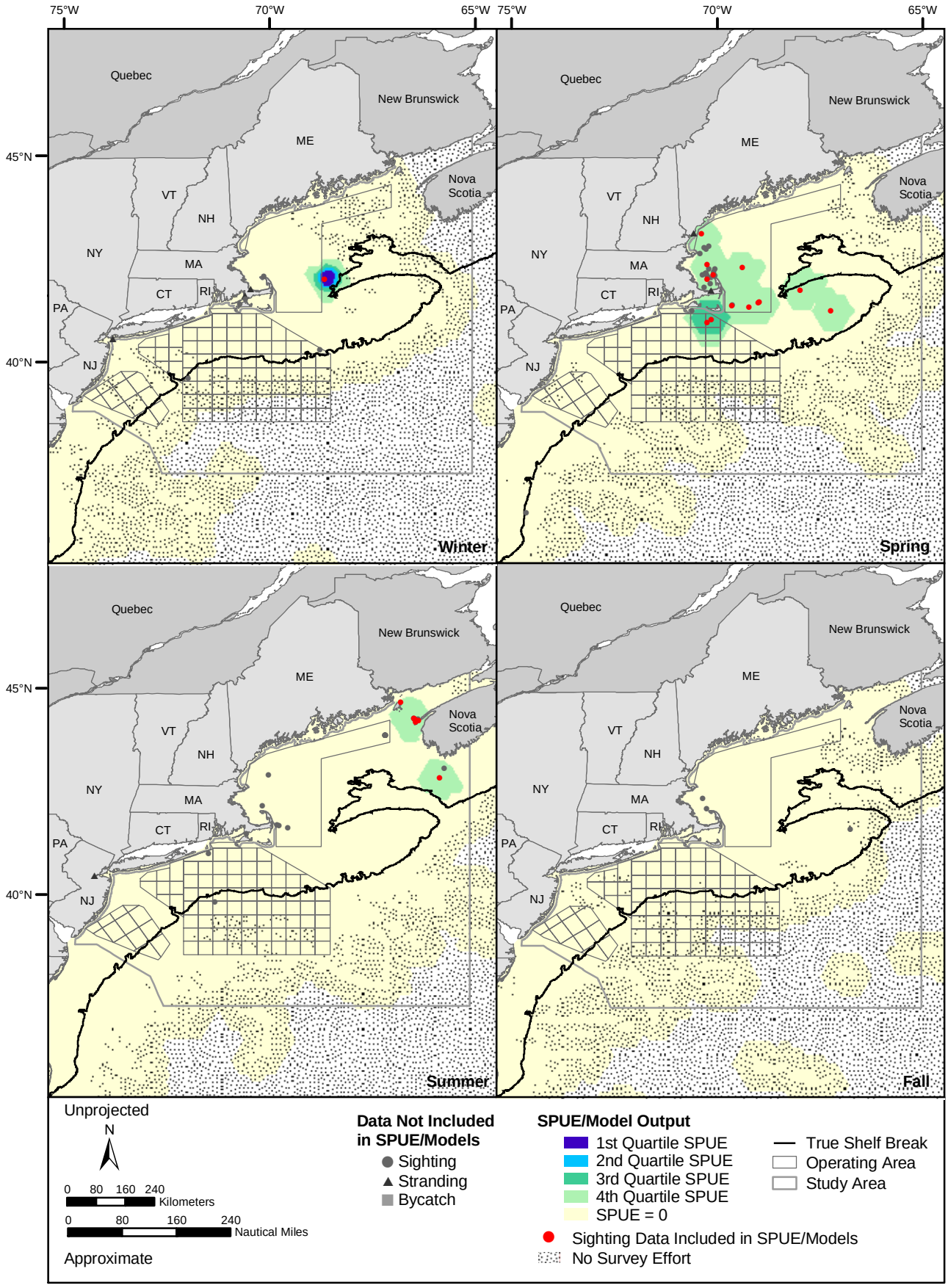

Figure B-20a. Occurrence of the white-beaked dolphin in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

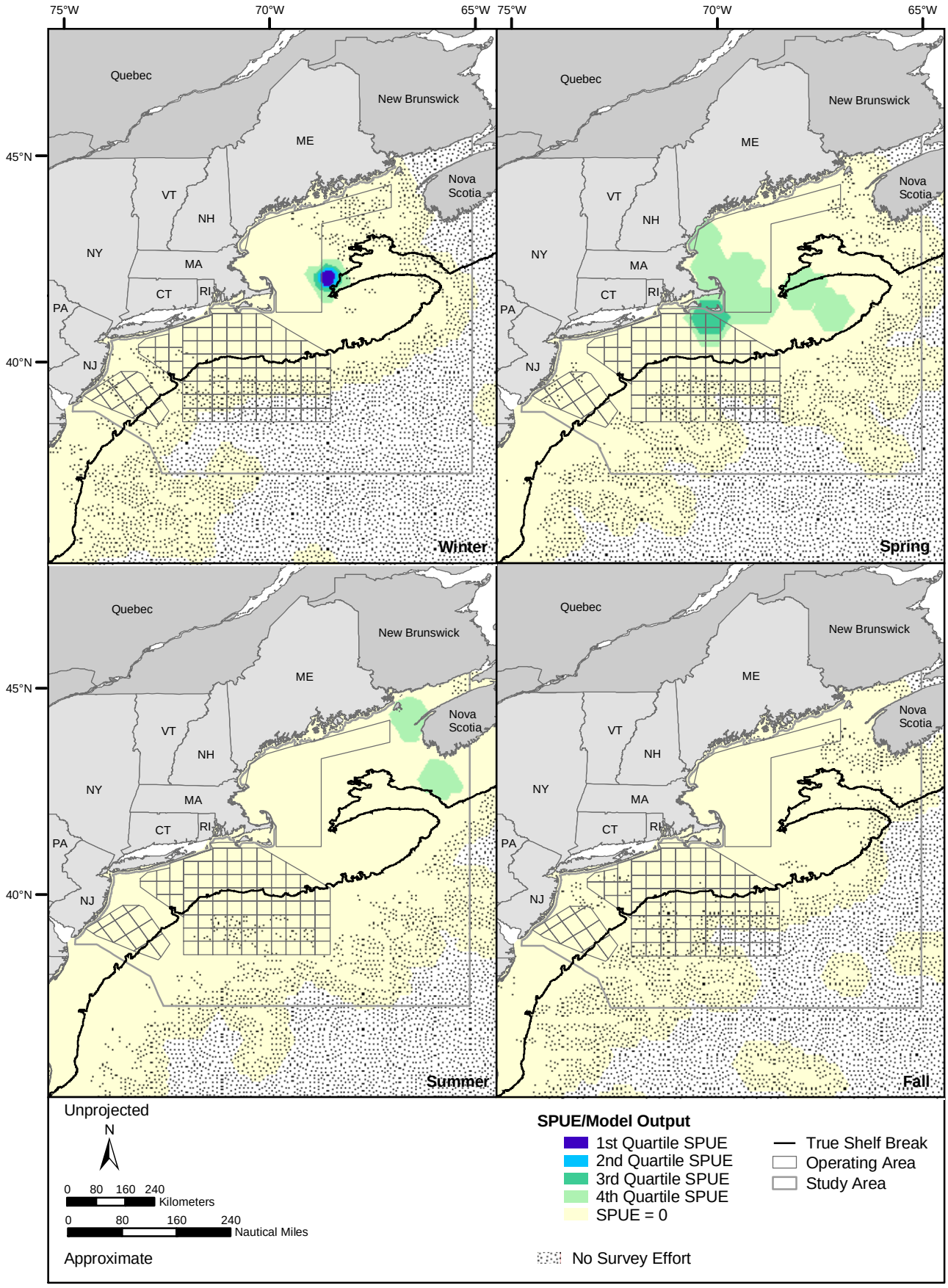

Figure B-20b. SPUE/model output of the white-beaked dolphin in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

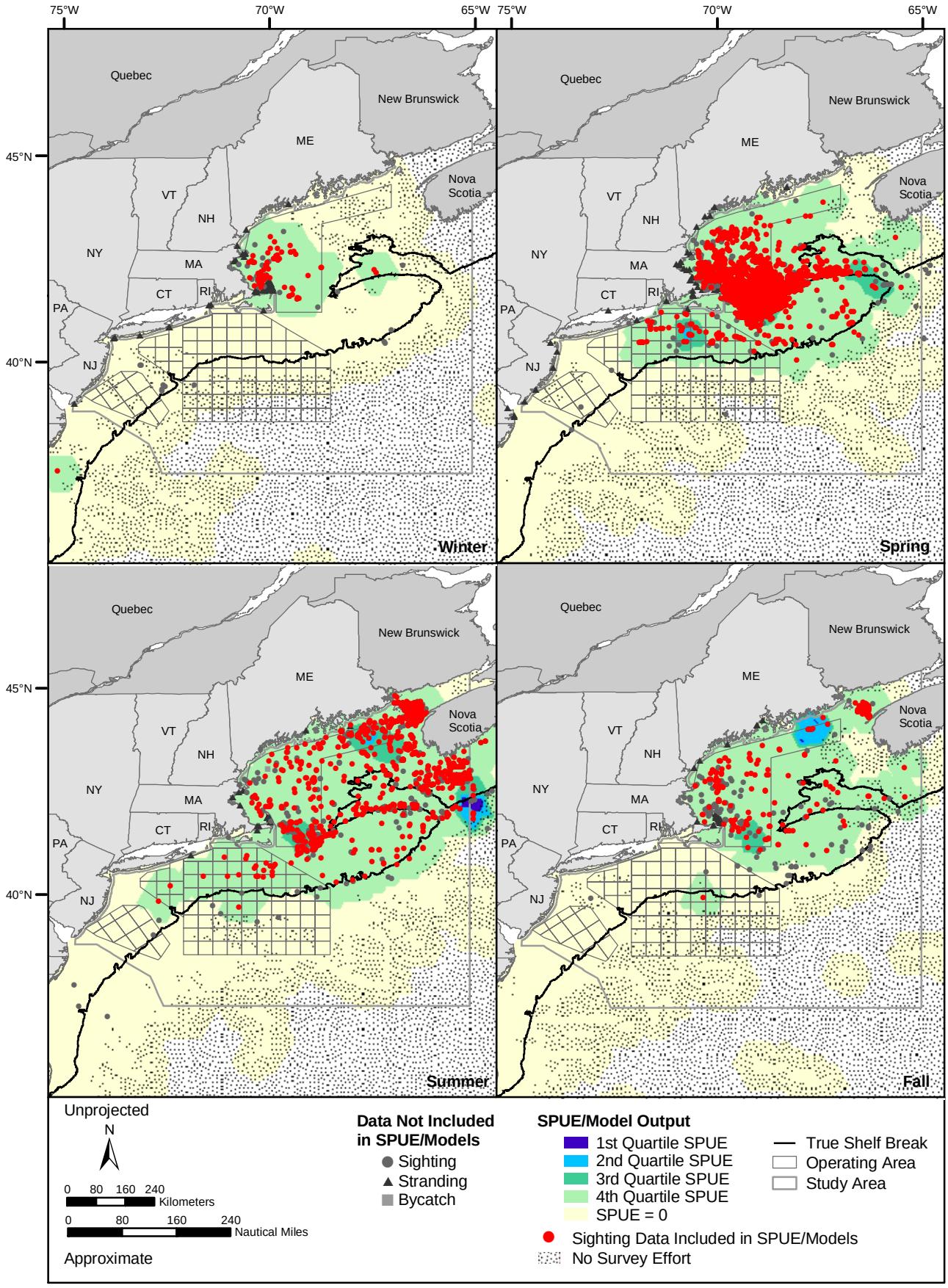

Figure B-21a. Occurrence of the Atlantic white-sided dolphin in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

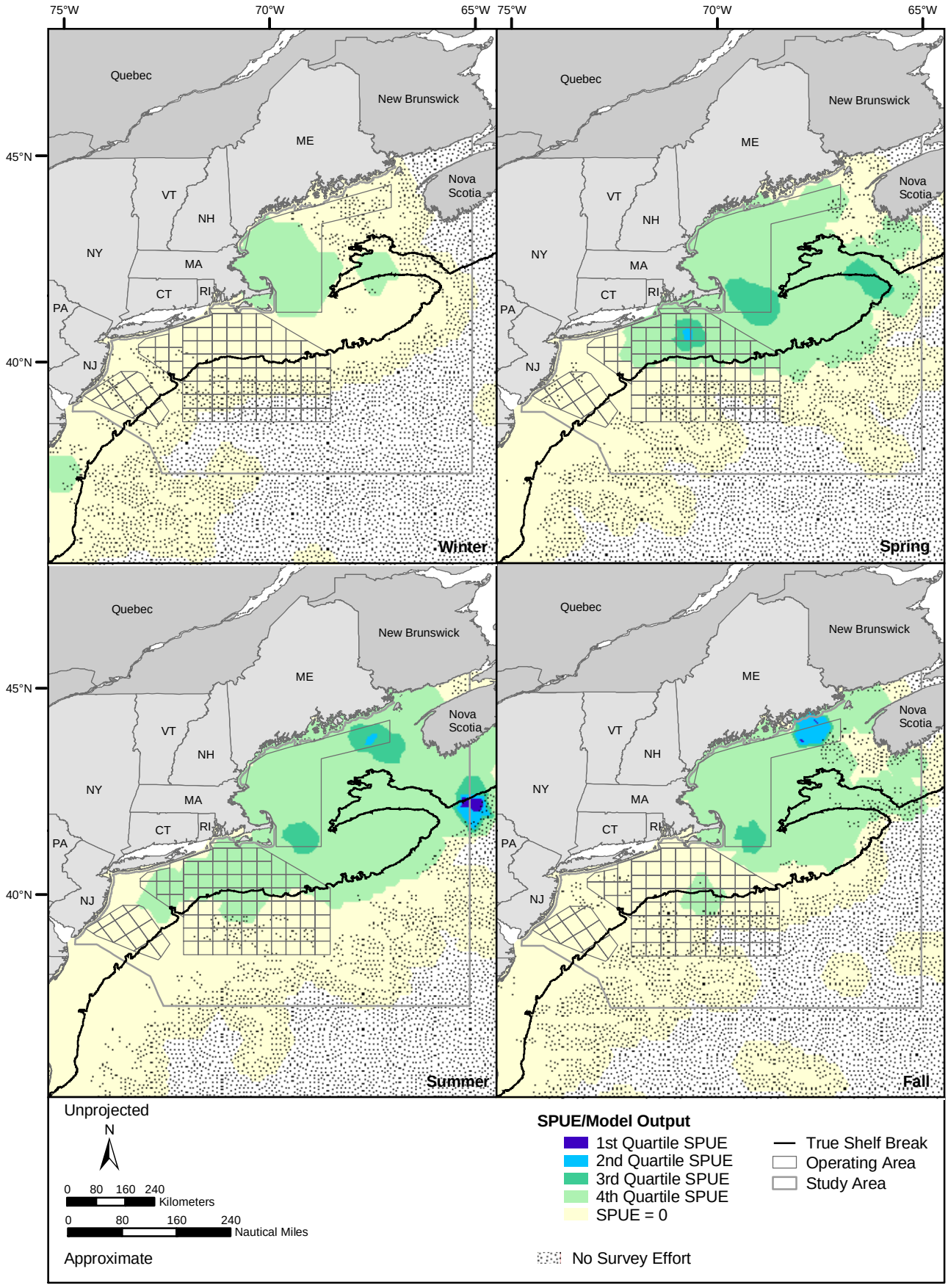

Figure B-21b. SPUE/model output of the Atlantic white-sided dolphin in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

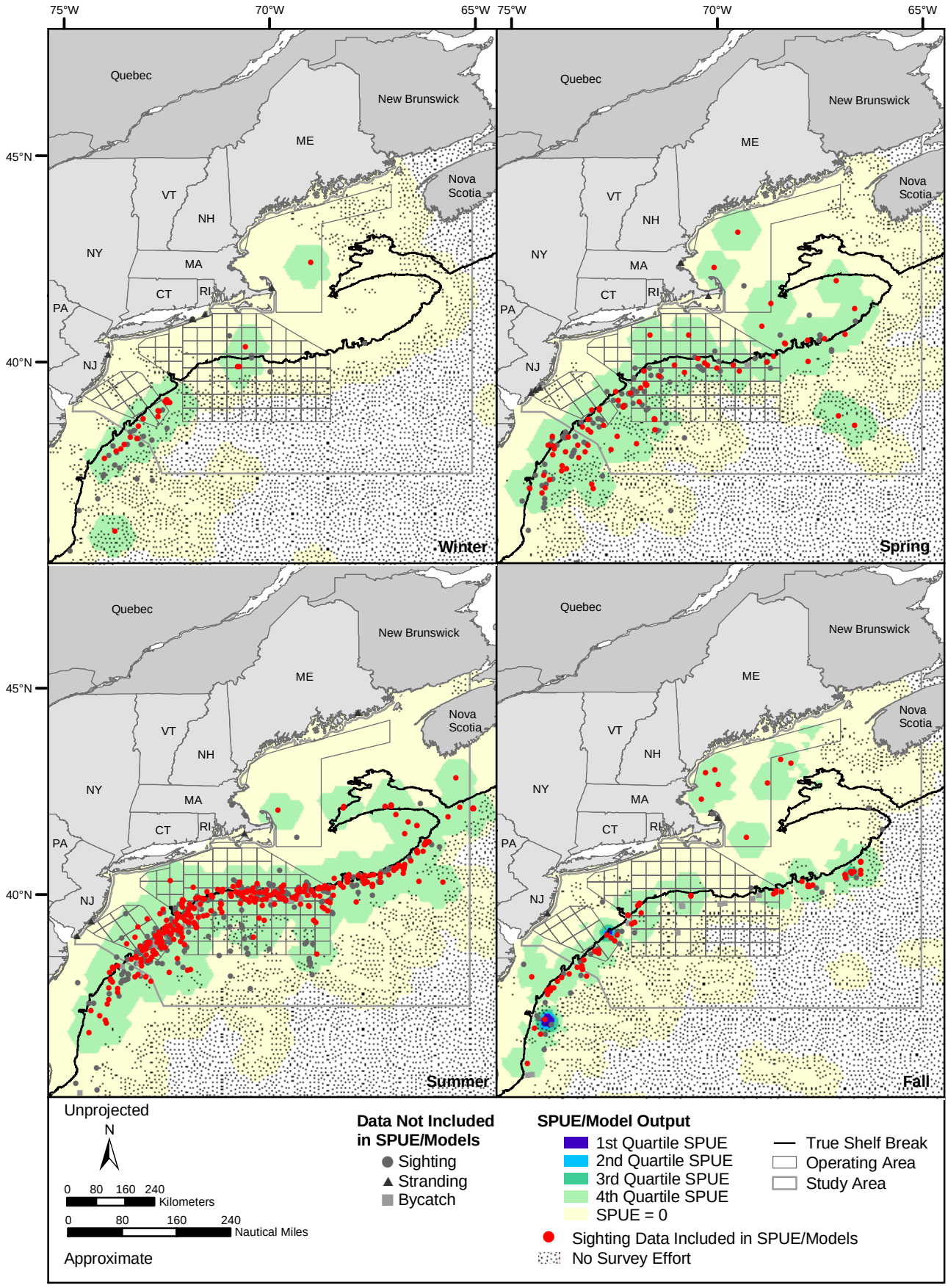

Figure B-22a. Occurrence of the Risso's dolphin in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

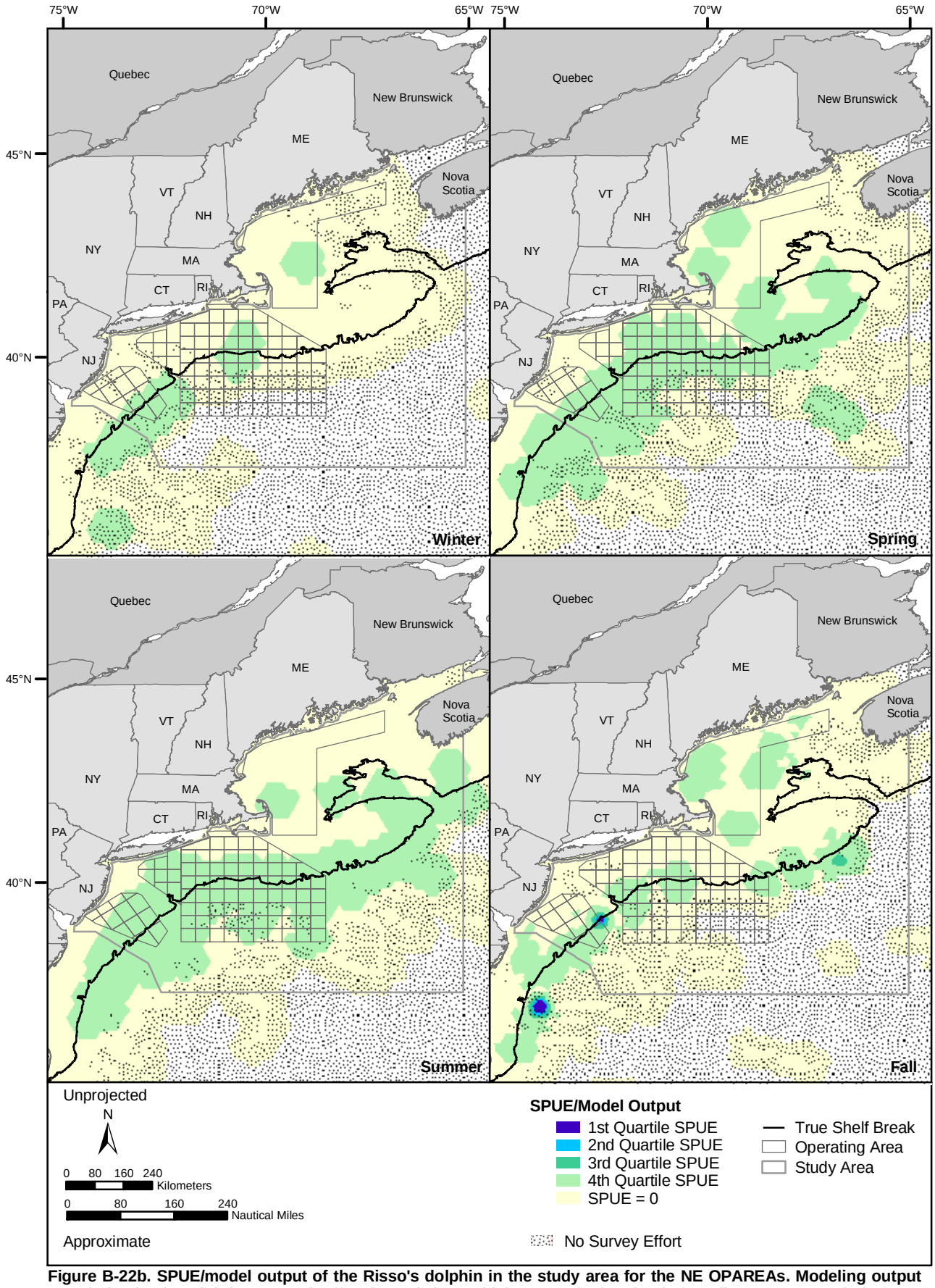

Figure B-22b. SPUE/model output of the Risso's dolphin in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

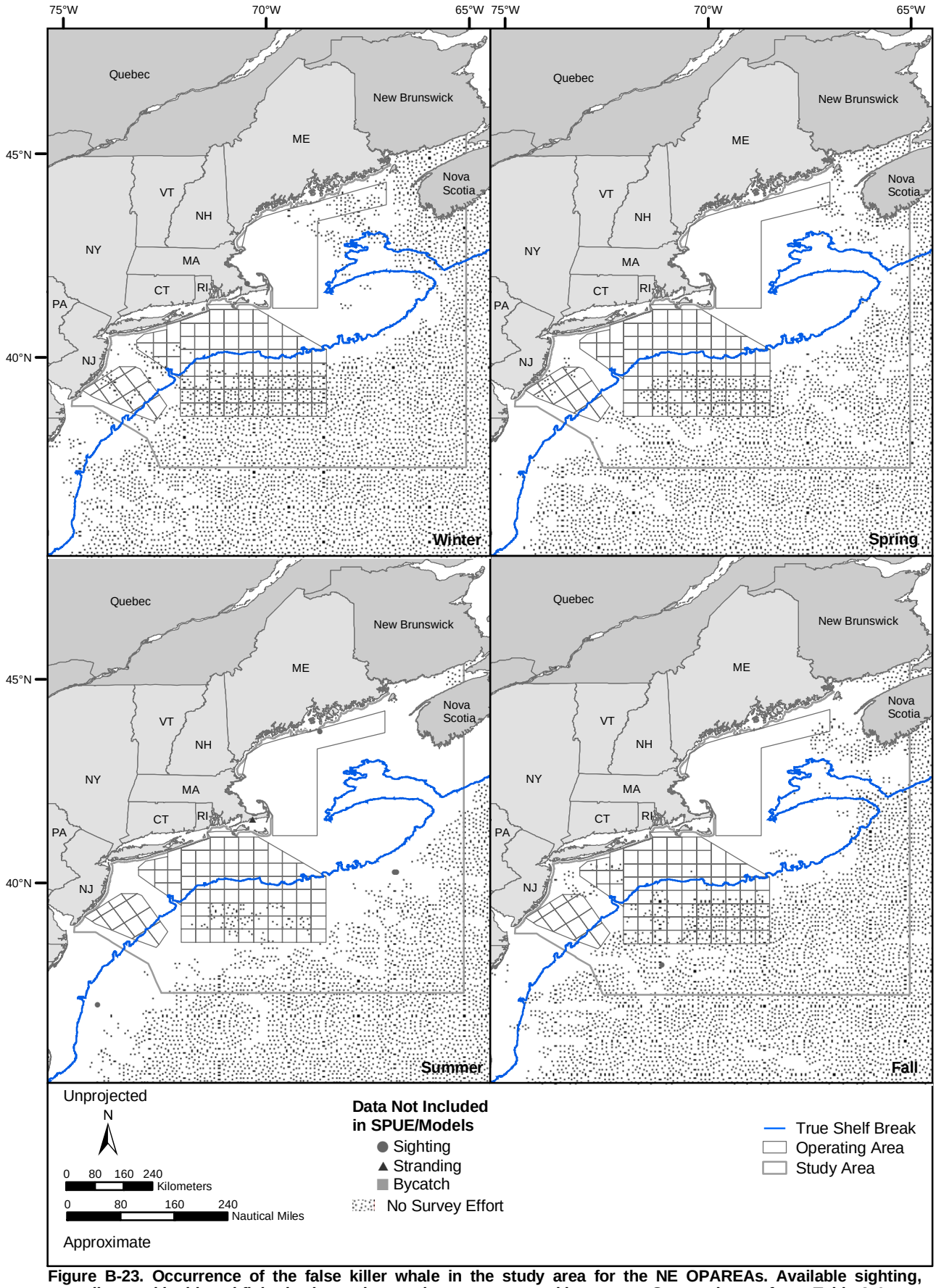

Figure B-23. Occurrence of the false killer whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

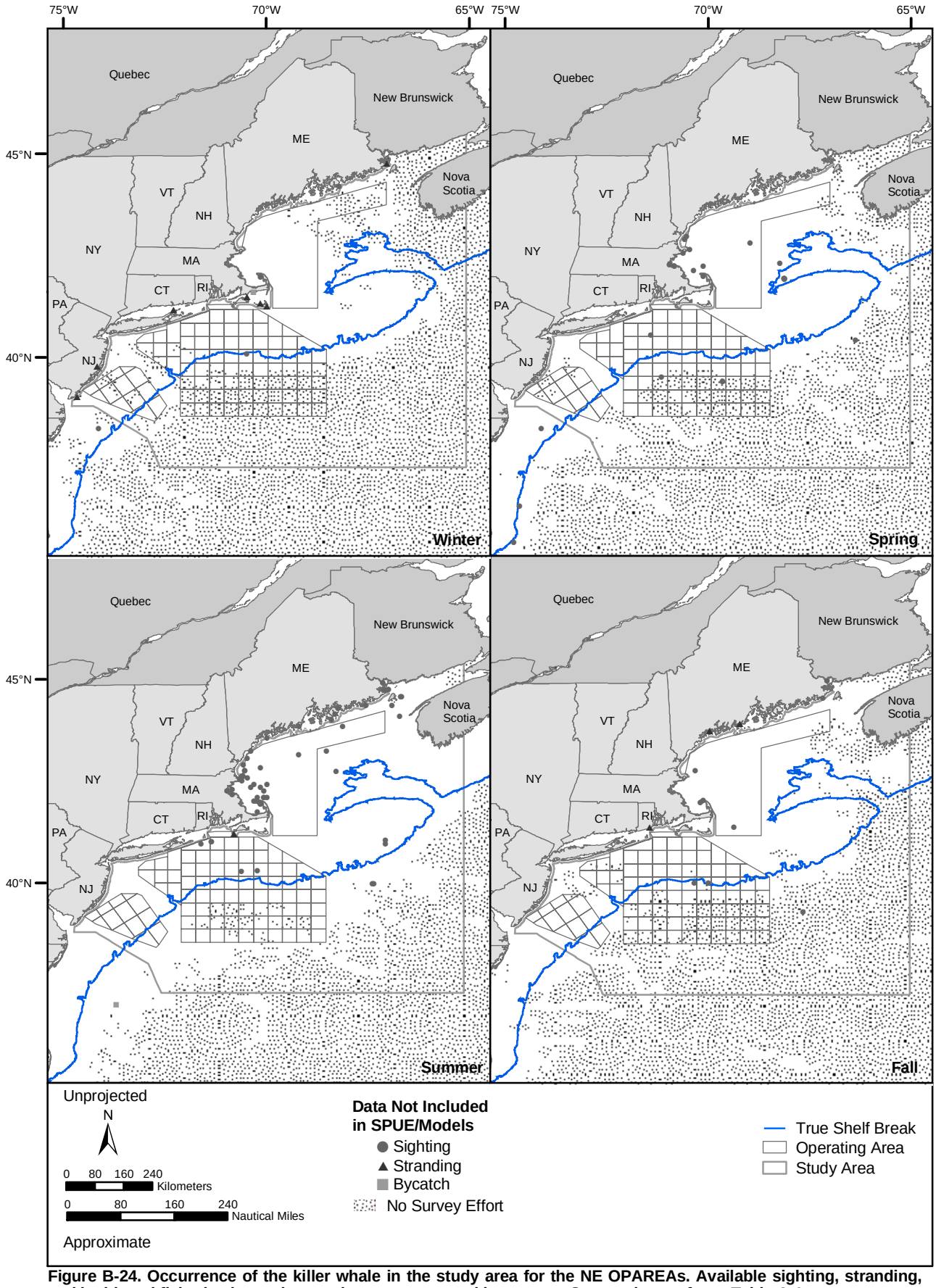

Figure B-24. Occurrence of the killer whale in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

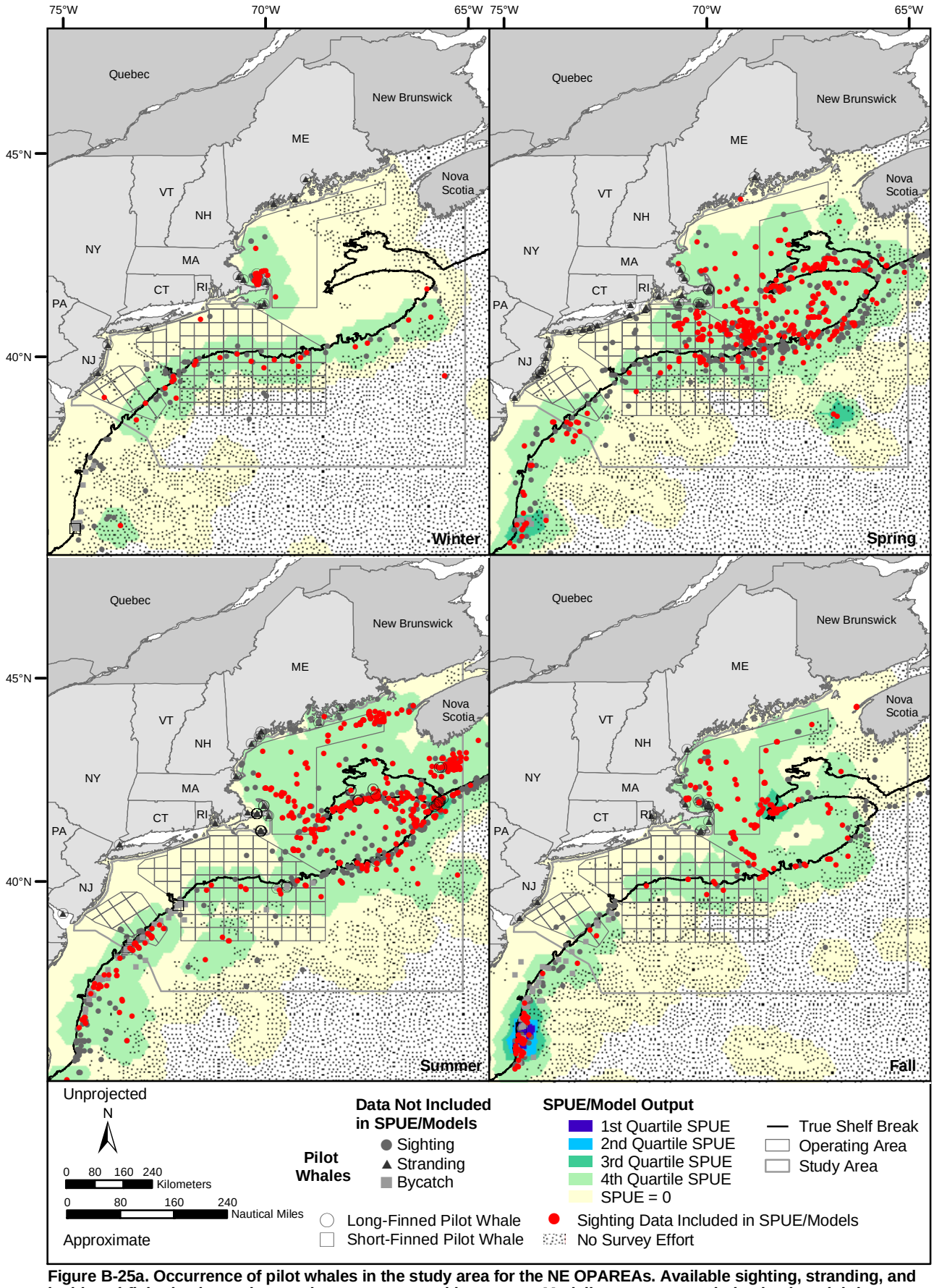

Figure B-25a. Occurrence of pilot whales in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

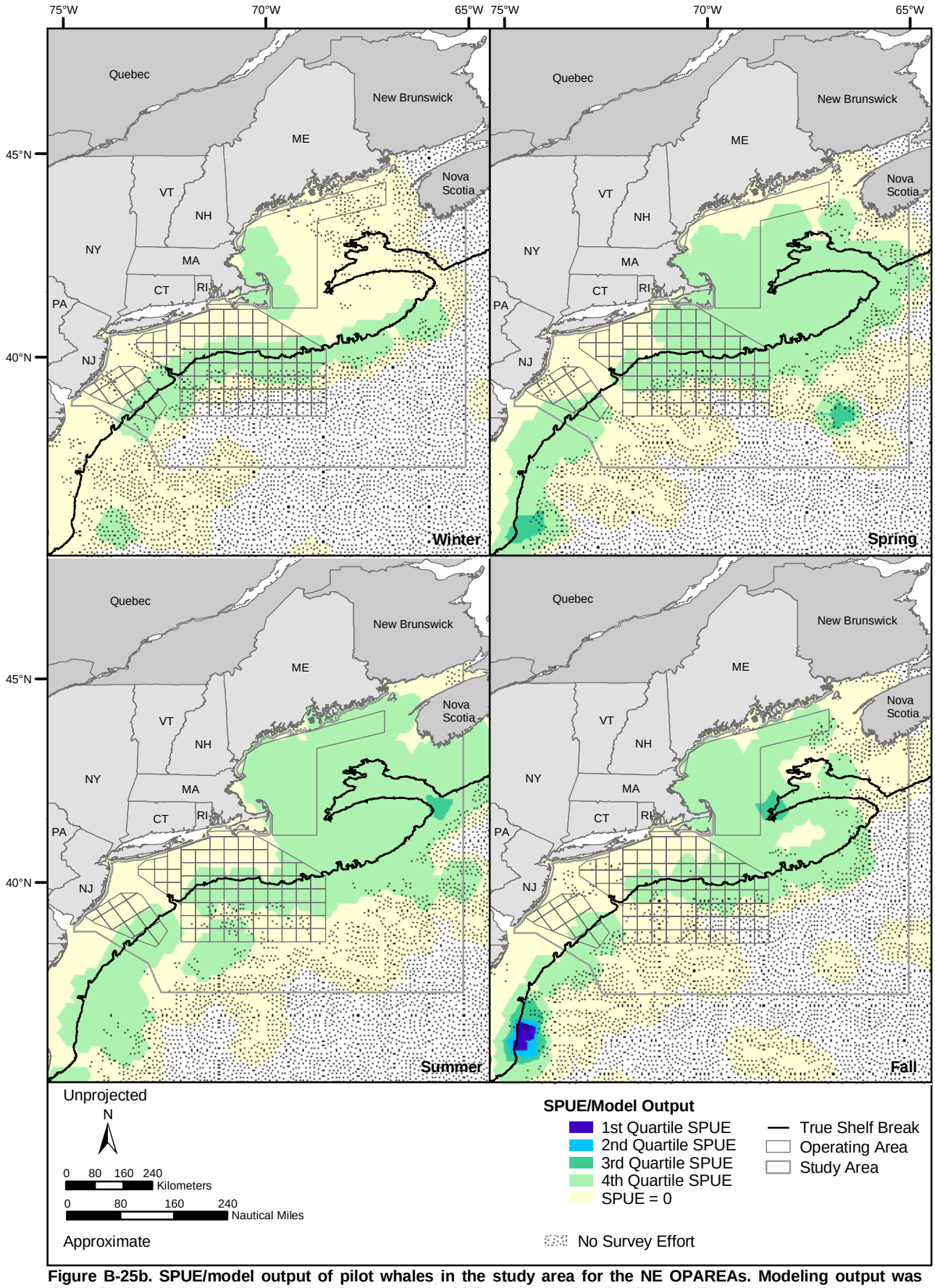

Figure B-25b. SPUE/model output of pilot whales in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

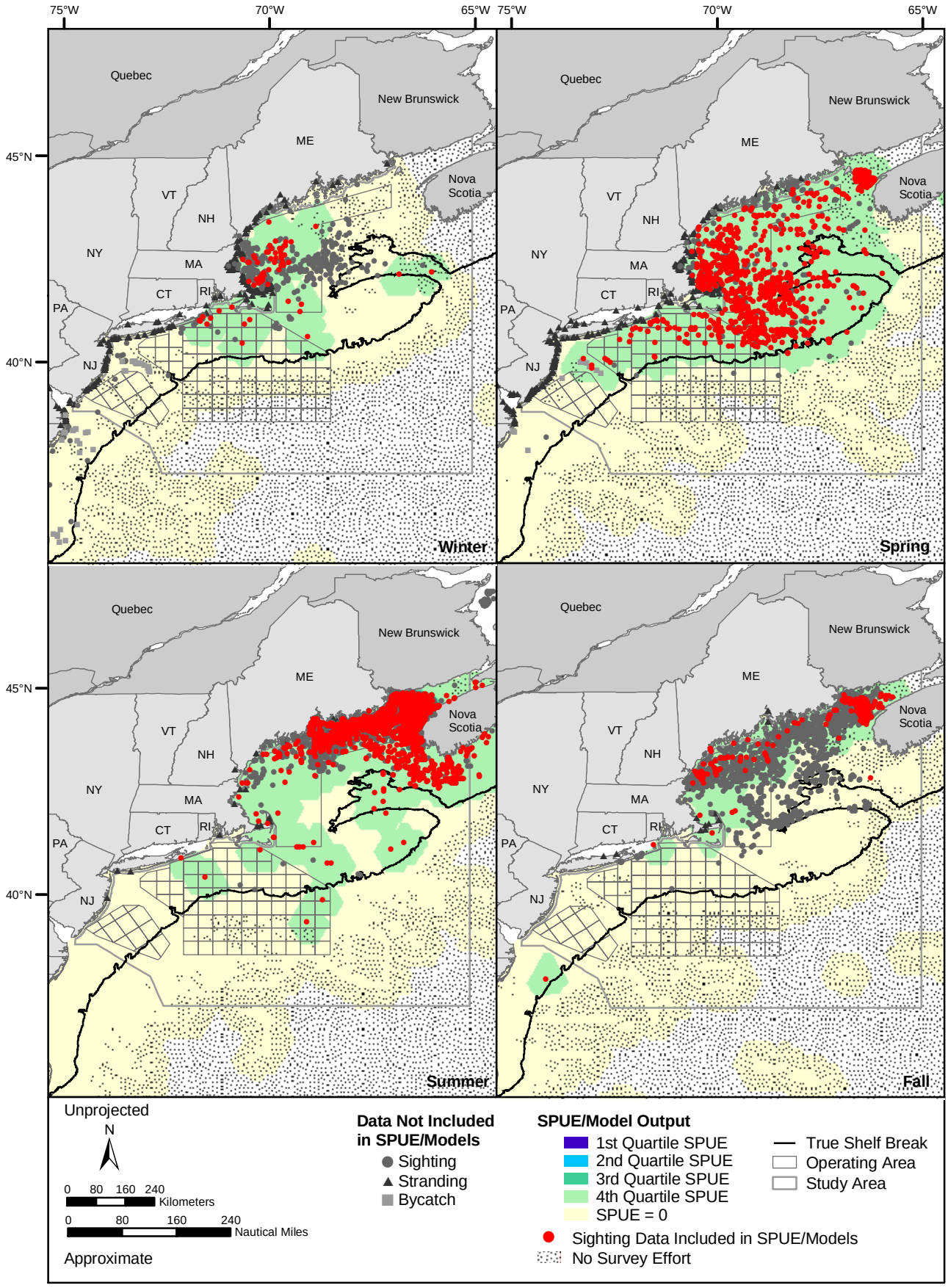

Figure B-26a. Occurrence of the harbor porpoise in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

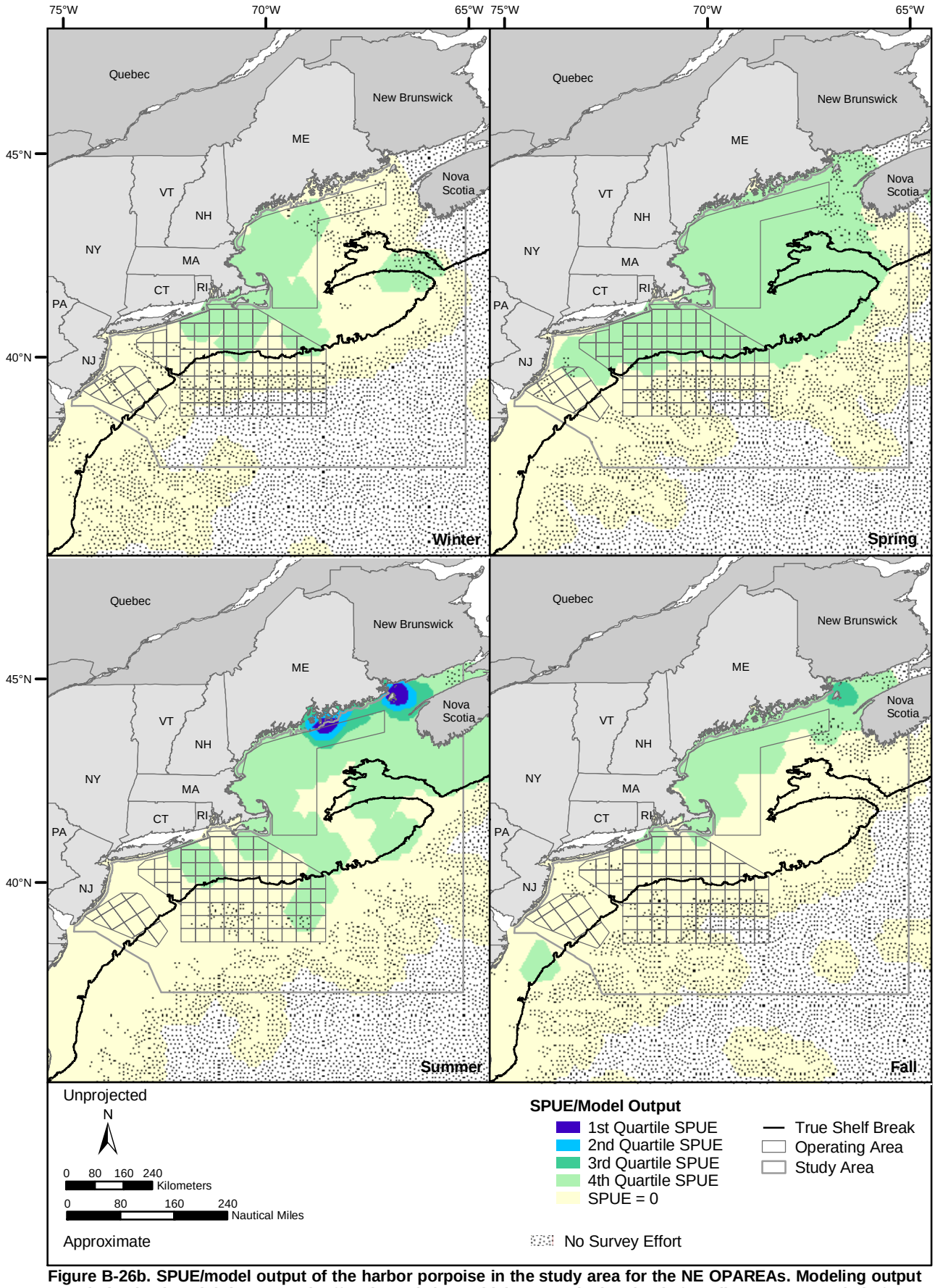

Figure B-26b. SPUE/model output of the harbor porpoise in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

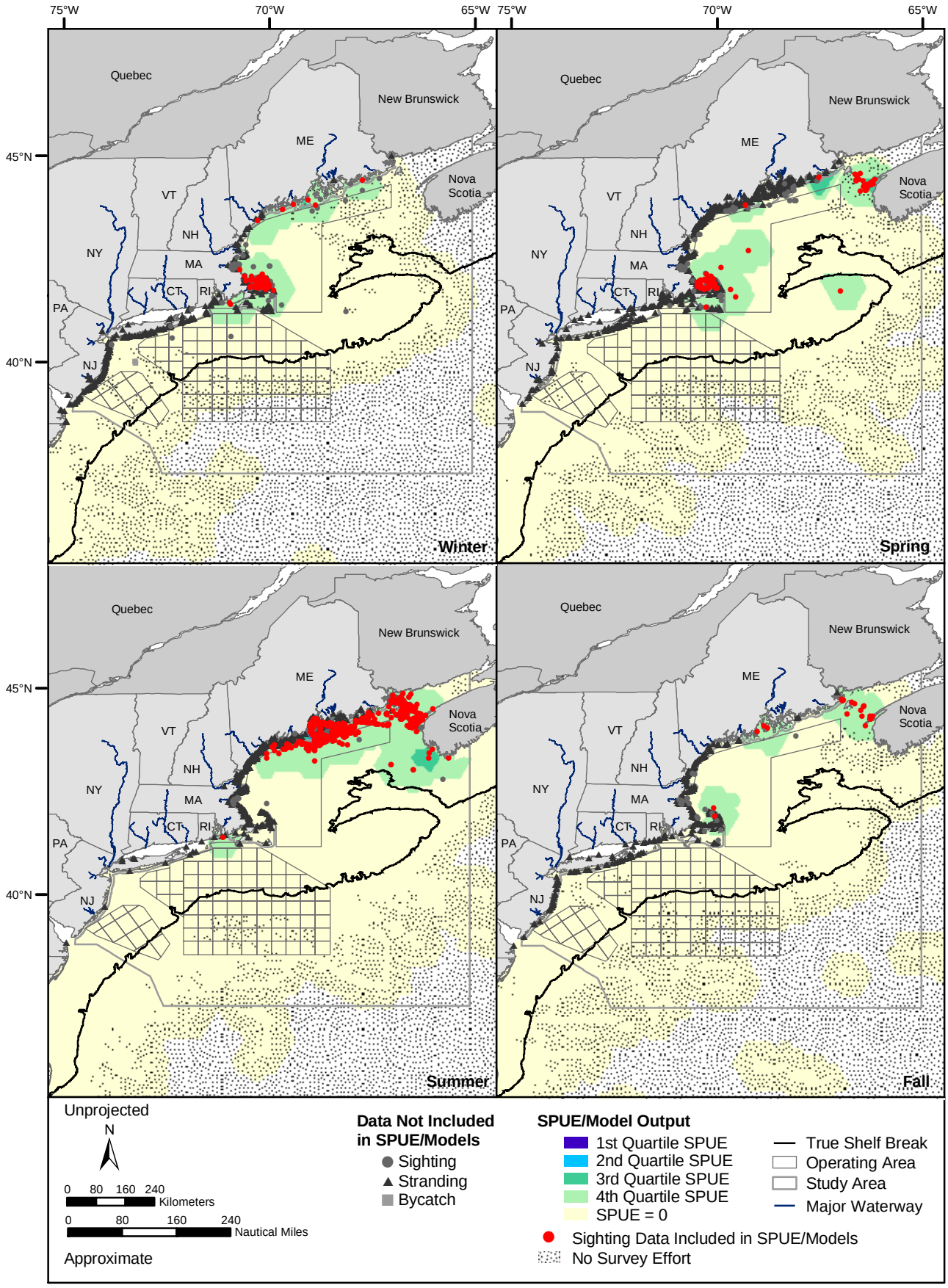

Figure B-27a. Occurrence of the harbor seal in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

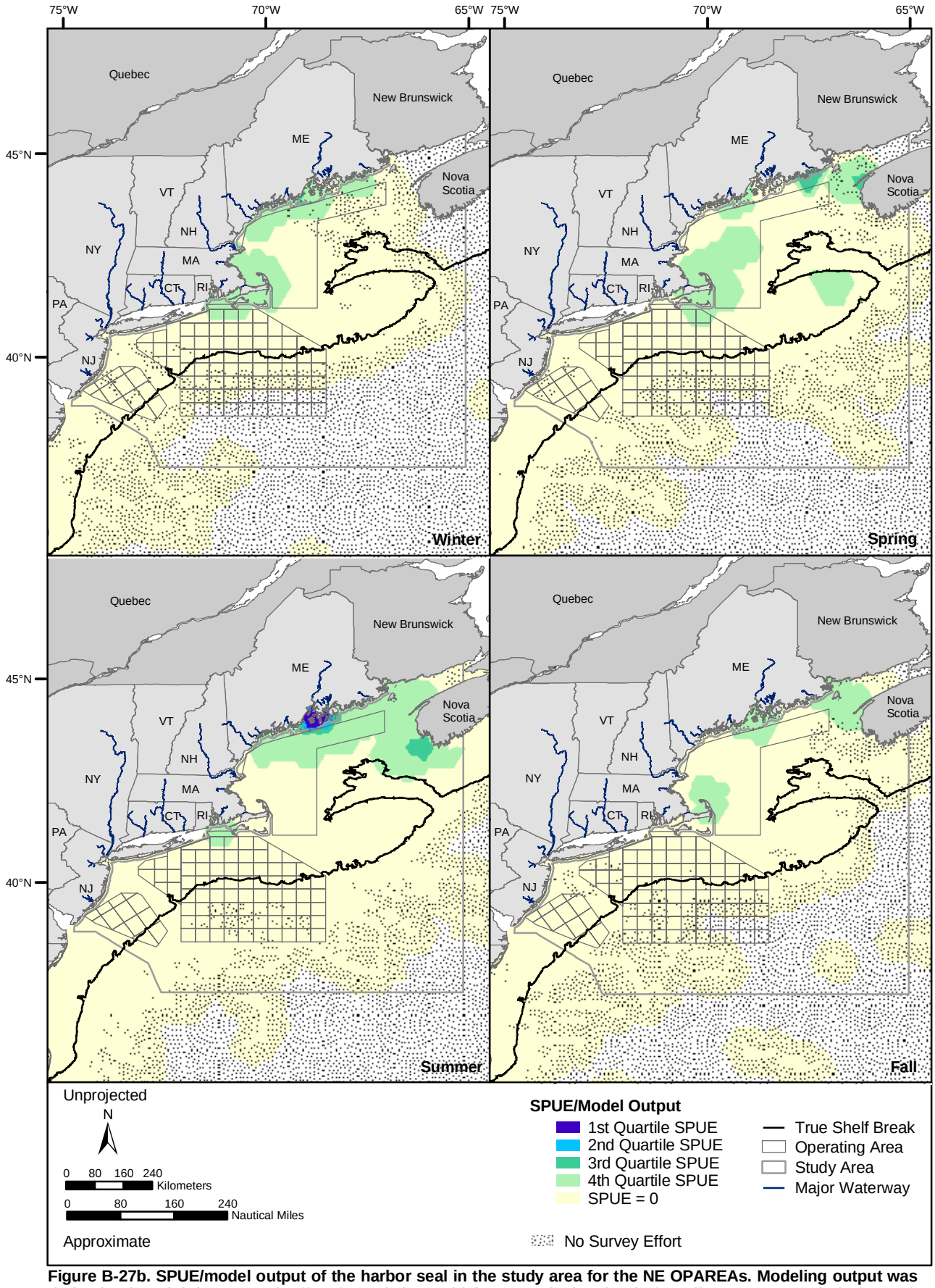

Figure B-27b. SPUE/model output of the harbor seal in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

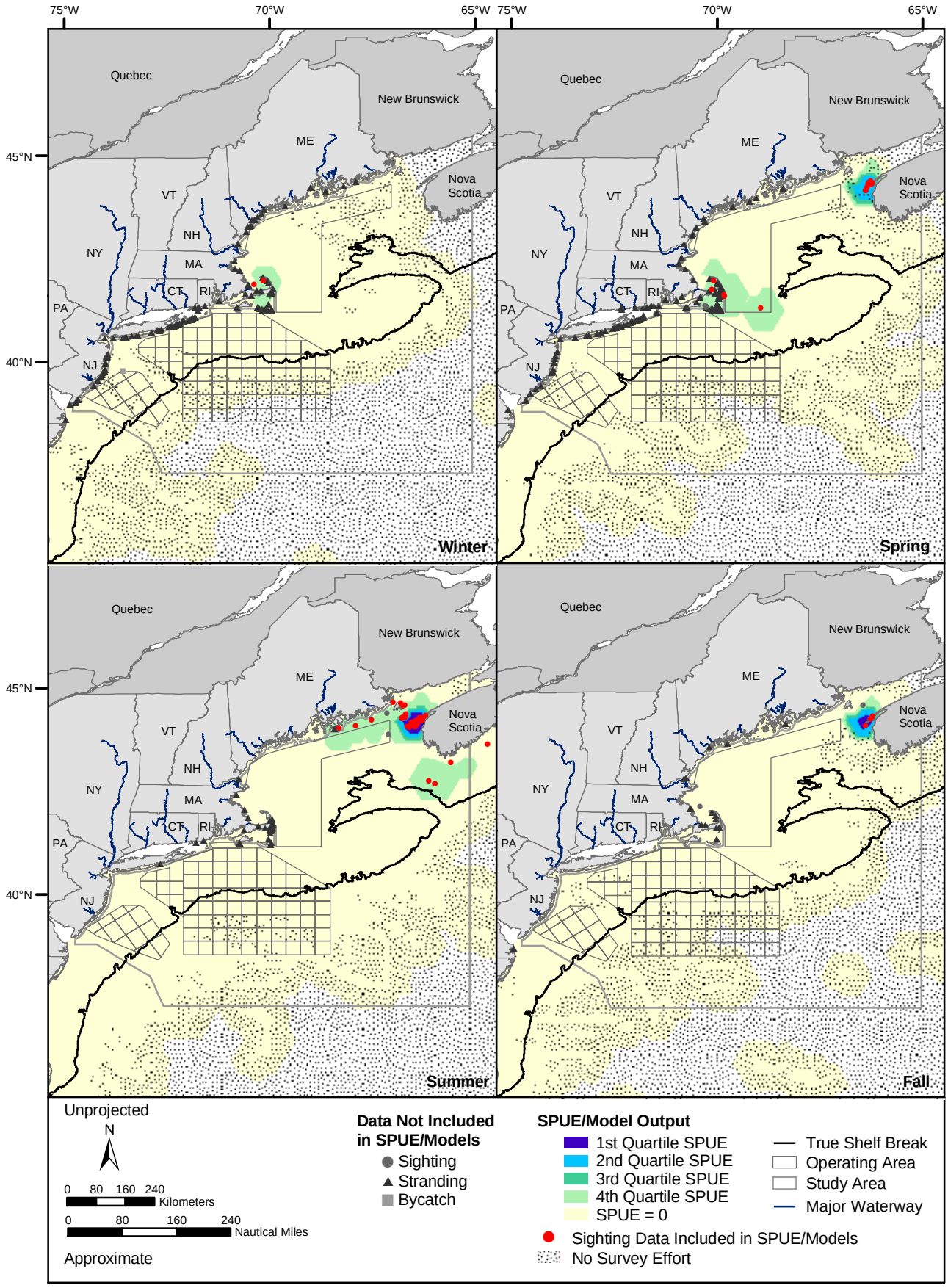

Figure B-28a. Occurrence of the gray seal in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

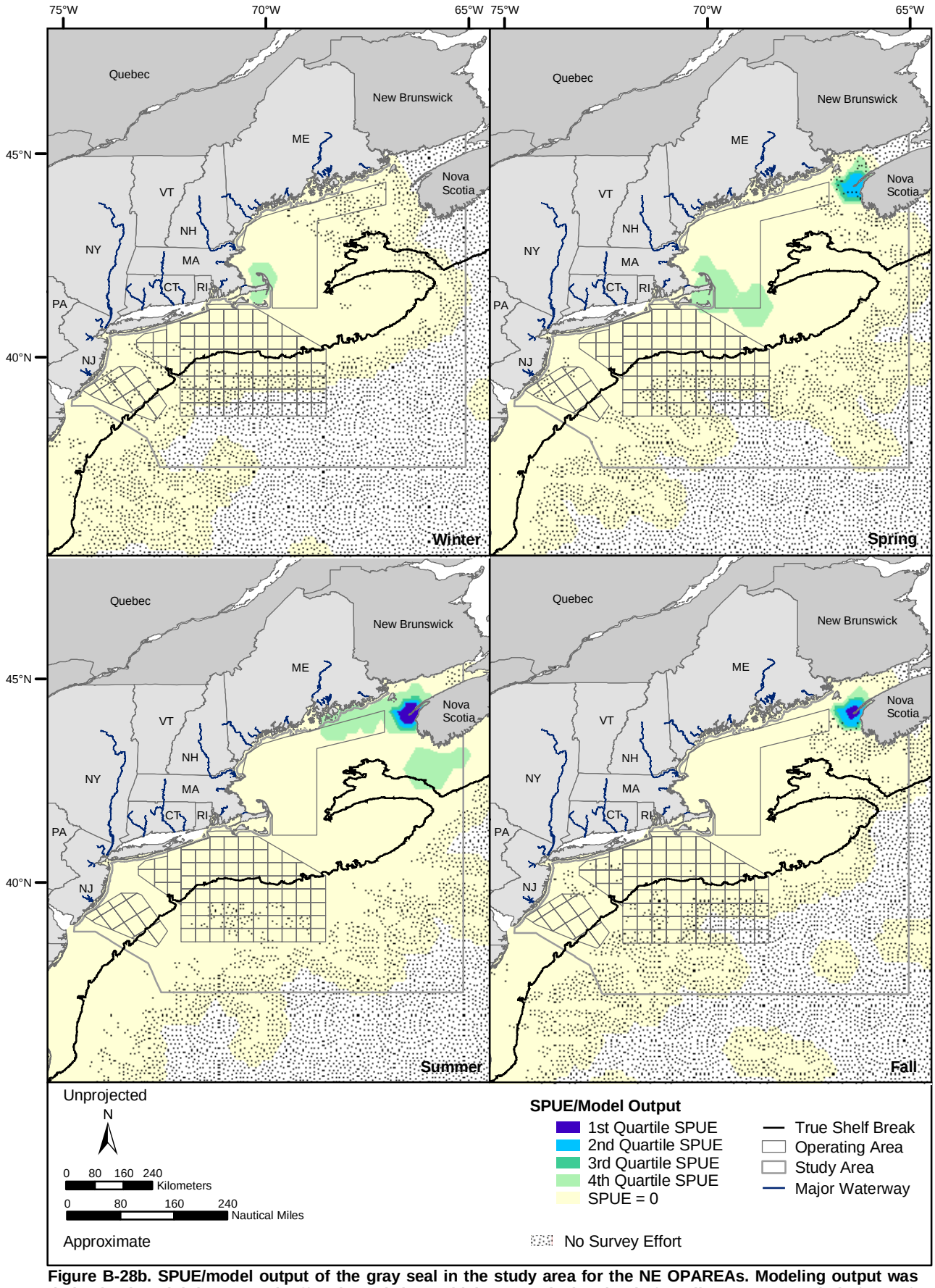

Figure B-28b. SPUE/model output of the gray seal in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

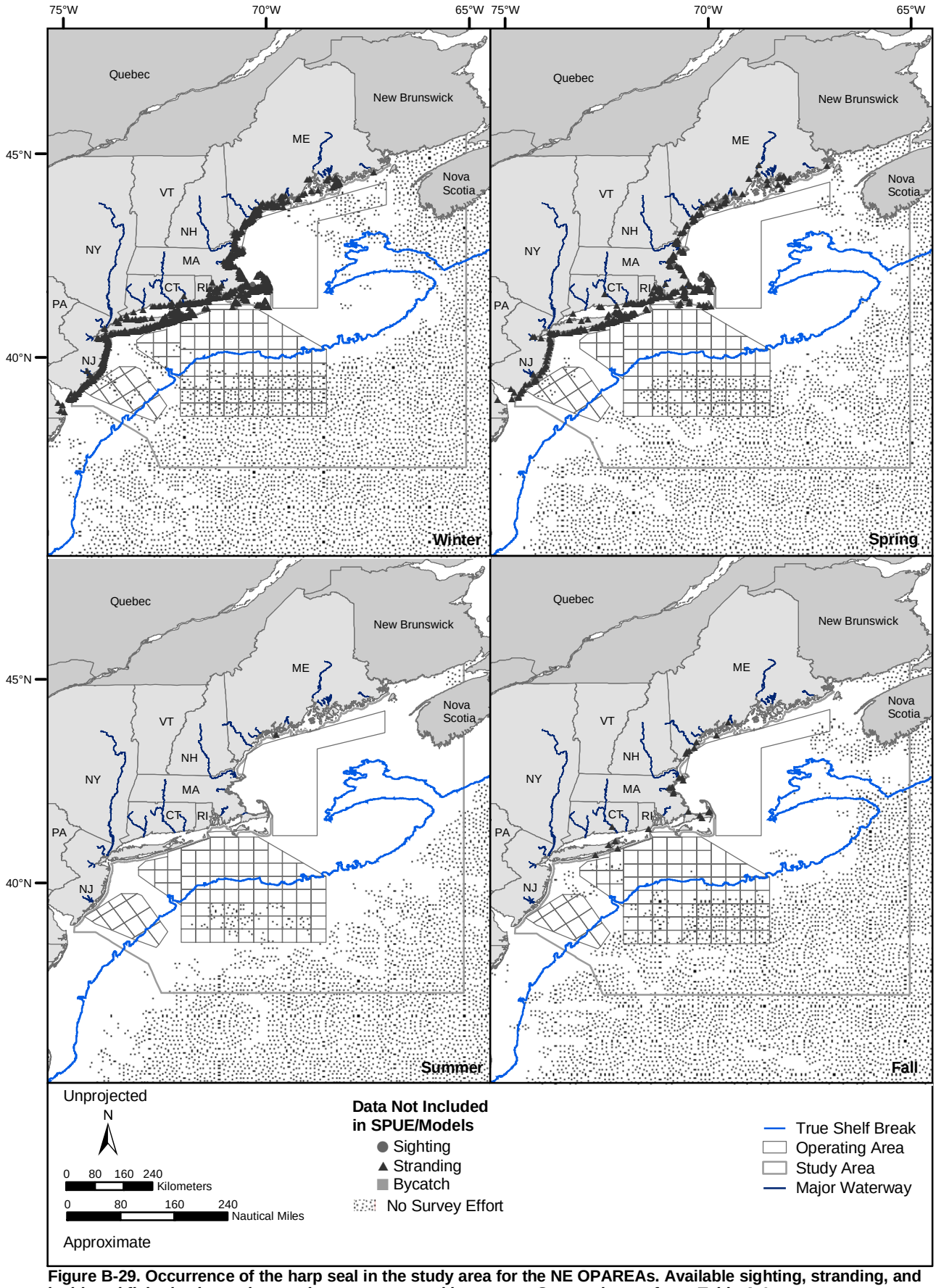

Figure B-29. Occurrence of the harp seal in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

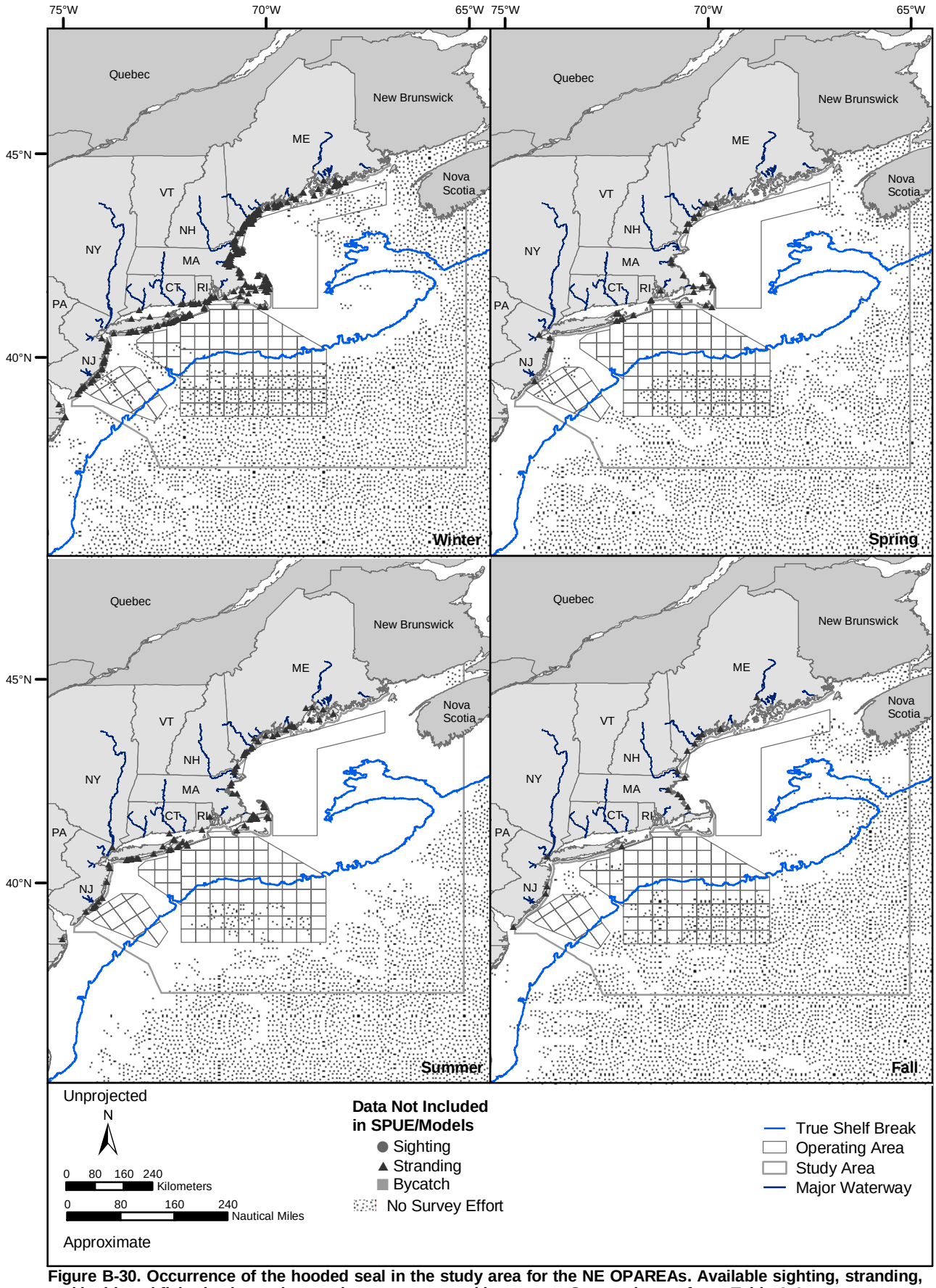

Figure B-30. Occurrence of the hooded seal in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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APPENDIX C: SEA TURTLES

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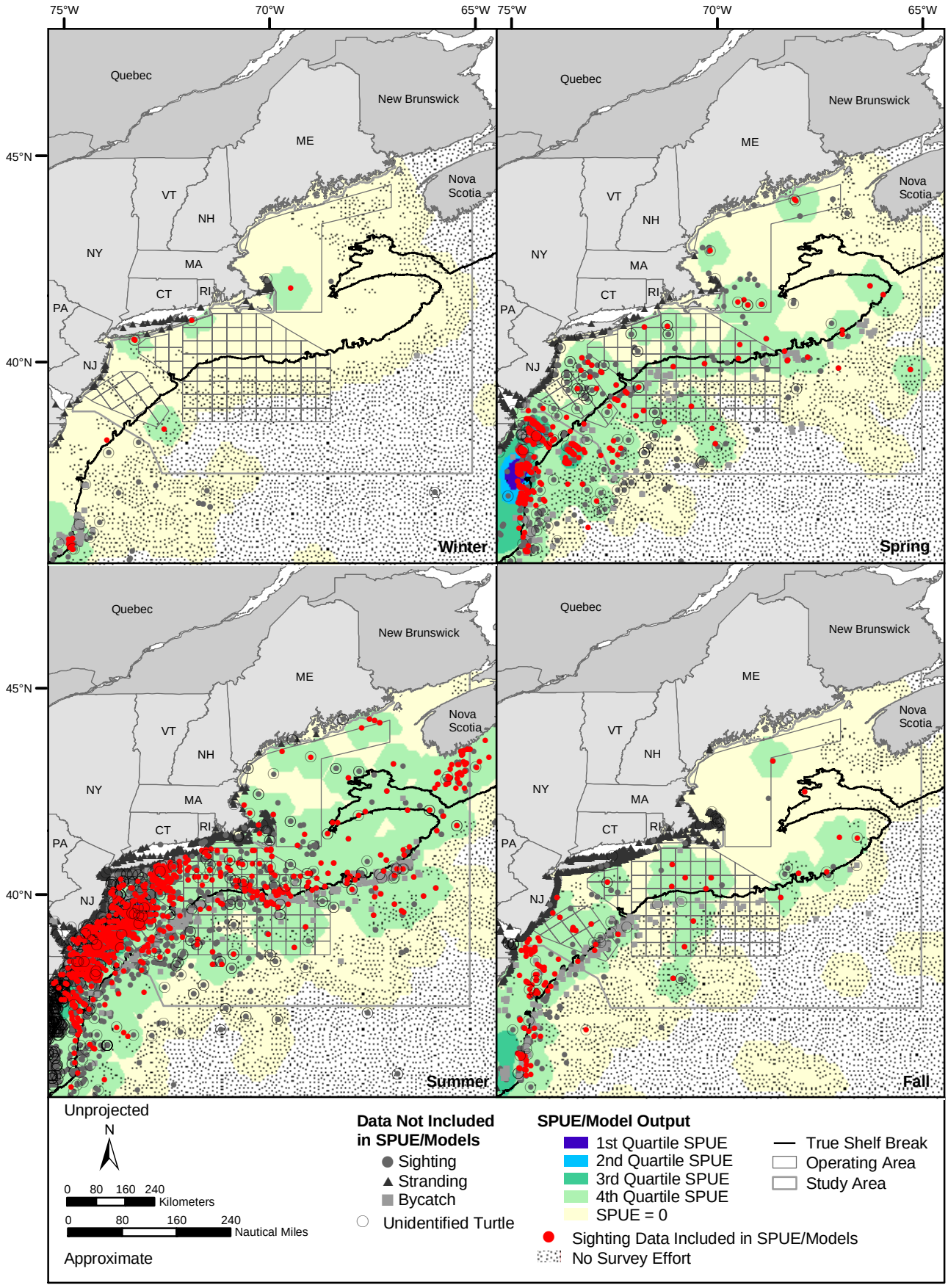

Figure C-1a. Occurrence of all sea turtles in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

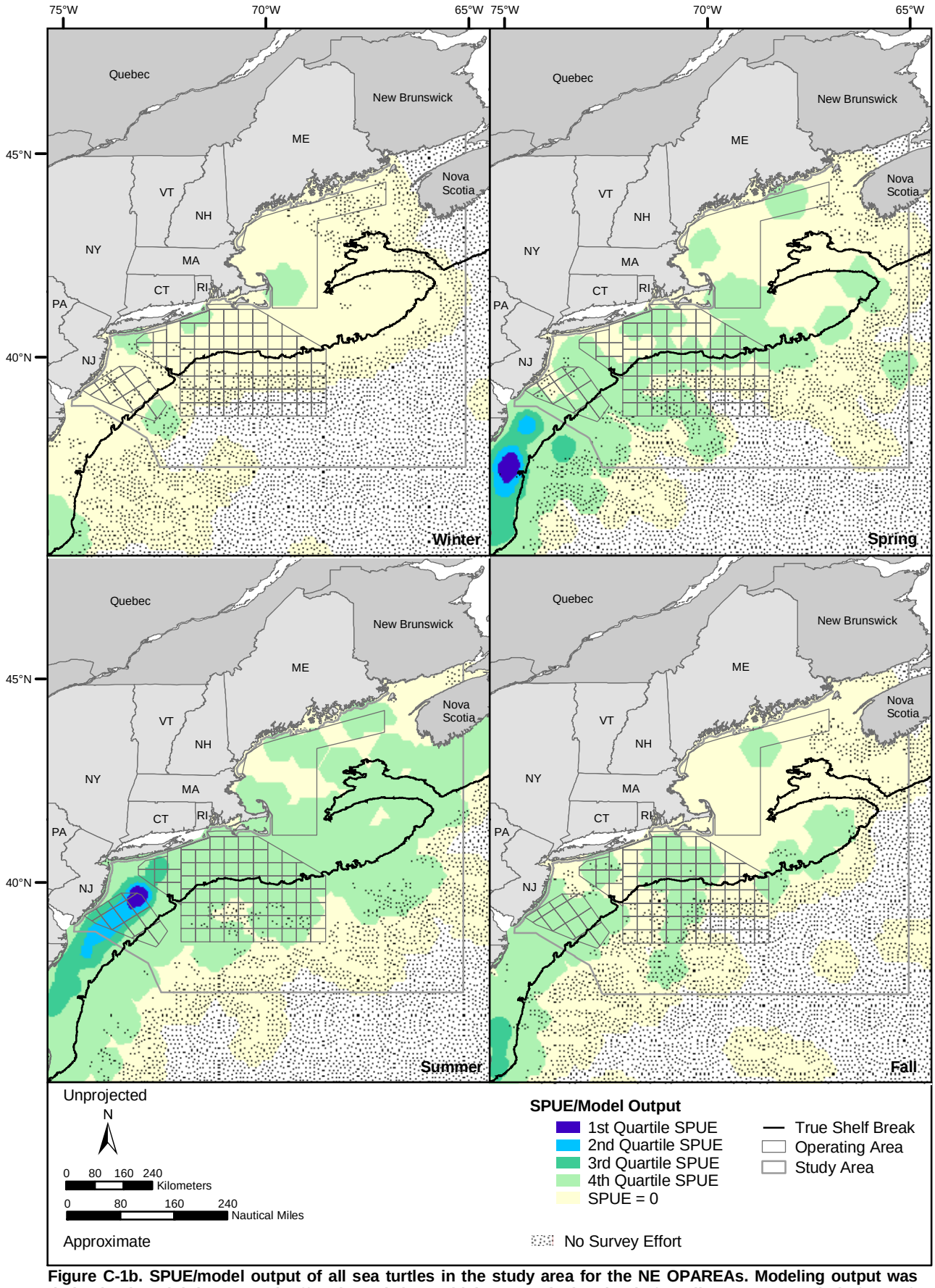

Figure C-1b. SPUE/model output of all sea turtles in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

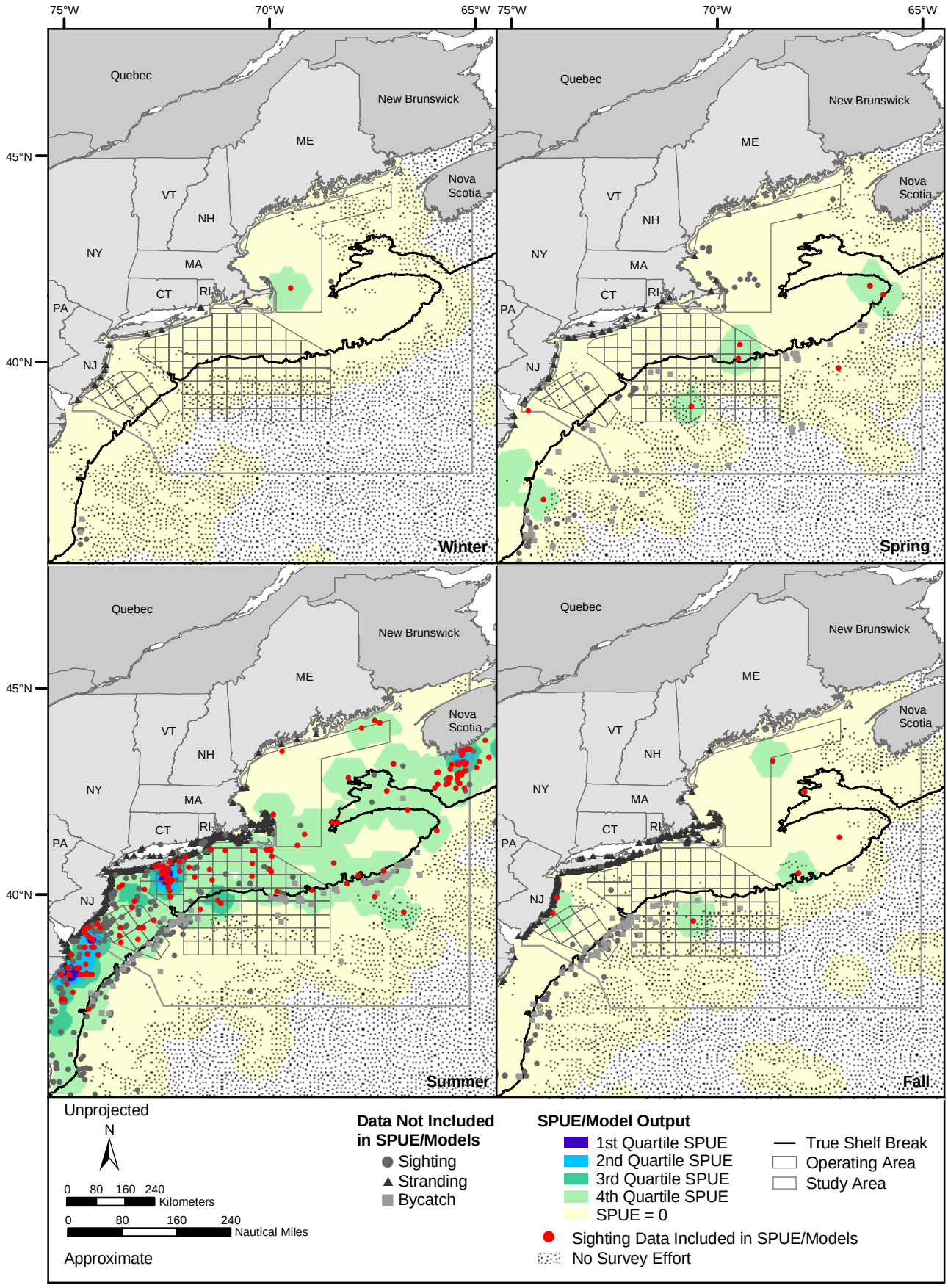

Figure C-2a. Occurrence of the leatherback turtle in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Occurrence estimates are modeled using sighting-per-unit-effort (SPUE) data that were calculated using only a portion of the sighting records. Source data: refer to Table A-1.

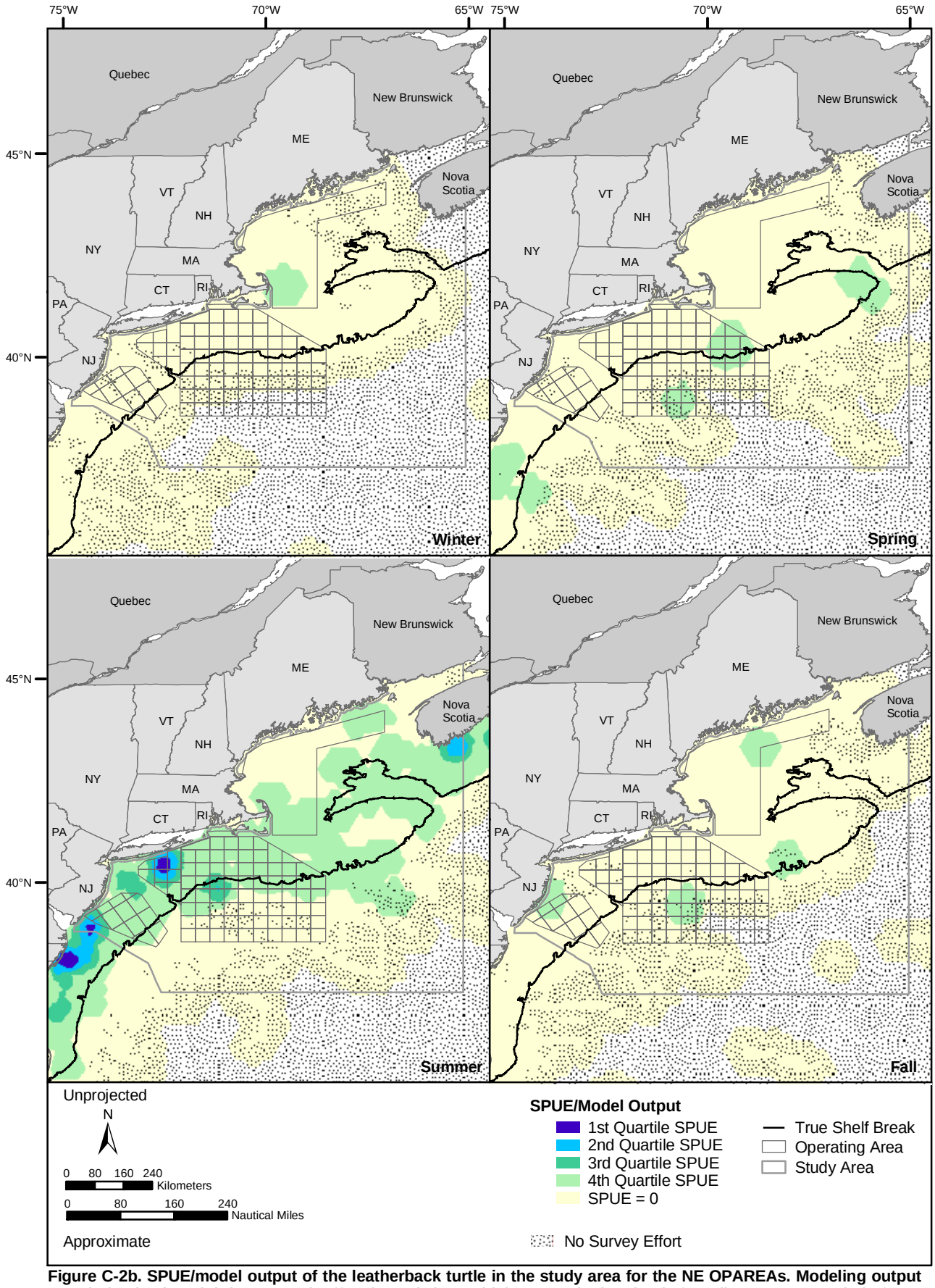

Figure C-2b. SPUE/model output of the leatherback turtle in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

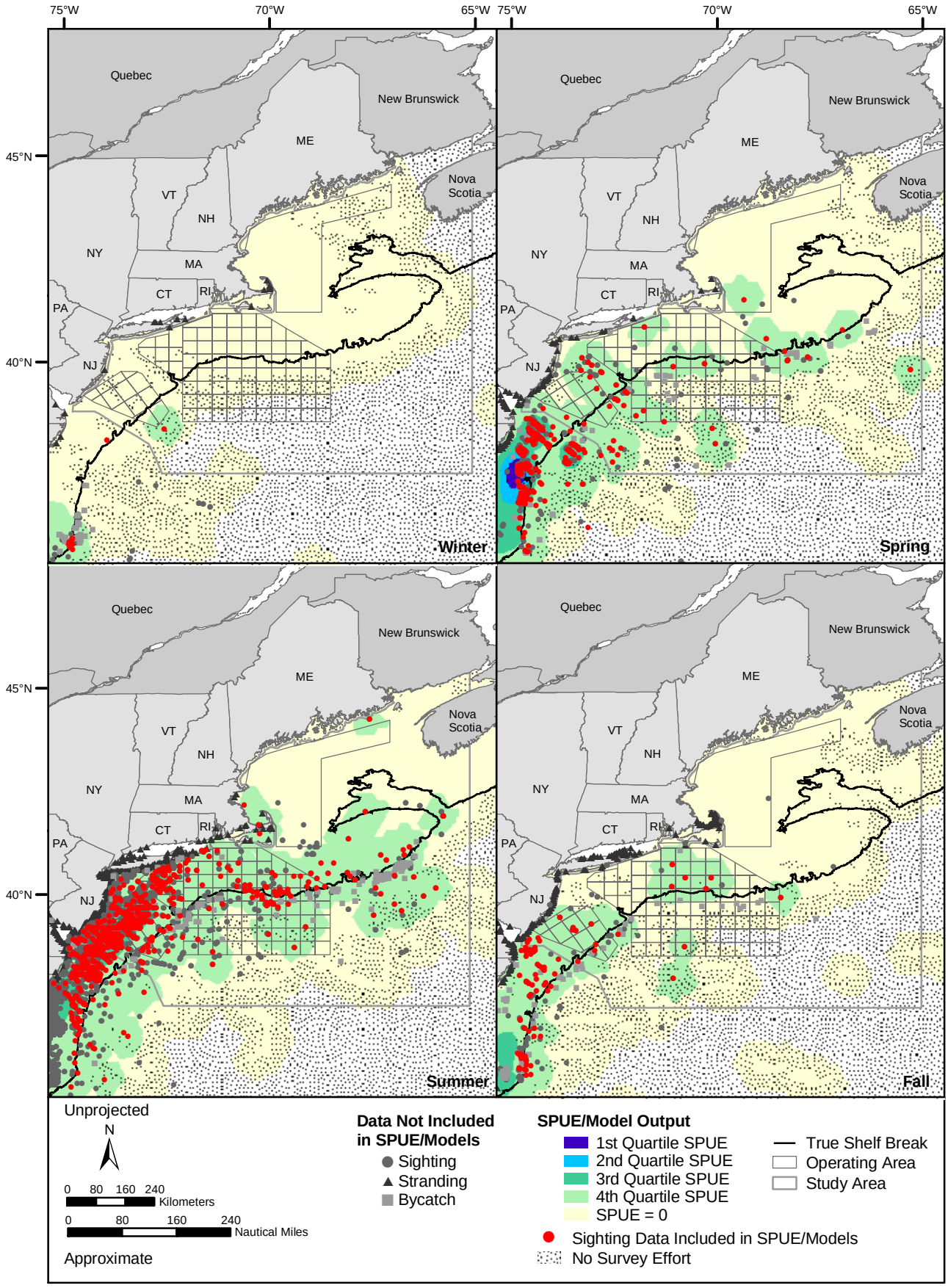

Figure C-3a. Occurrence of the loggerhead turtle in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

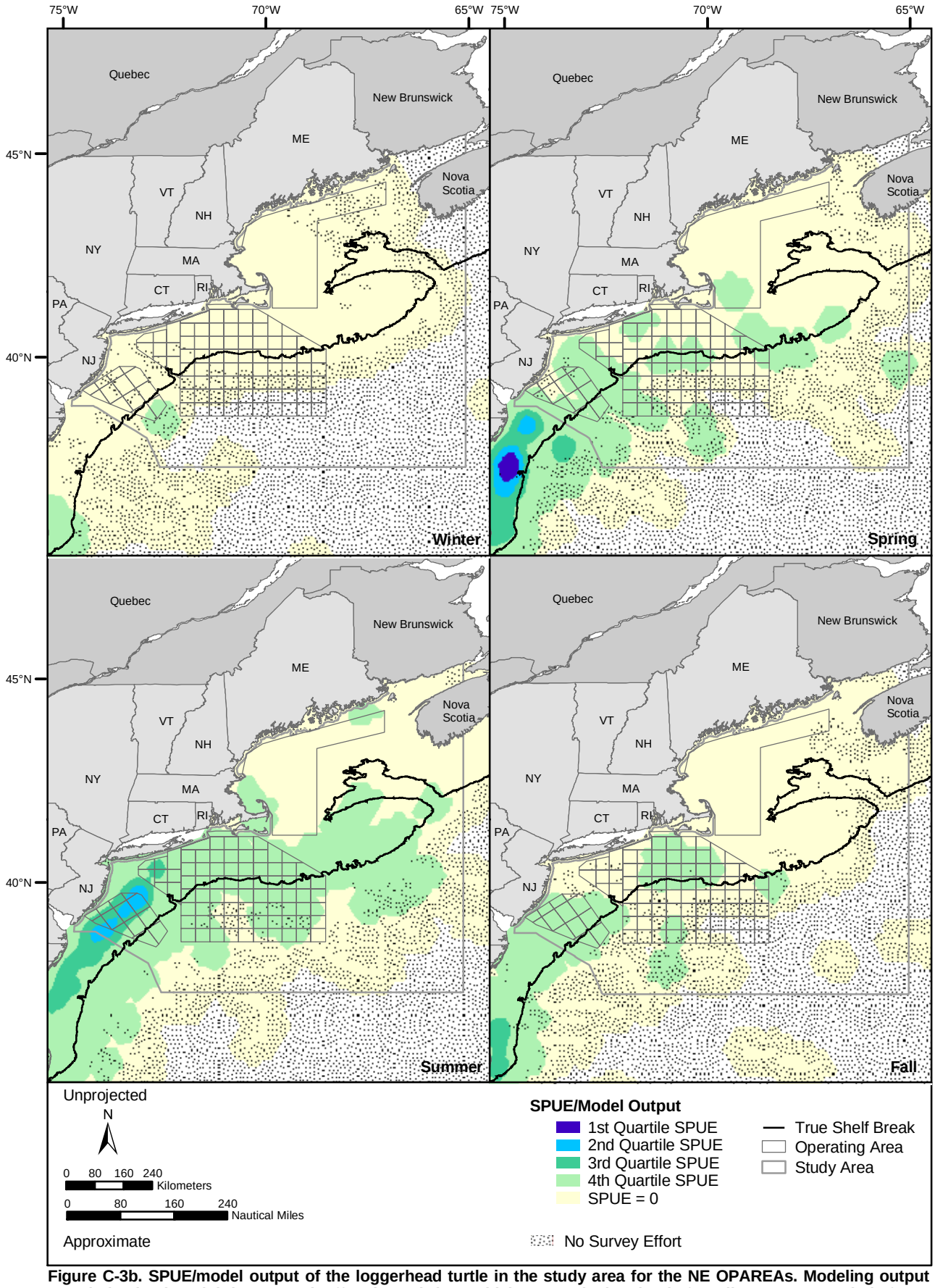

Figure C-3b. SPUE/model output of the loggerhead turtle in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

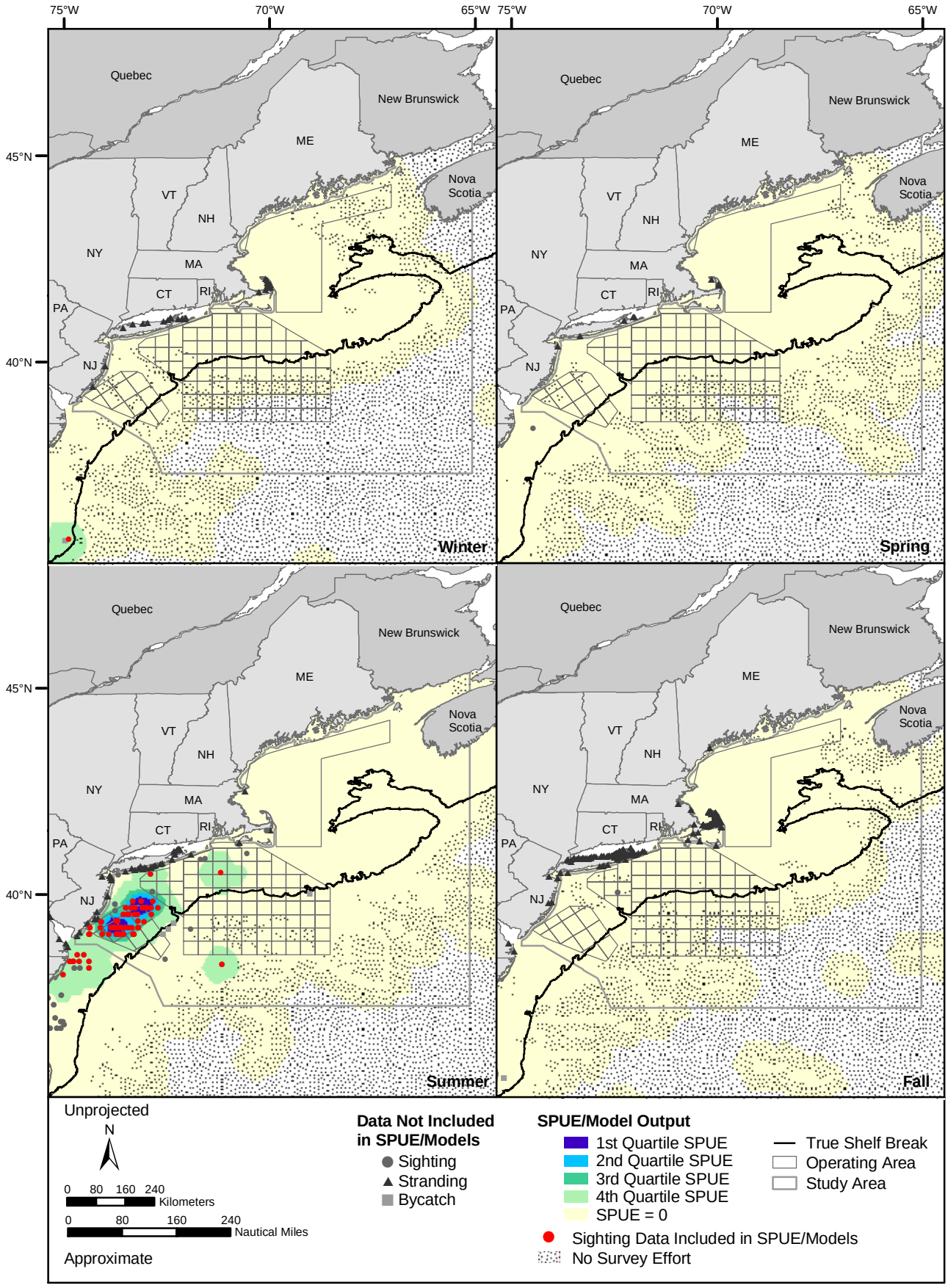

Figure C-4a. Occurrence of the Kemp's ridley turtle in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

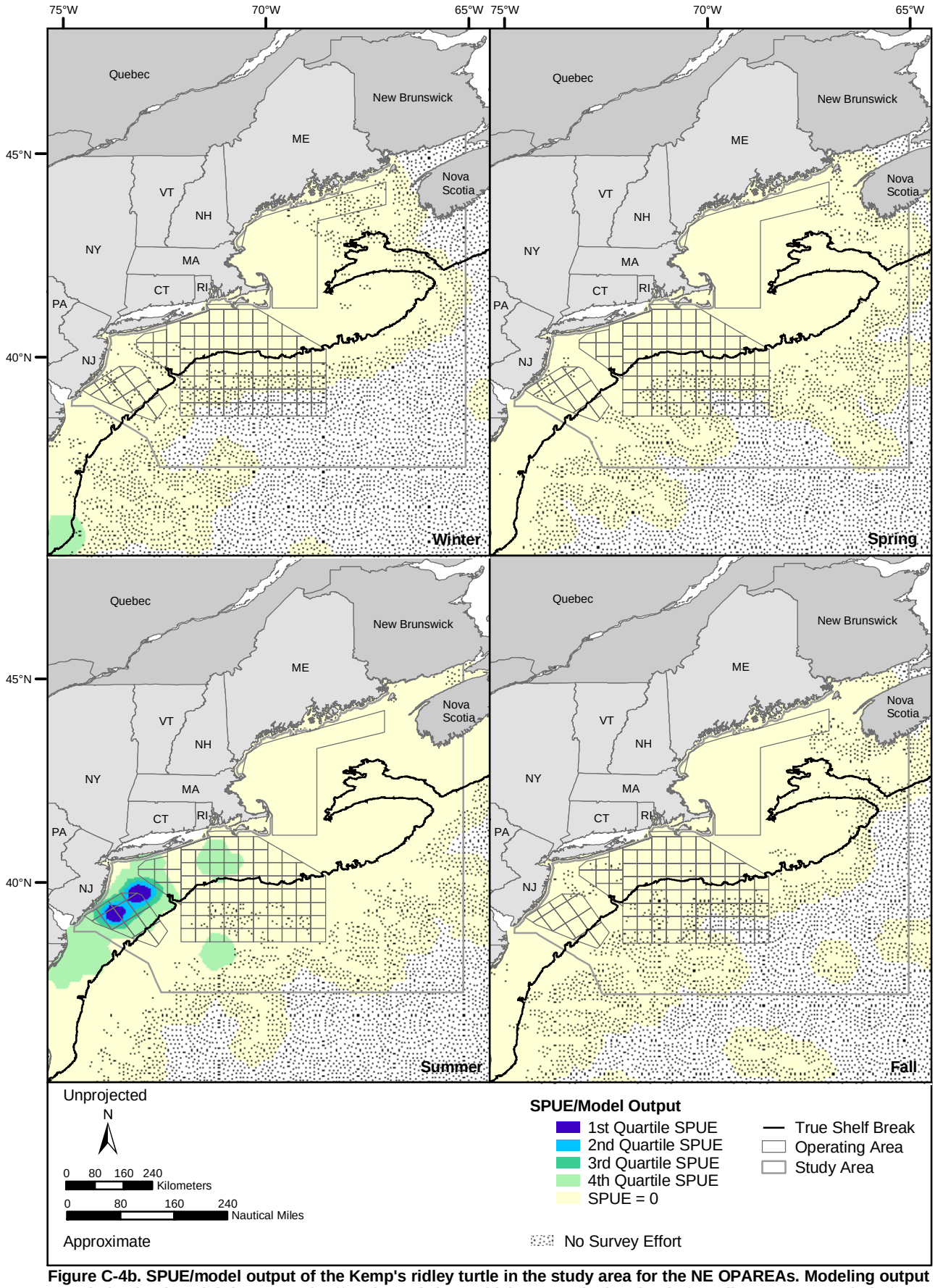

Figure C-4b. SPUE/model output of the Kemp's ridley turtle in the study area for the NE OPAREAs. Modeling output was derived using sighting-per-unit-effort (SPUE) data, which were calculated only from line-transect and platform-of-opportunity sighting data. Source data: refer to Table A-1.

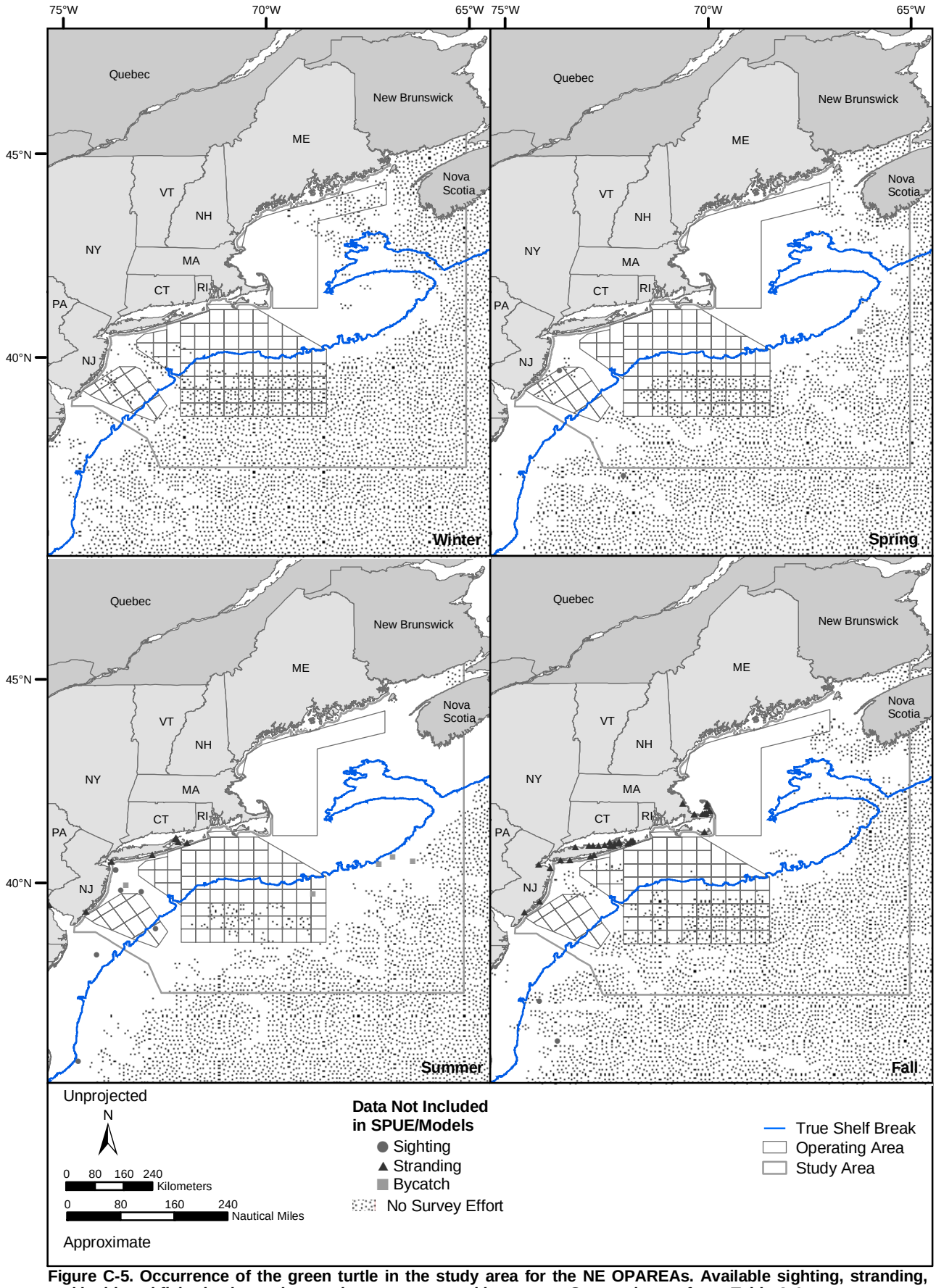

Figure C-5. Occurrence of the green turtle in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

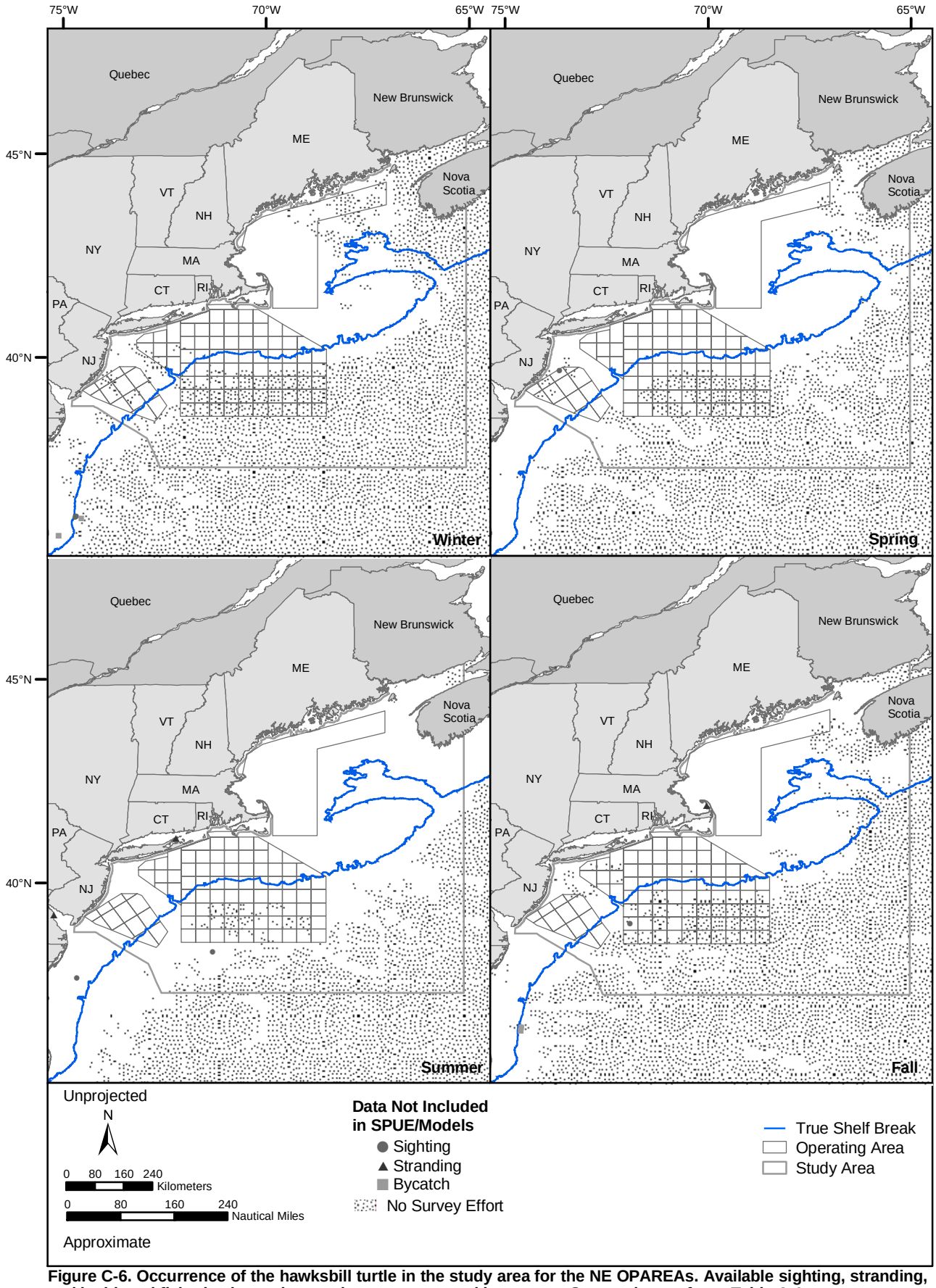

Figure C-6. Occurrence of the hawksbill turtle in the study area for the NE OPAREAs. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

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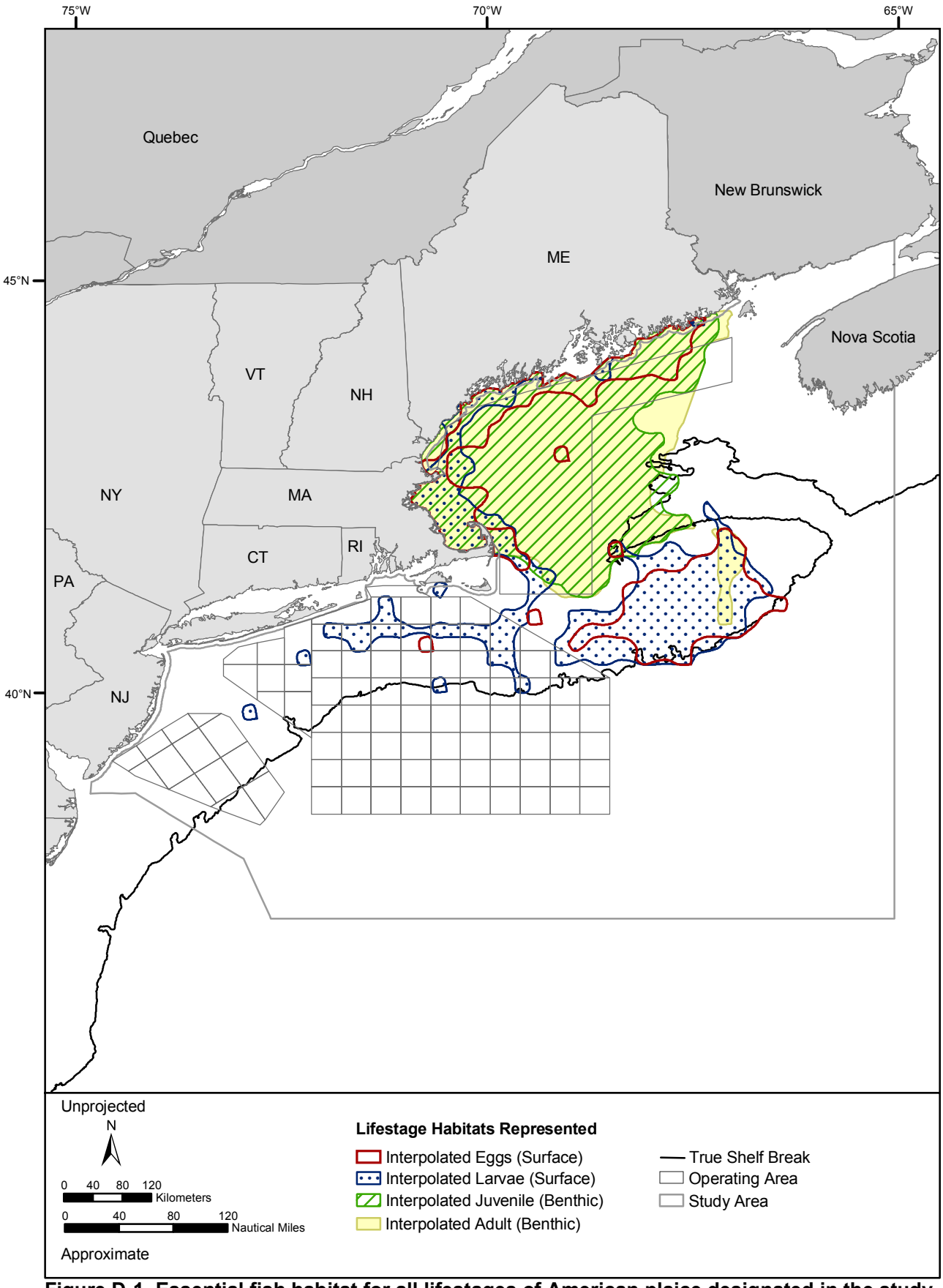
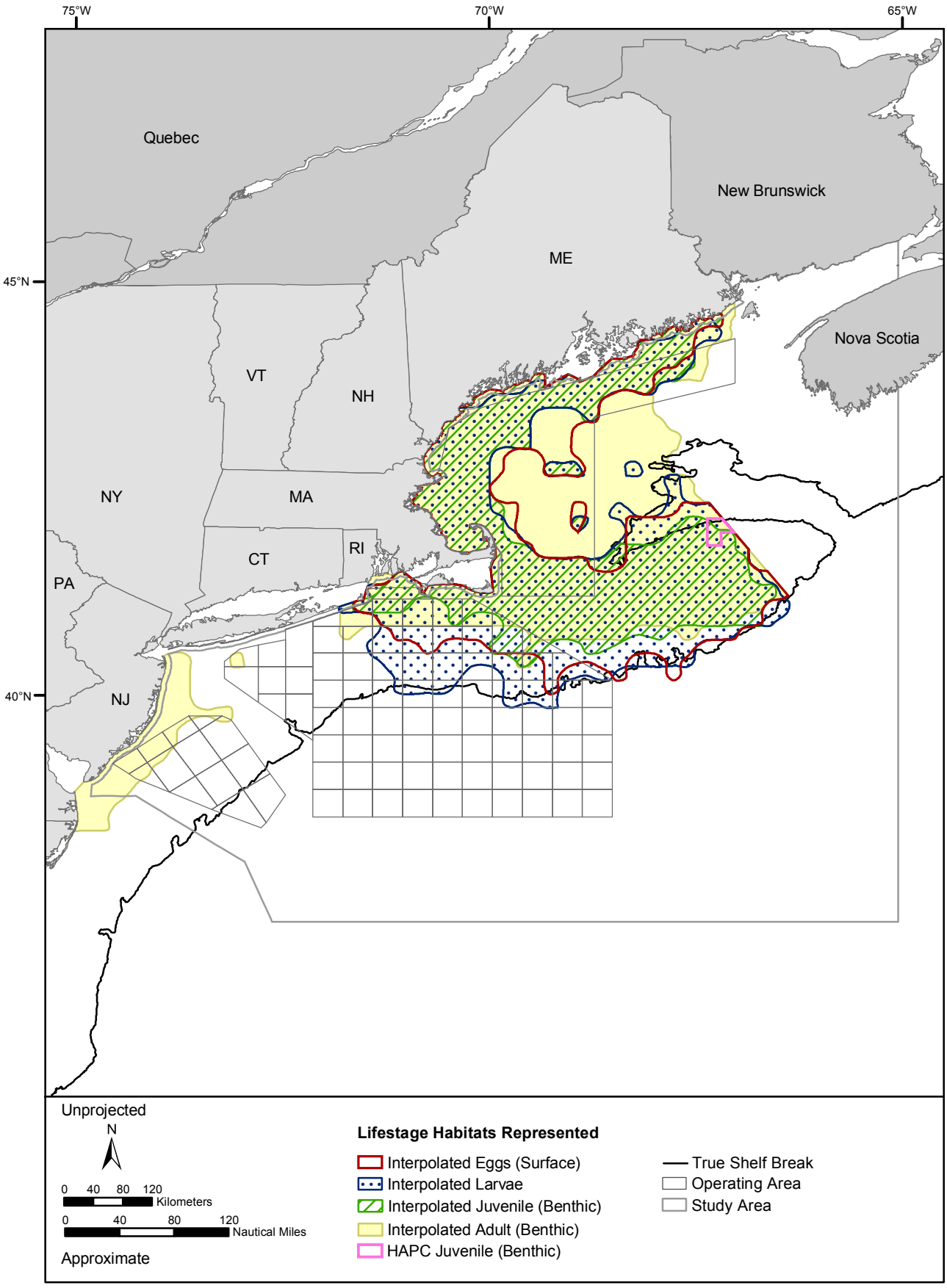


Figure D-1. Essential fish habitat for all lifestages of American plaice designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).



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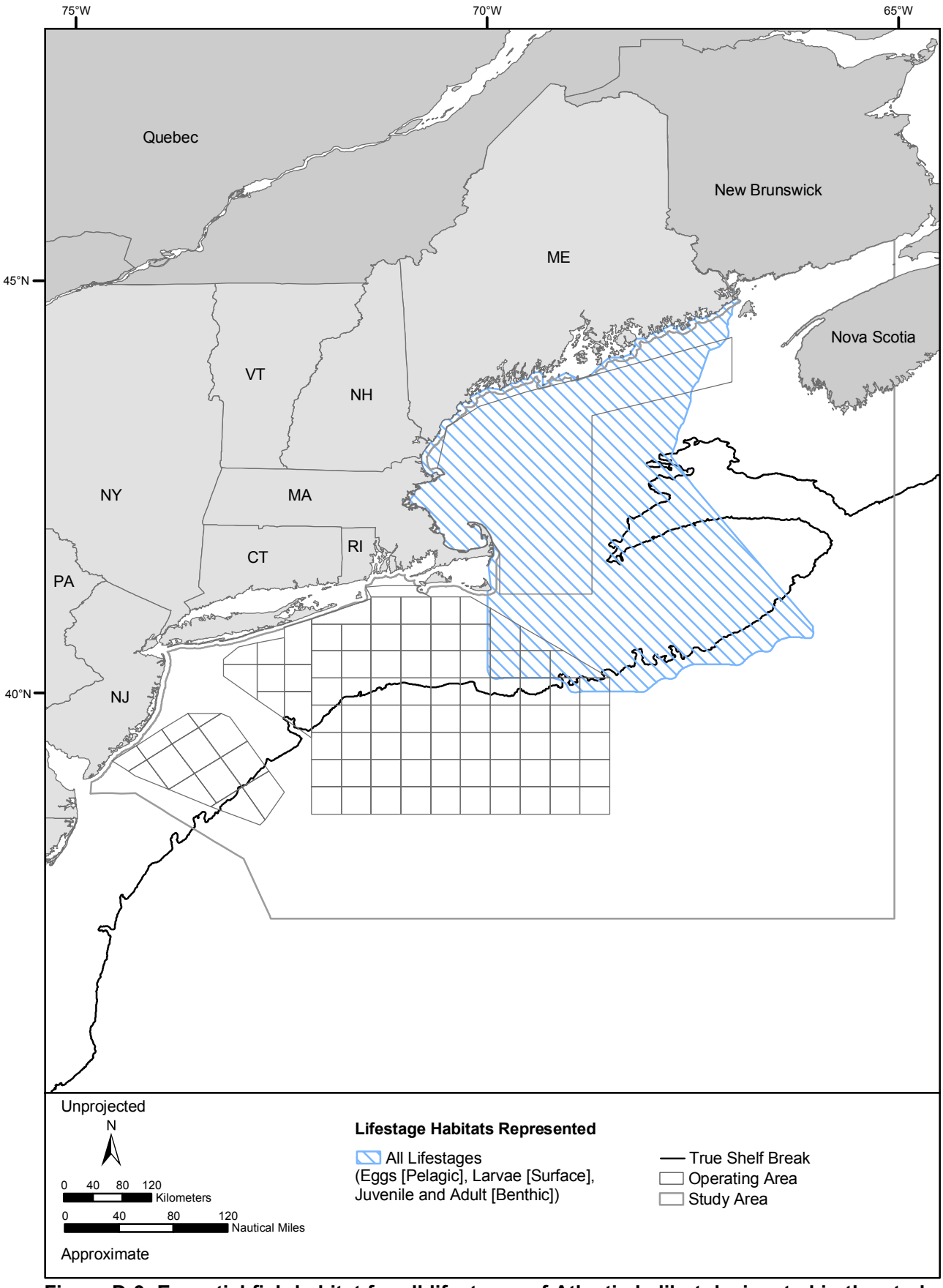


Figure D-3. Essential fish habitat for all lifestages of Atlantic halibut designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

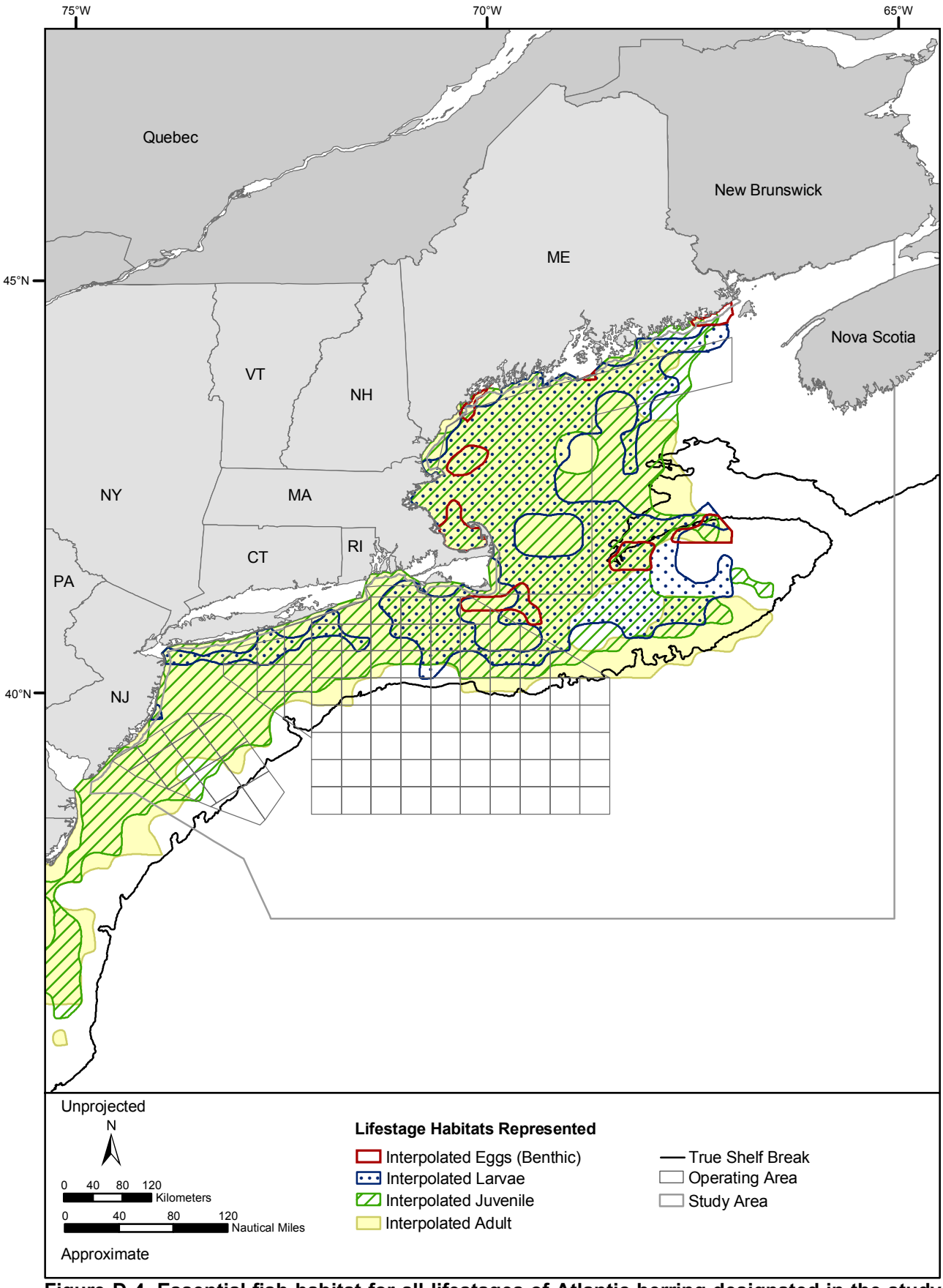


Figure D-4. Essential fish habitat for all lifestages of Atlantic herring designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

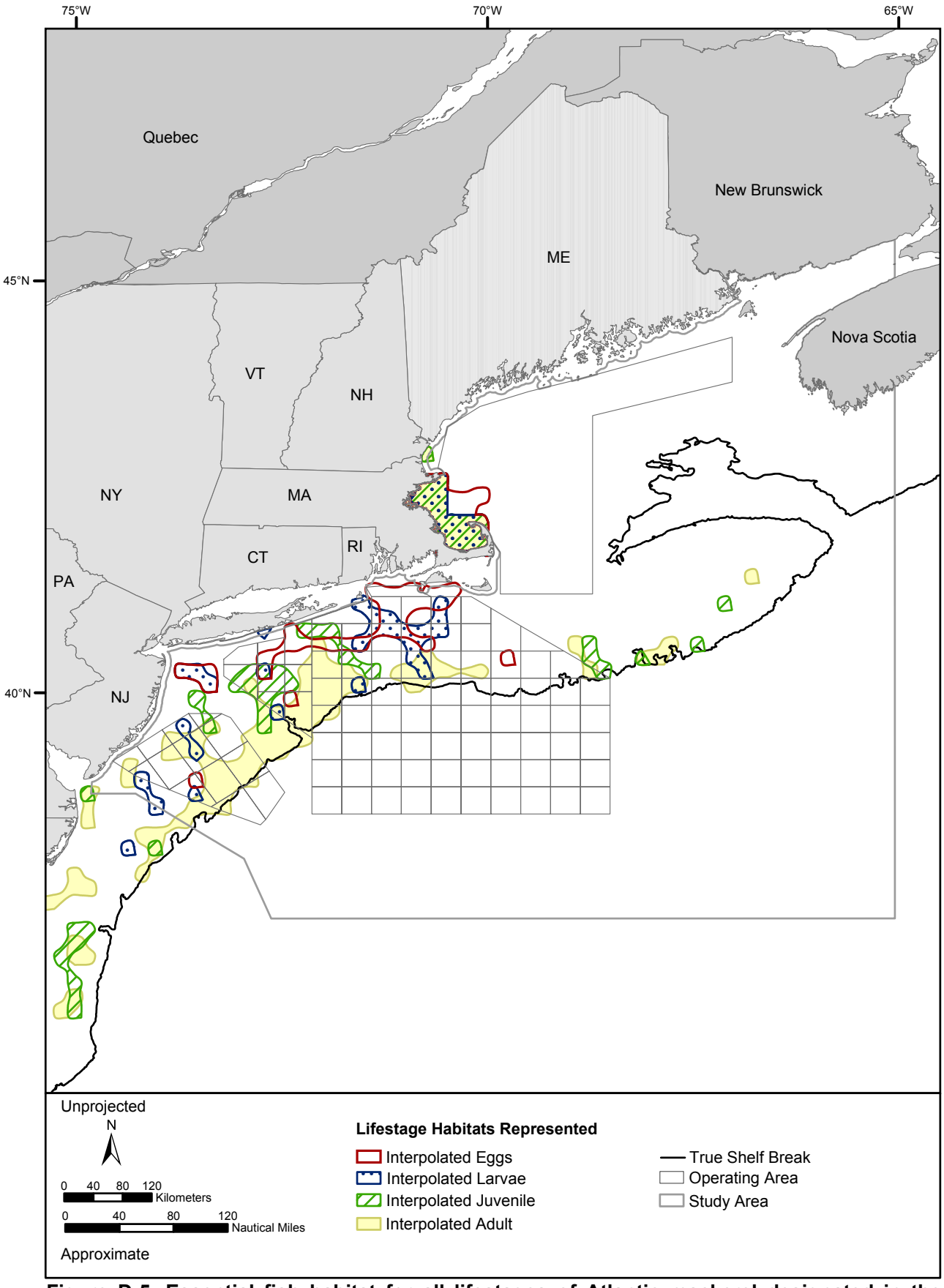


Figure D-5. Essential fish habitat for all lifestages of Atlantic mackerel designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC (1998b).

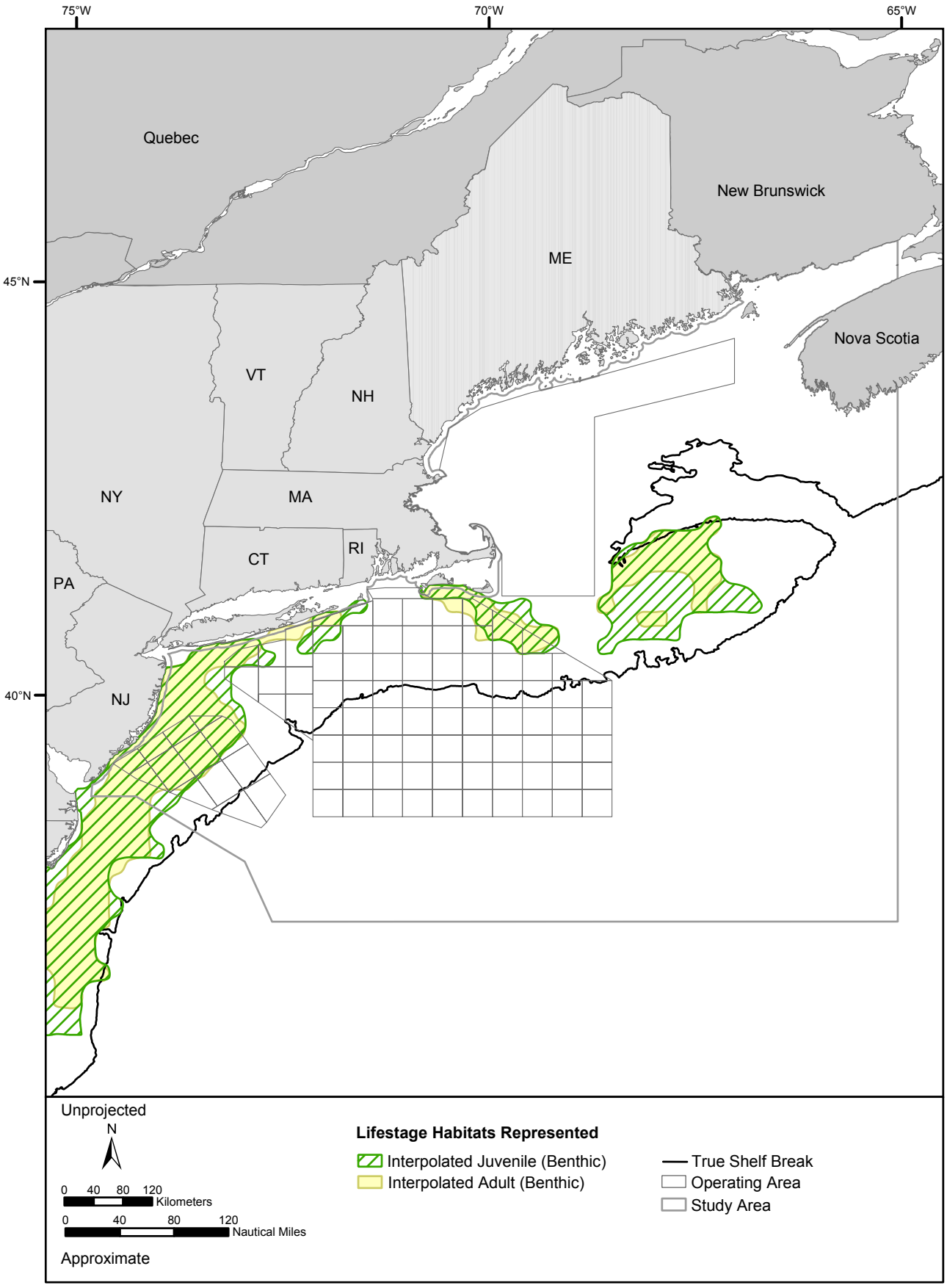


Figure D-6. Essential fish habitat for all lifestages of the Atlantic surfclam designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC (1998a).

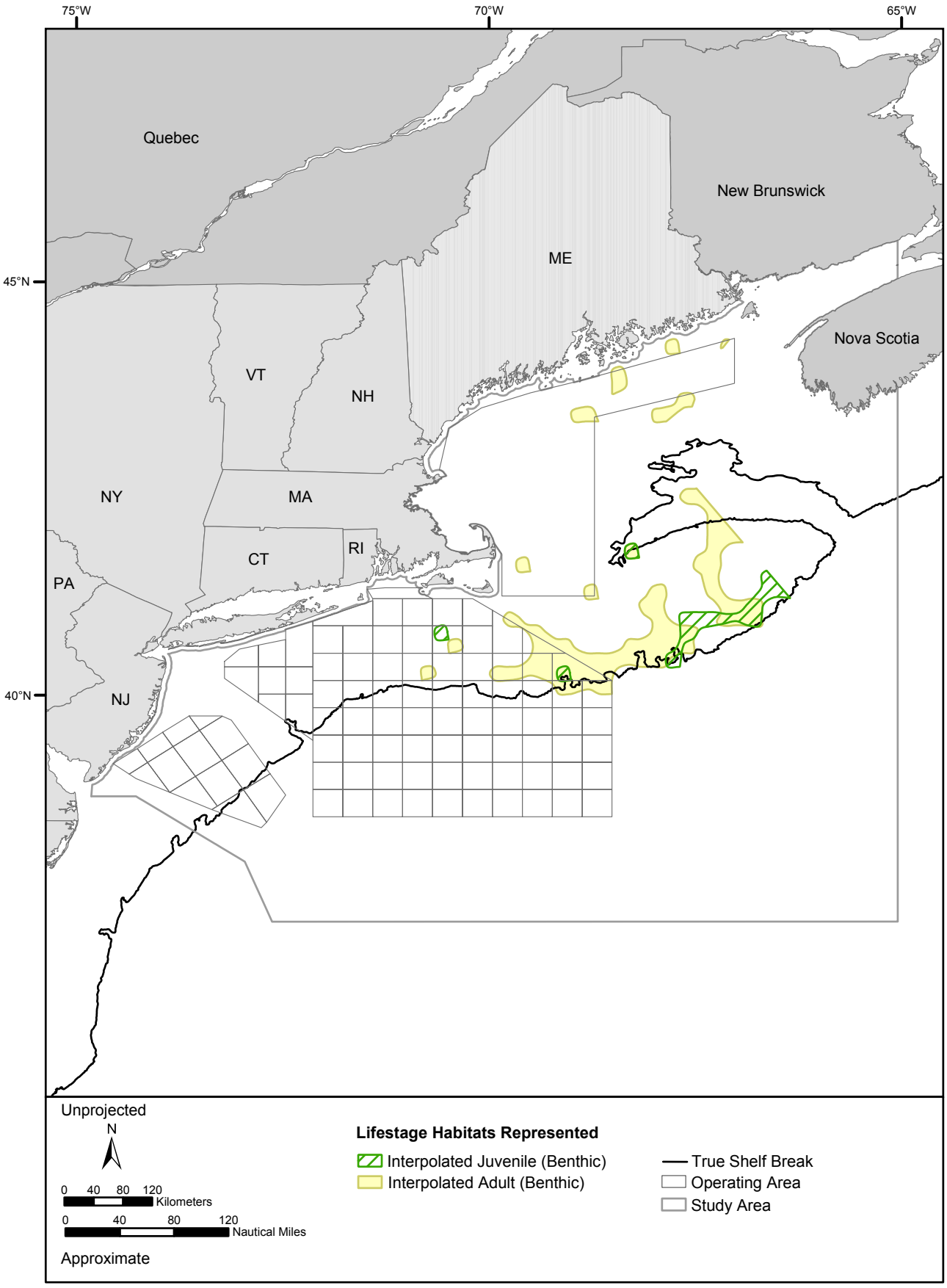


Figure D-7. Essential fish habitat for all lifestages of barndoor skate designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2003a).

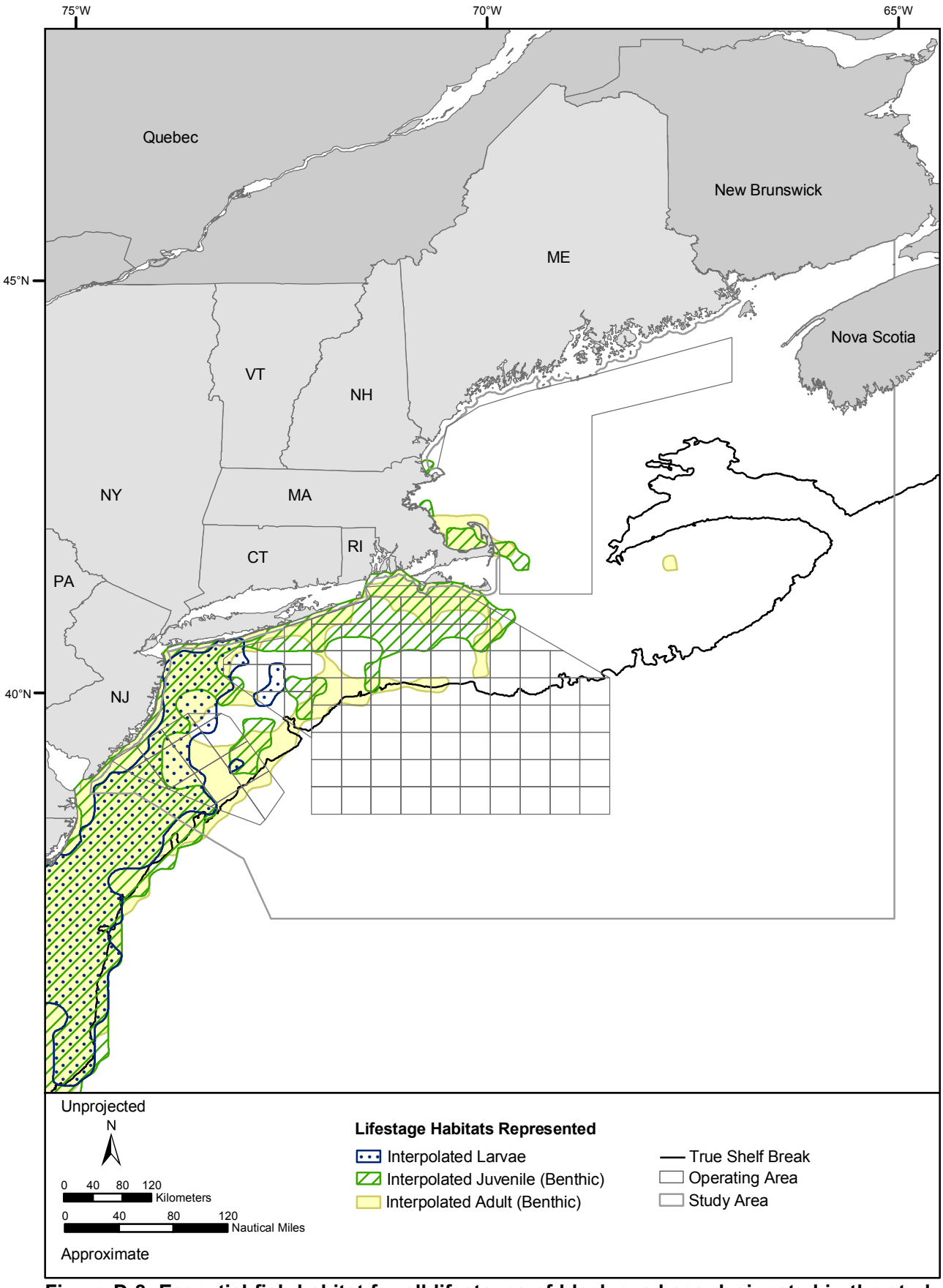


Figure D-8. Essential fish habitat for all lifestages of black sea bass designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC and ASMFC (1998a).

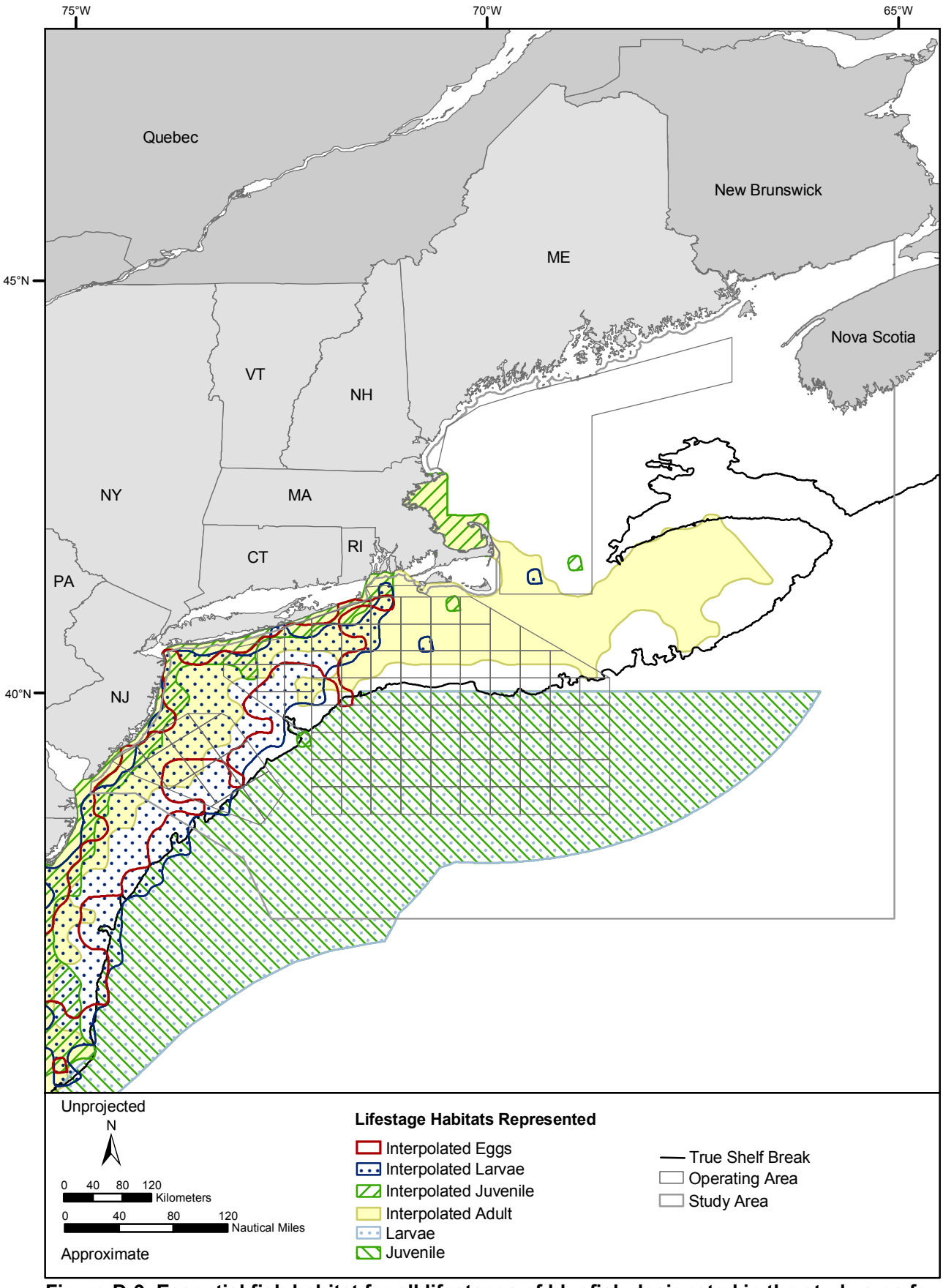
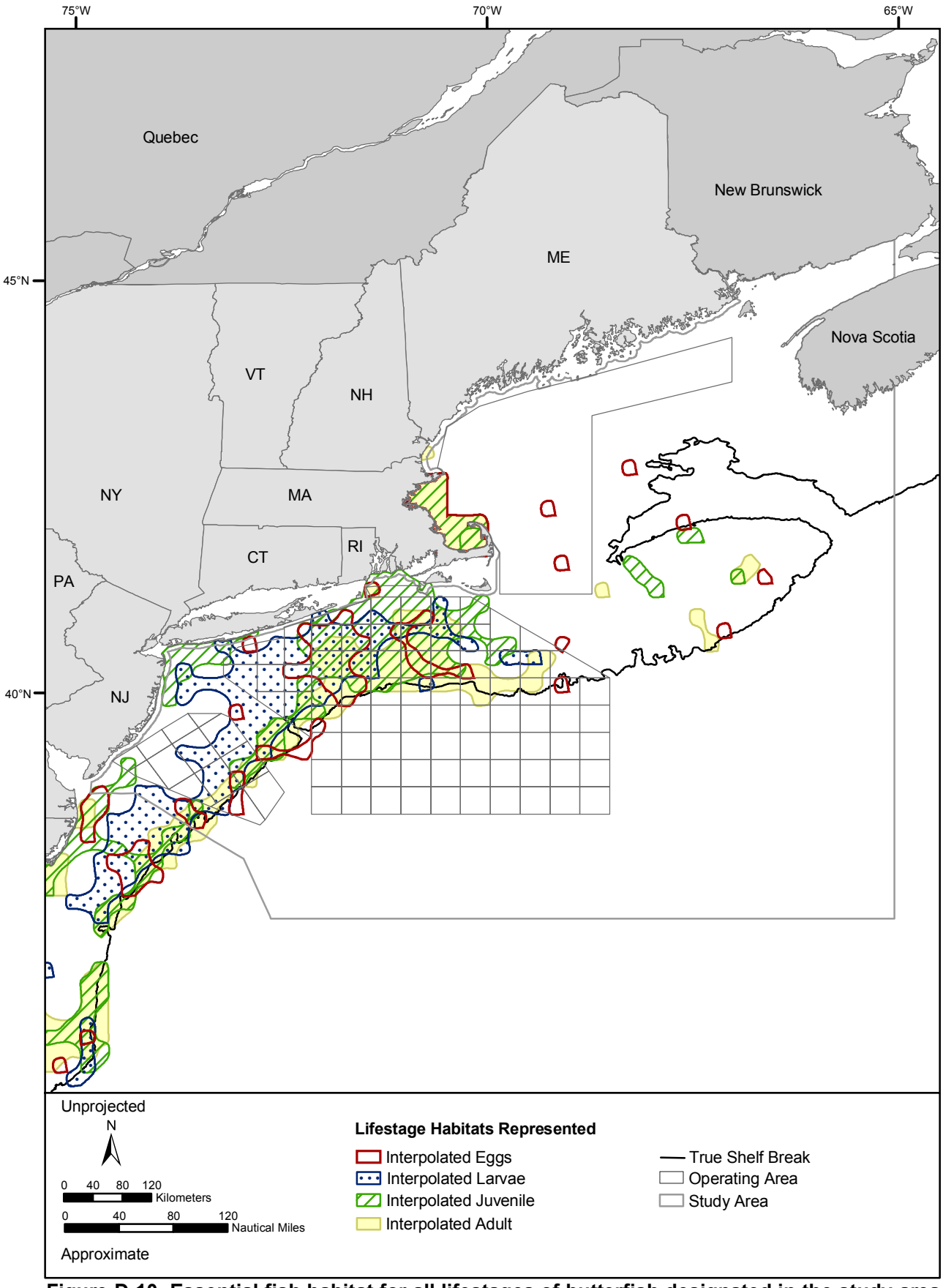


Figure D-9. Essential fish habitat for all lifestages of bluefish designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC and ASMFC (1998b).



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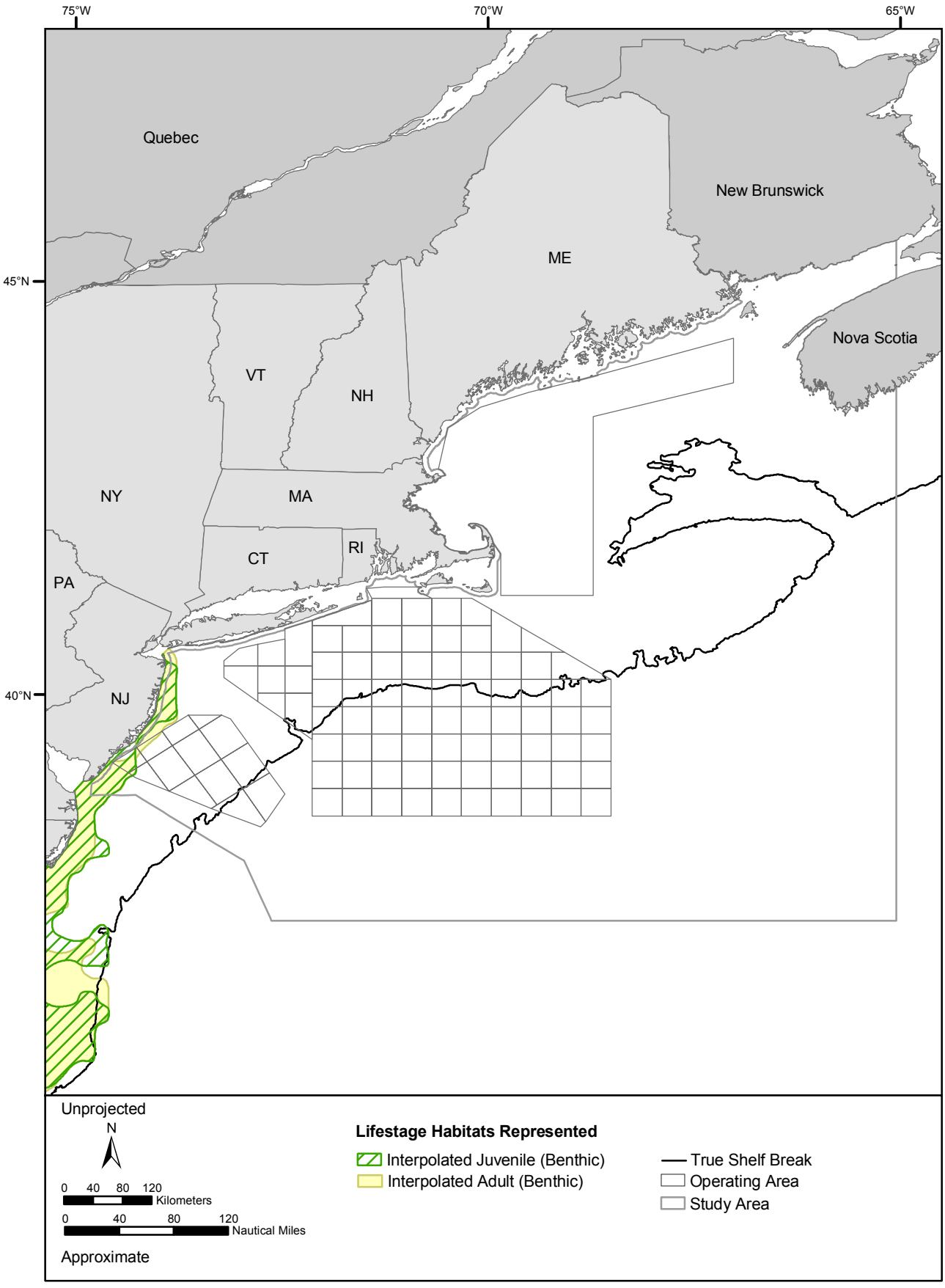


Figure D-11. Essential fish habitat for all lifestages of clearnose skate designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2003a).

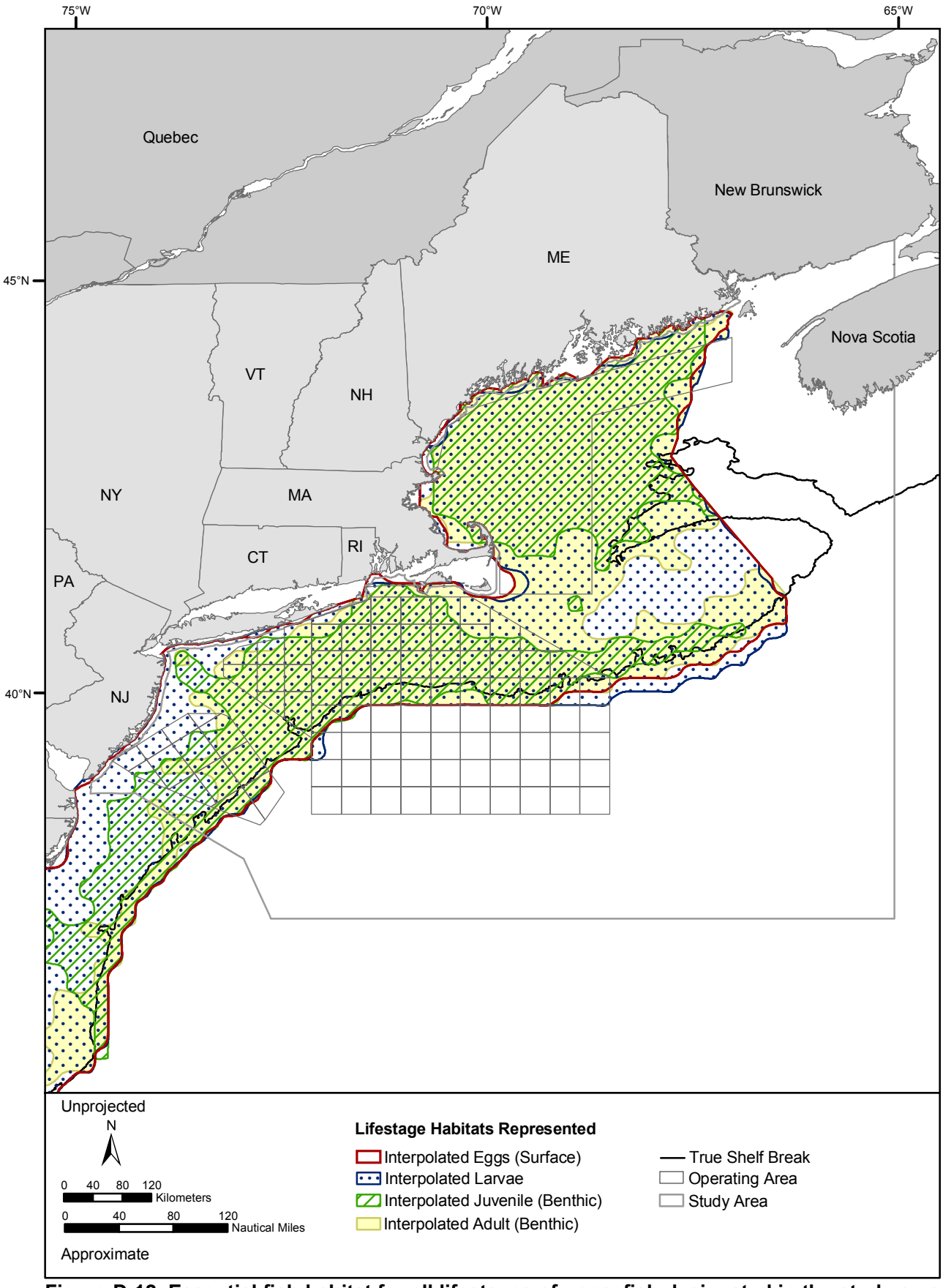


Figure D-12. Essential fish habitat for all lifestages of goosefish designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

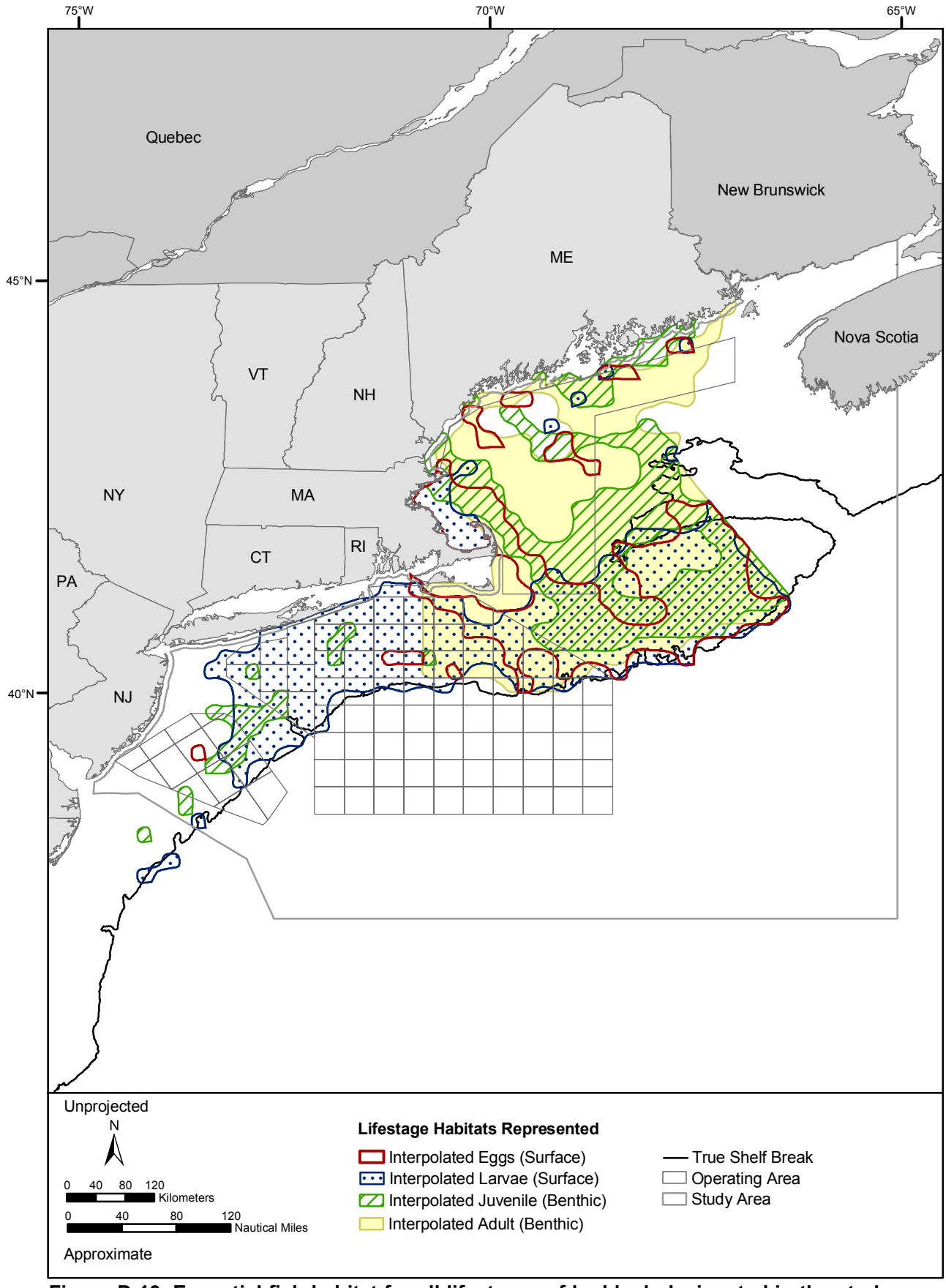


Figure D-13. Essential fish habitat for all lifestages of haddock designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

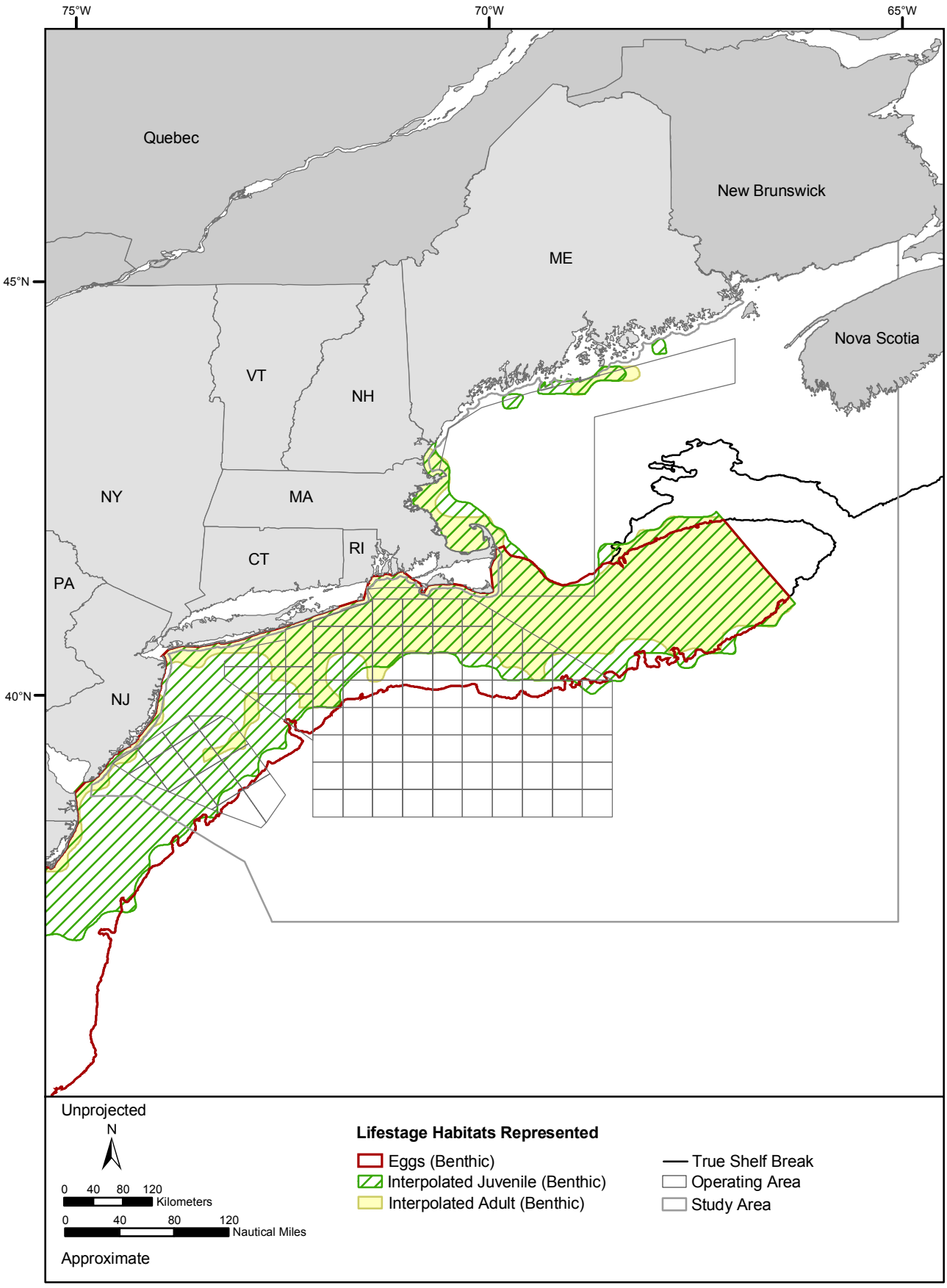


Figure D-14. Essential fish habitat for all lifestages of little skate designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2003a). Source Information: NEFMC (2003a).

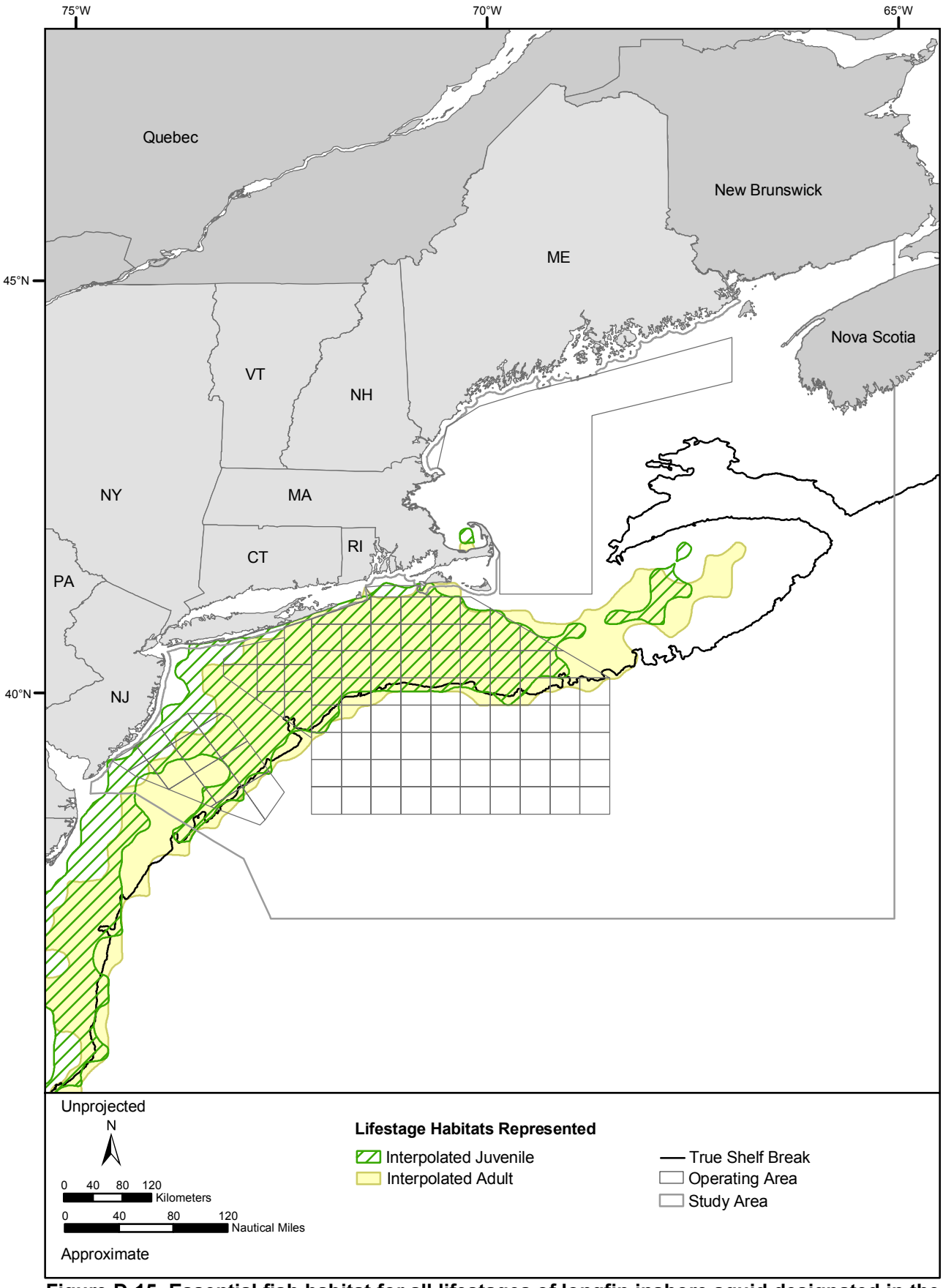
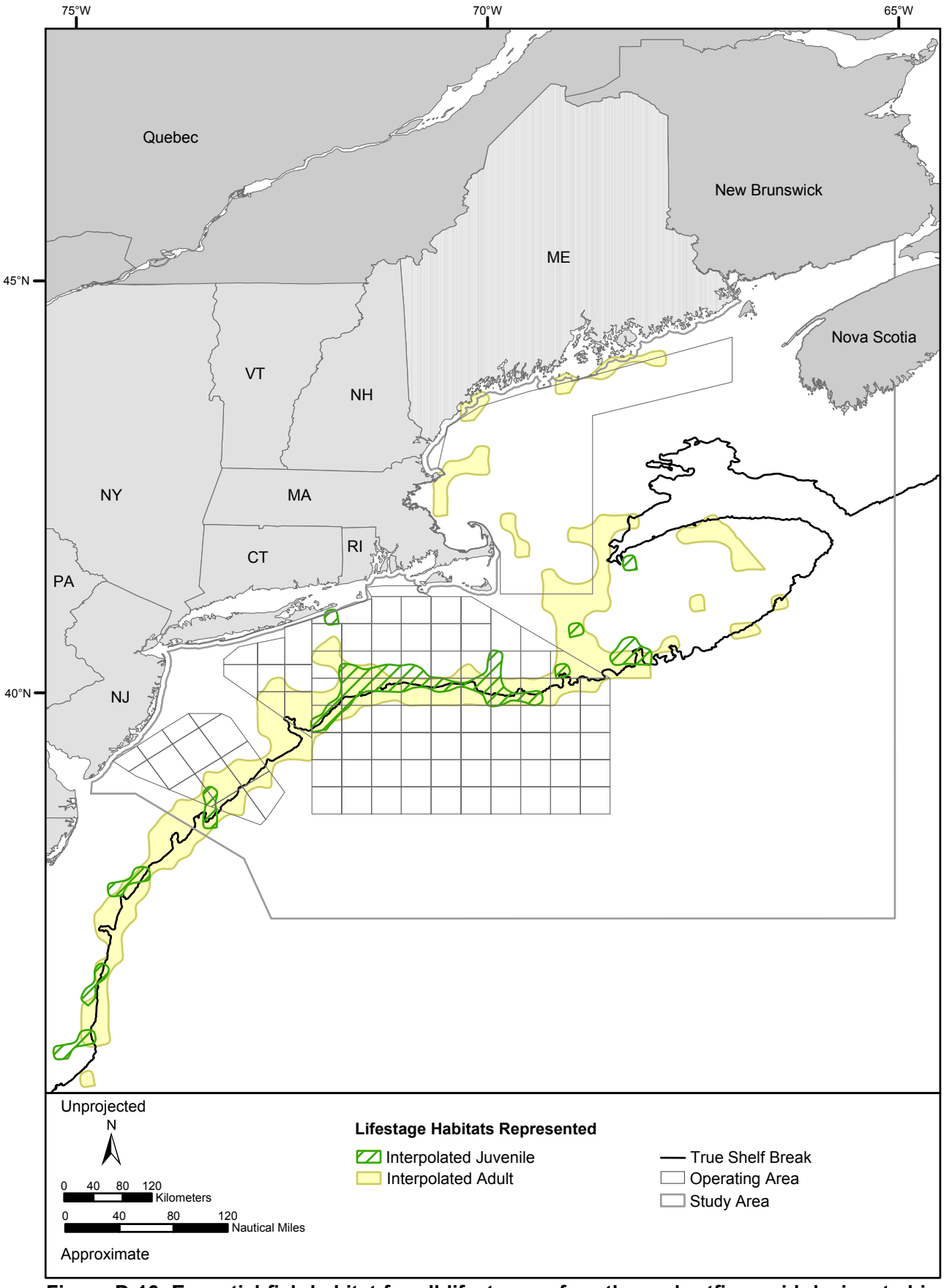


Figure D-15. Essential fish habitat for all lifestages of longfin inshore squid designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC (1998b).



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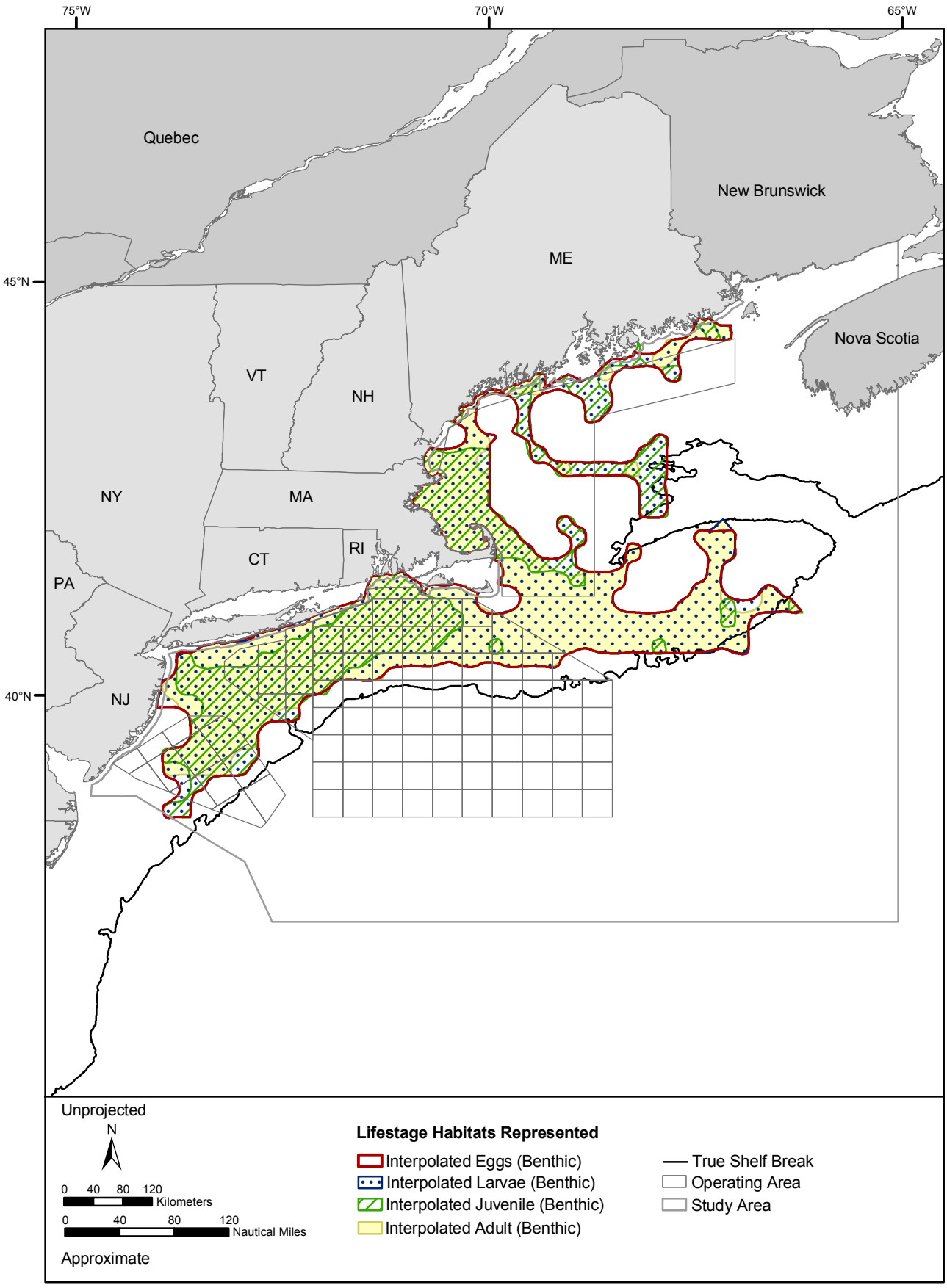


Figure D-17. Essential fish habitat for all lifestages of ocean pout designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

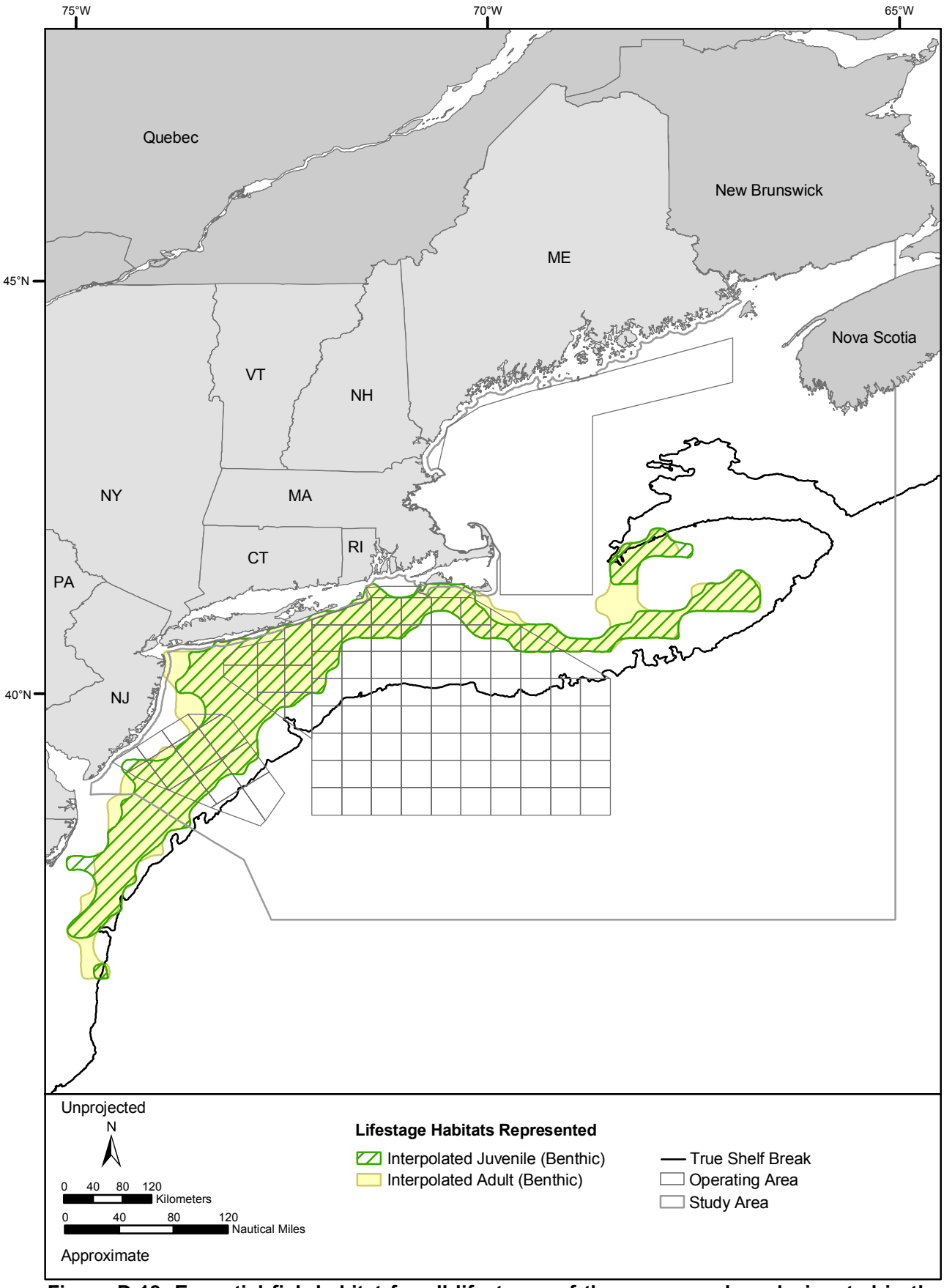


Figure D-18. Essential fish habitat for all lifestages of the ocean quahog designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC (1998a).

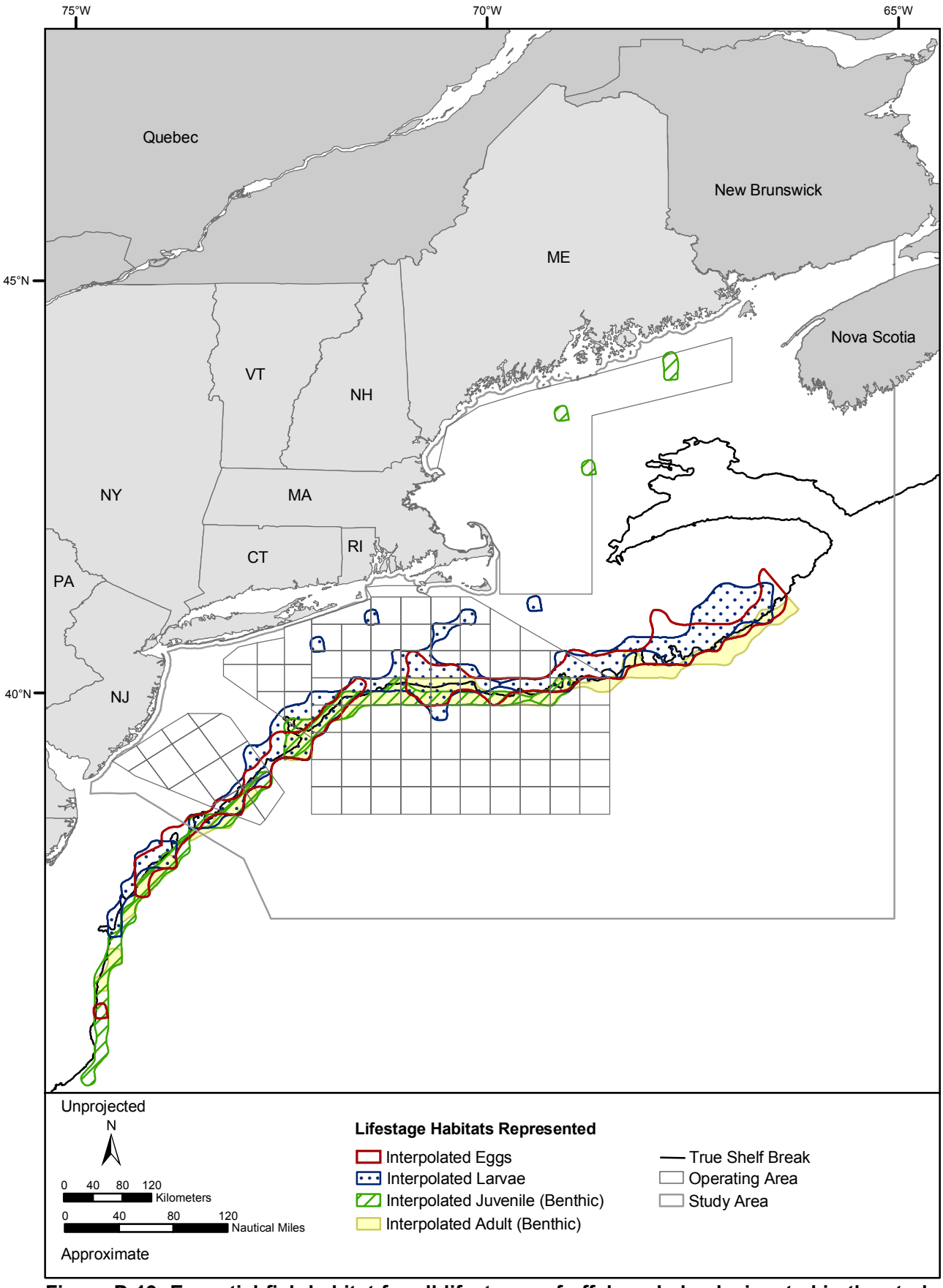


Figure D-19. Essential fish habitat for all lifestages of offshore hake designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1999b).

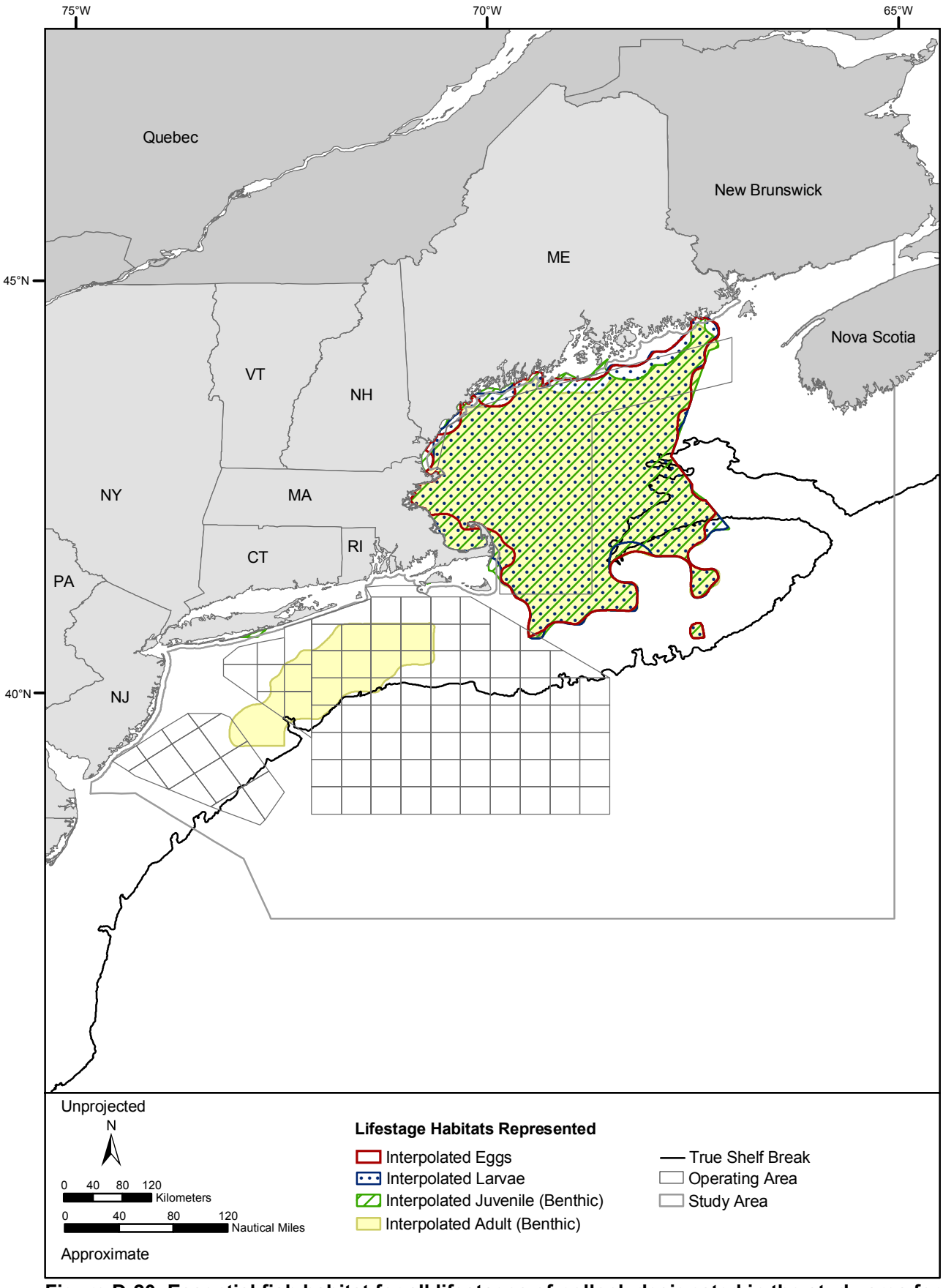


Figure D-20. Essential fish habitat for all lifestages of pollock designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

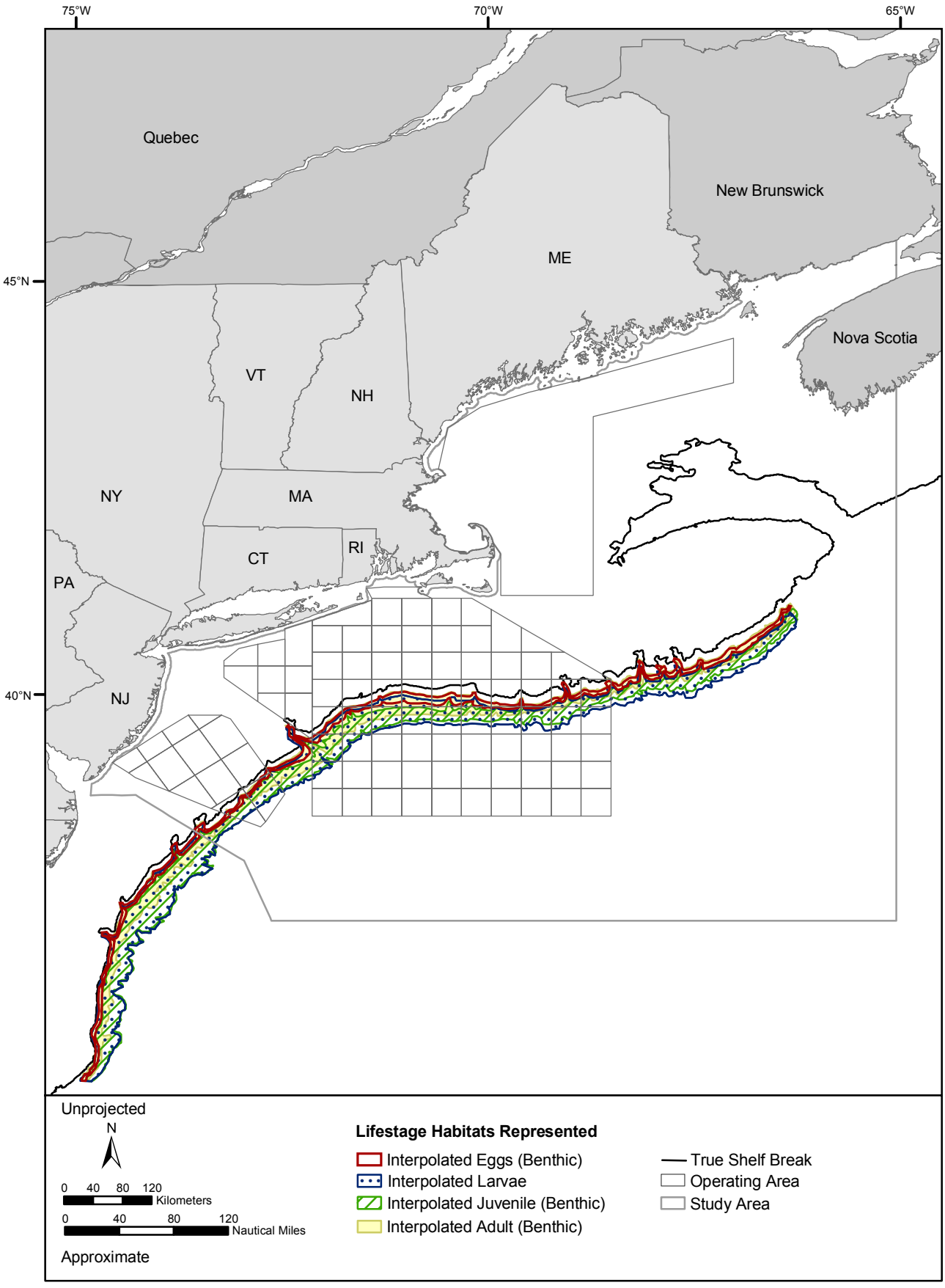
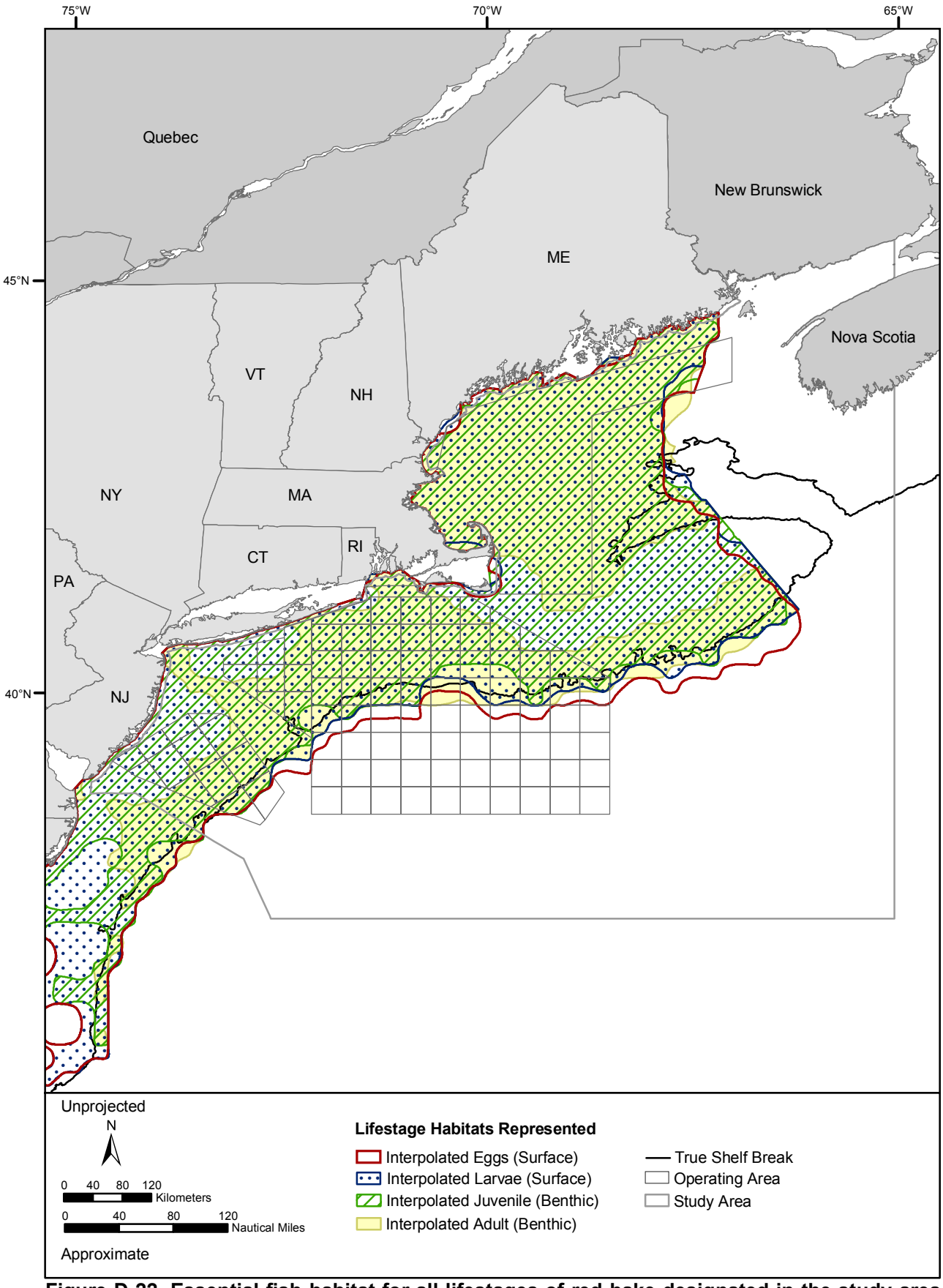


Figure D-21. Essential fish habitat for all lifestages of the red deepsea crab designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2002).



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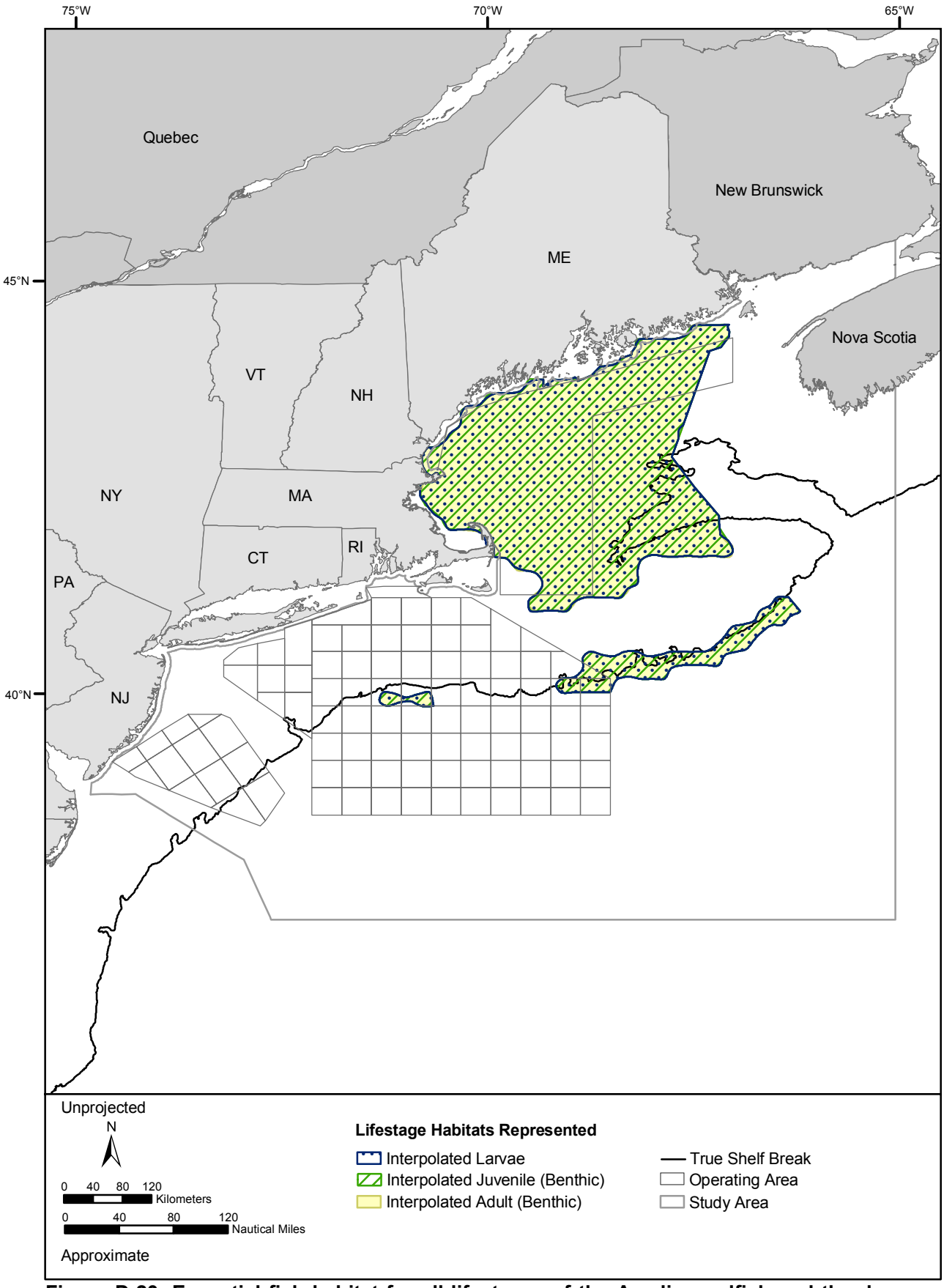

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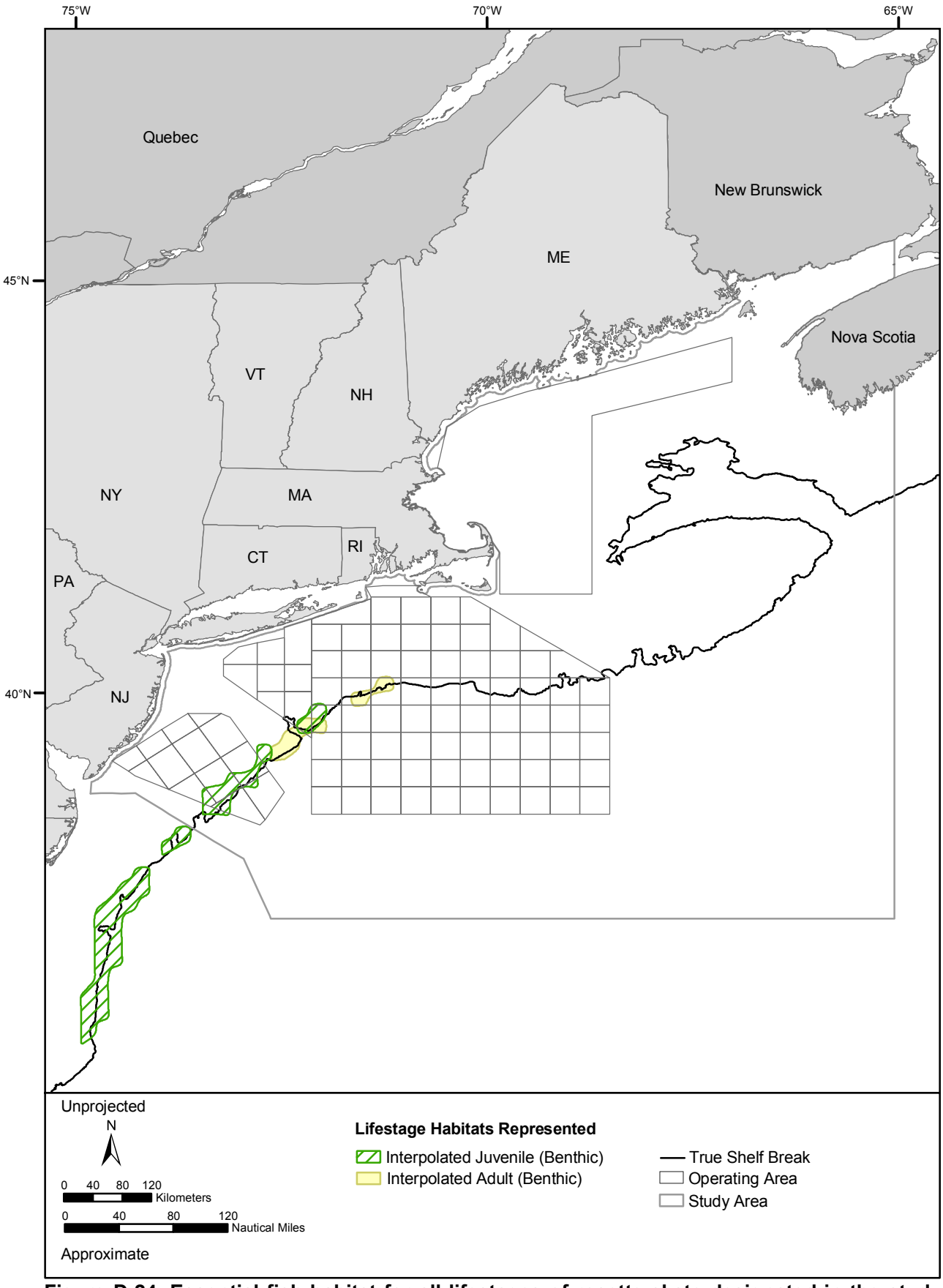

Figure D-24. Essential fish habitat for all lifestages of rosette skate designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2003a).

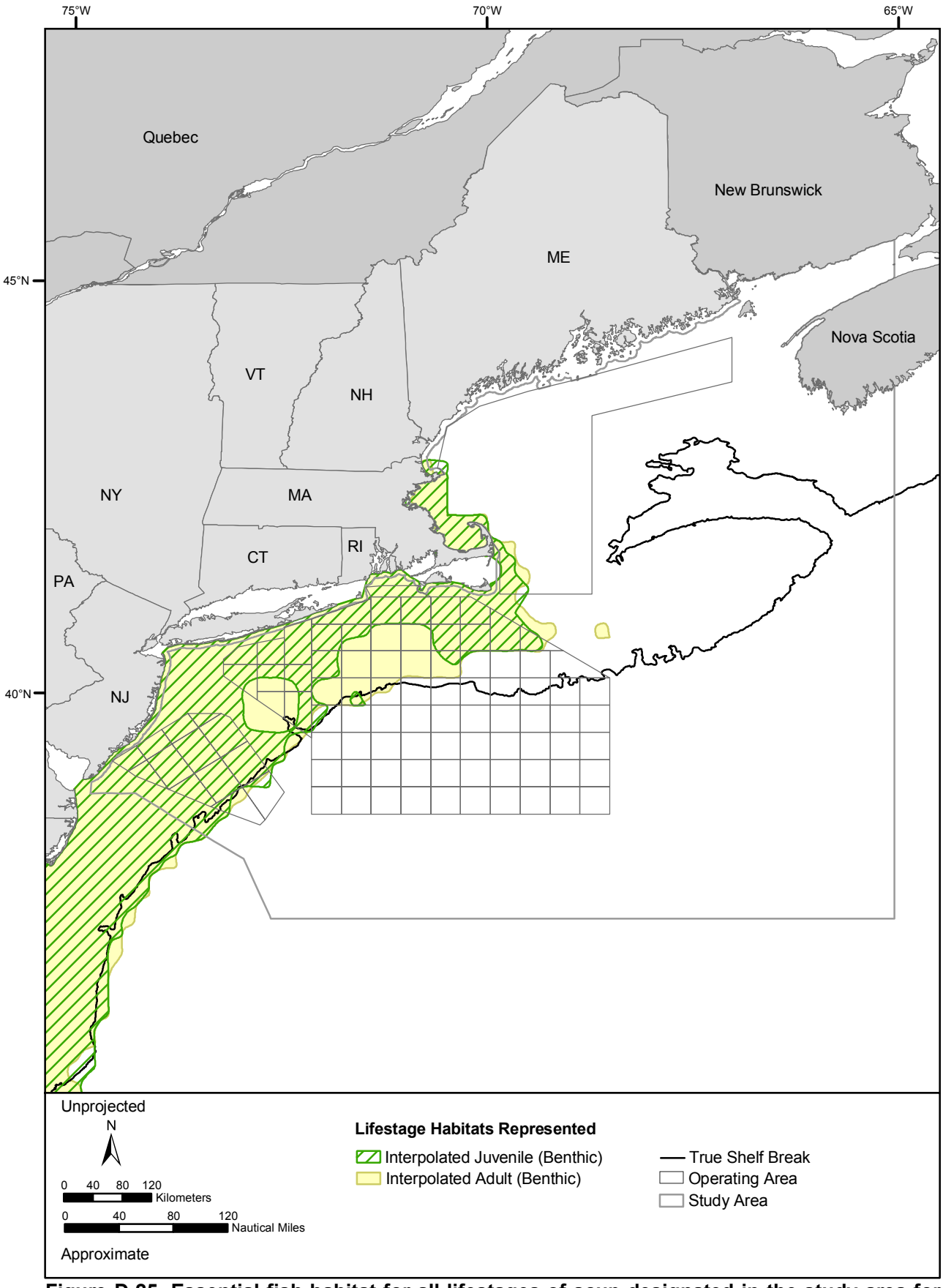

Figure D-25. Essential fish habitat for all lifestages of scup designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC and ASMFC (1998a).

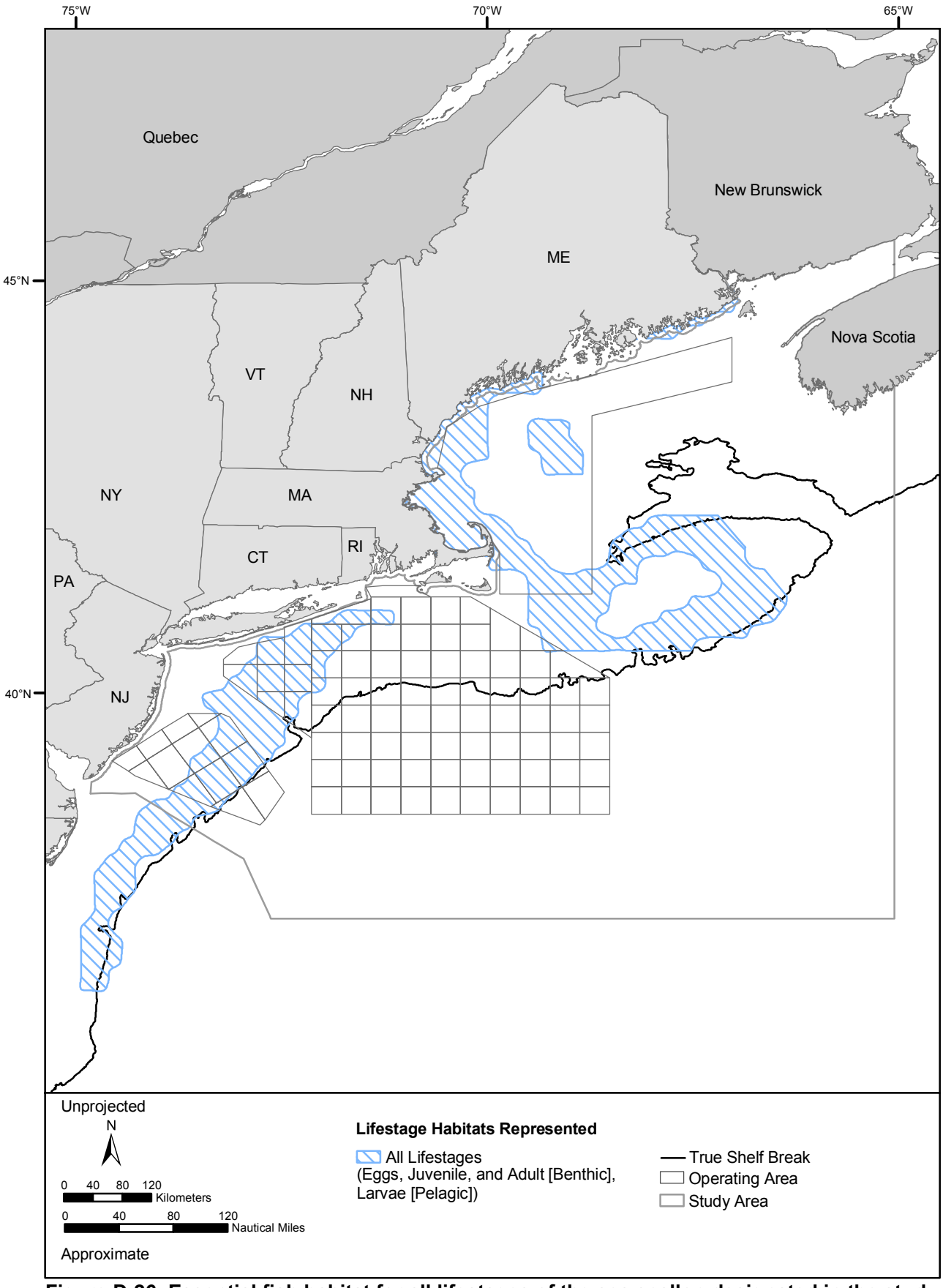

Figure D-26. Essential fish habitat for all lifestages of the sea scallop designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

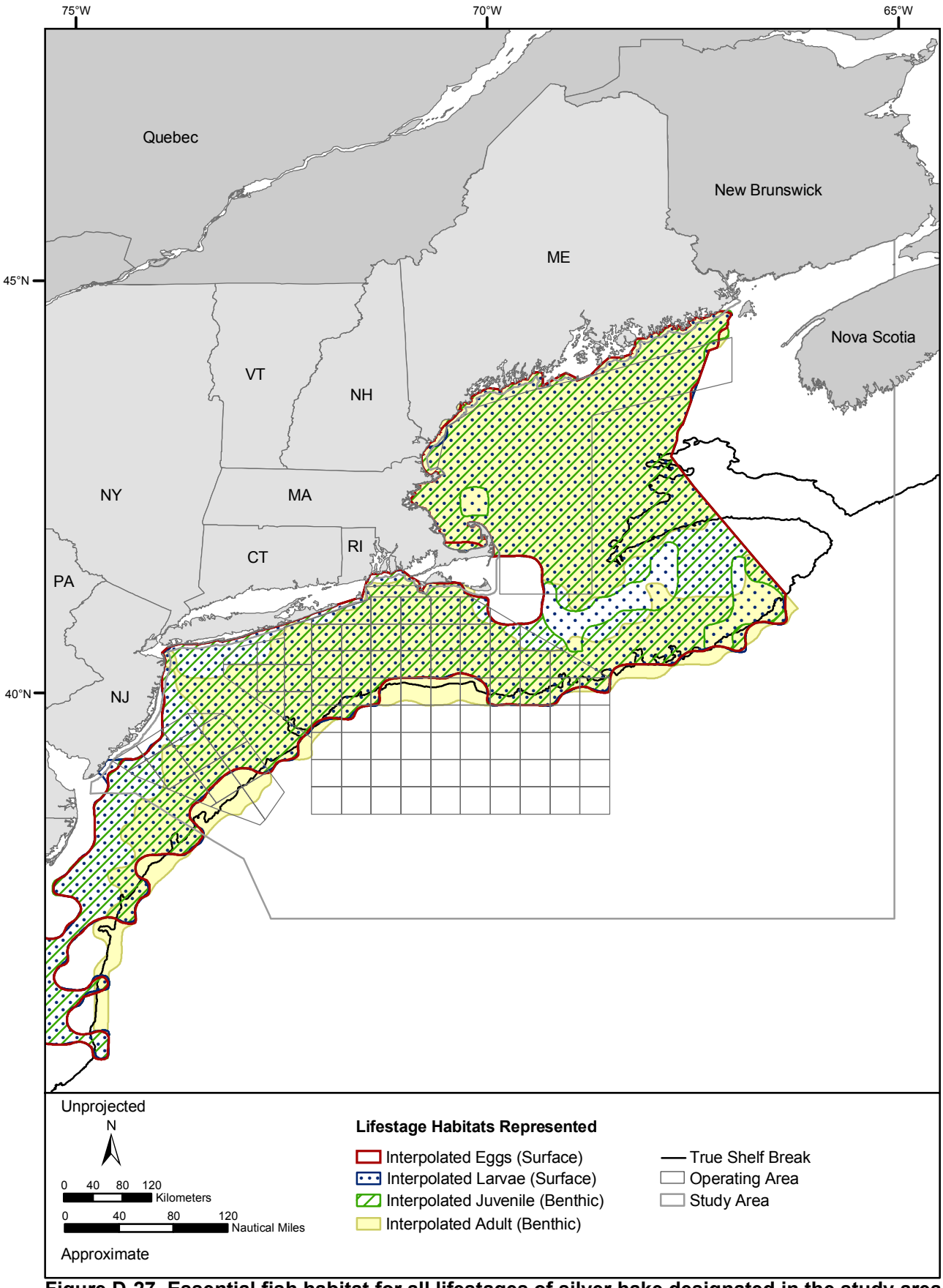

Figure D-27. Essential fish habitat for all lifestages of silver hake designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

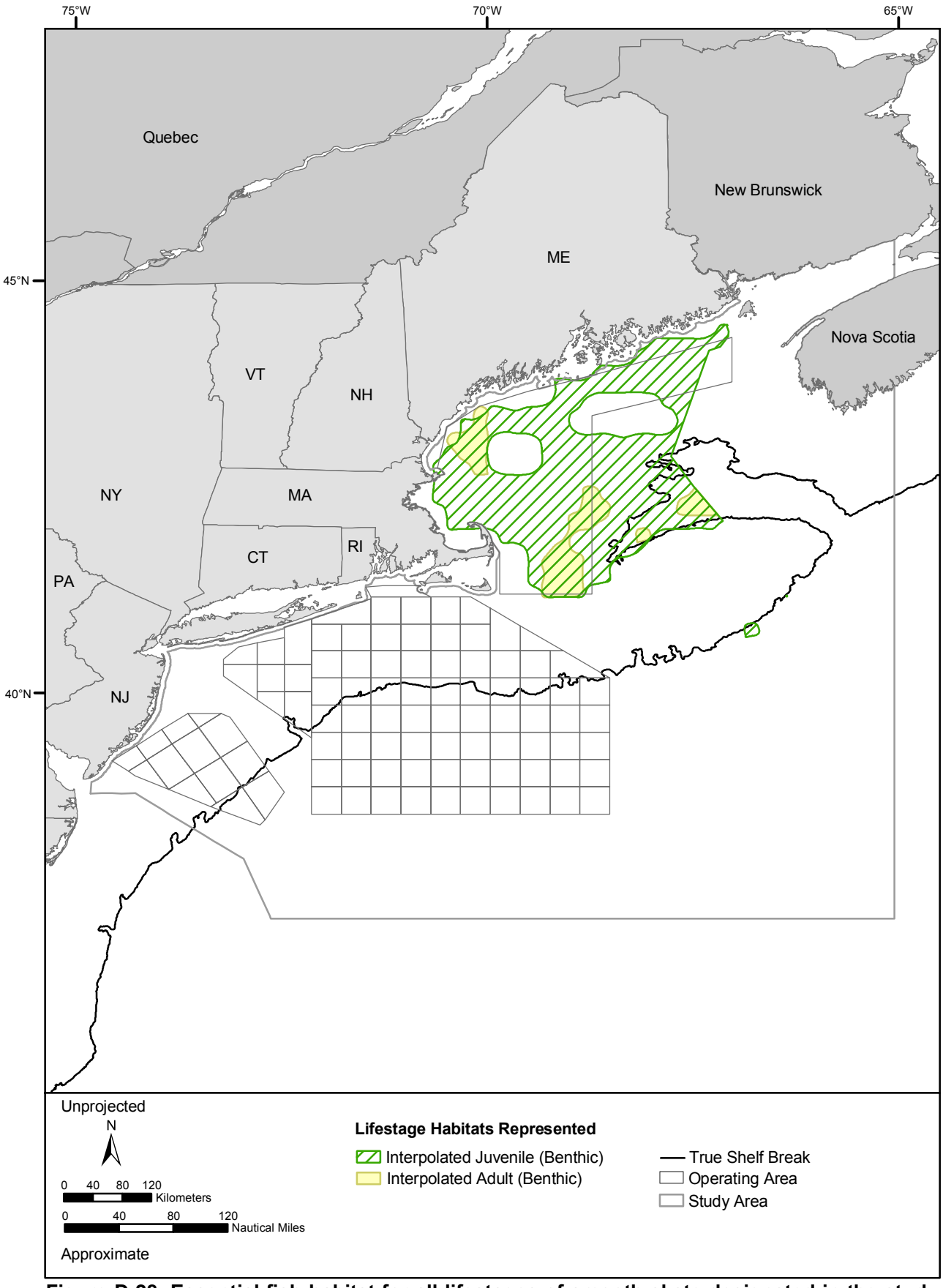

Figure D-28. Essential fish habitat for all lifestages of smooth skate designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2003a).

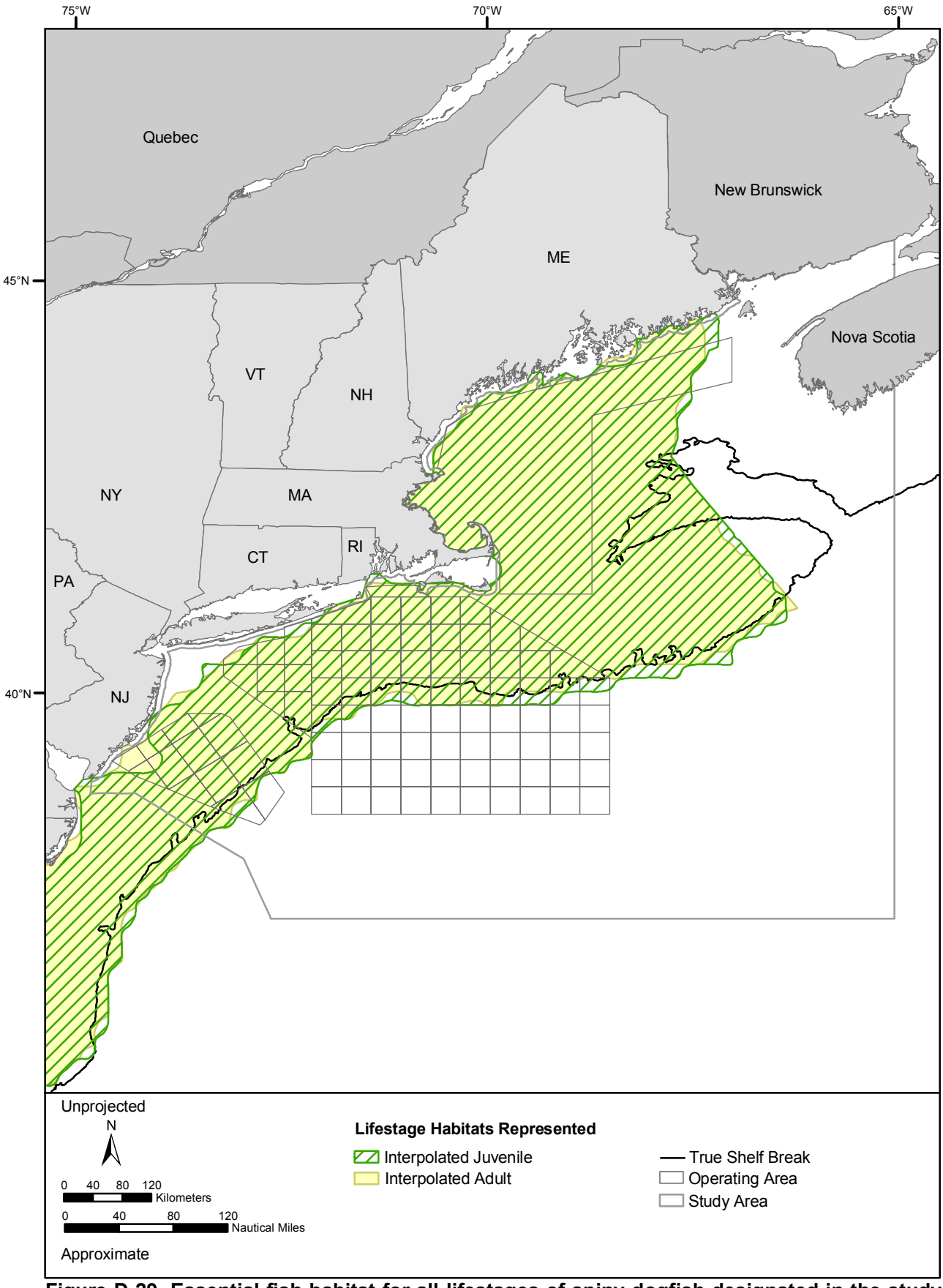

Figure D-29. Essential fish habitat for all lifestages of spiny dogfish designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC and NEFMC (1999).

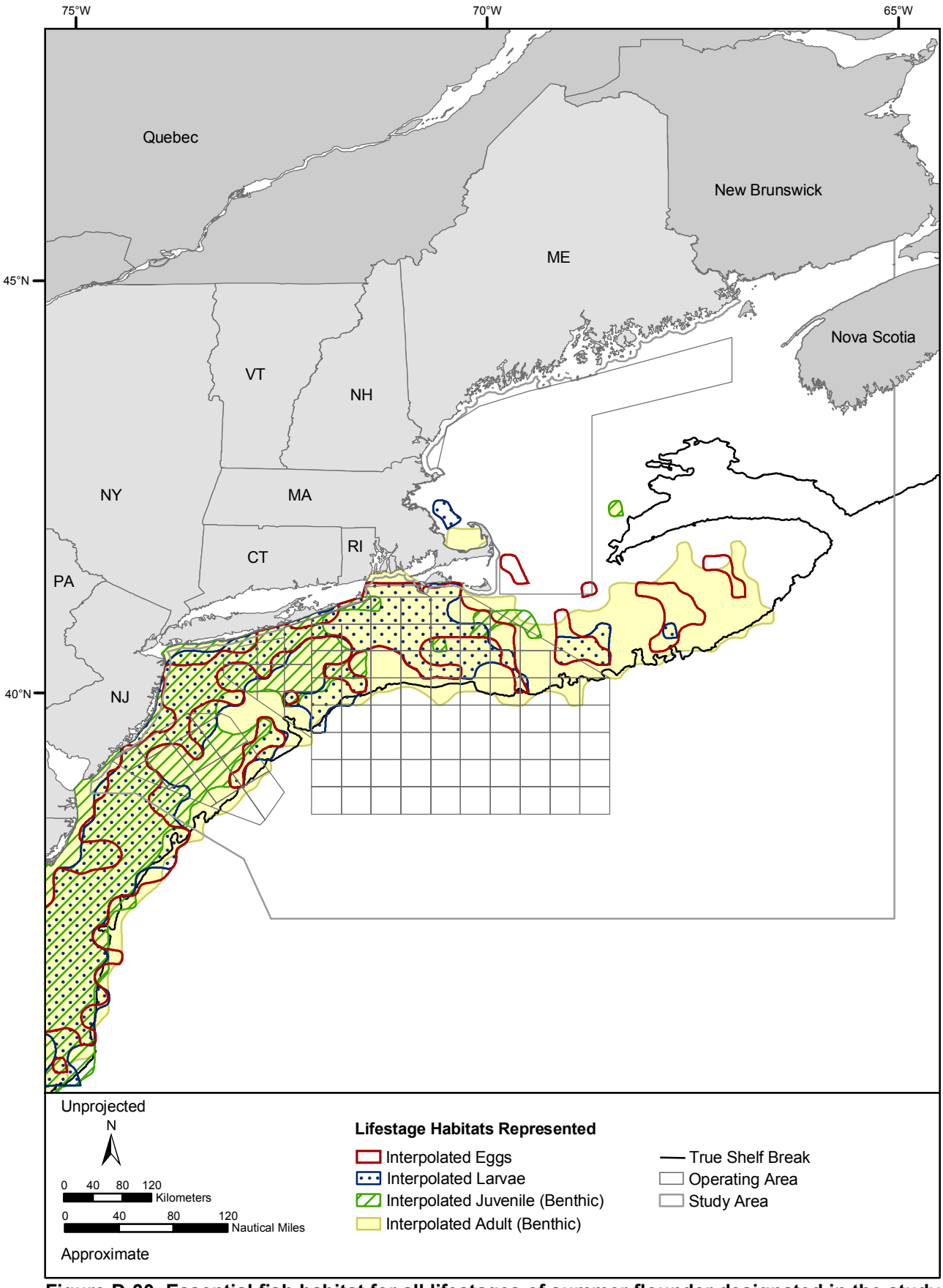

Figure D-30. Essential fish habitat for all lifestages of summer flounder designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC and ASMFC (1998a).

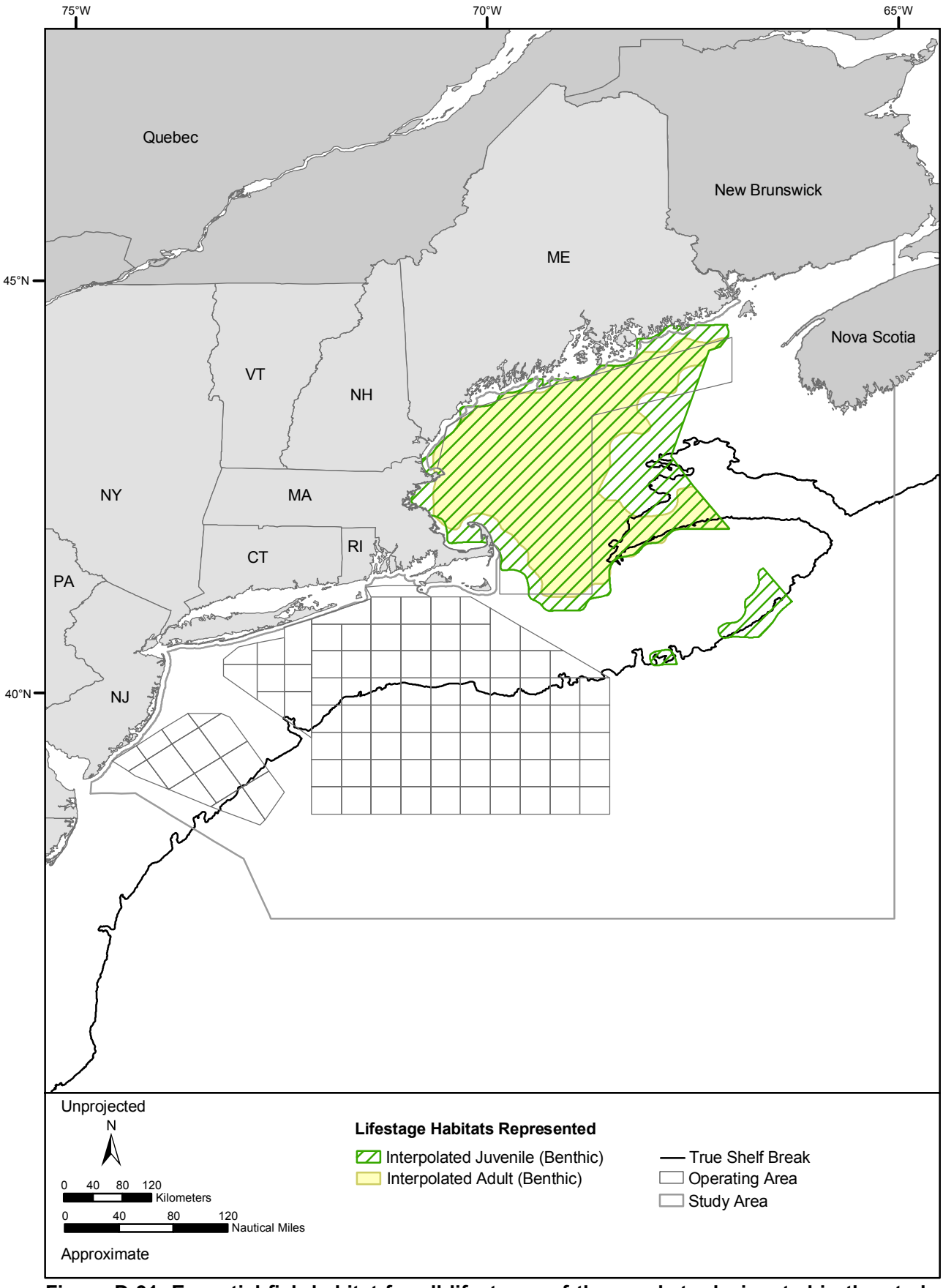

Figure D-31. Essential fish habitat for all lifestages of thorny skate designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2003a).

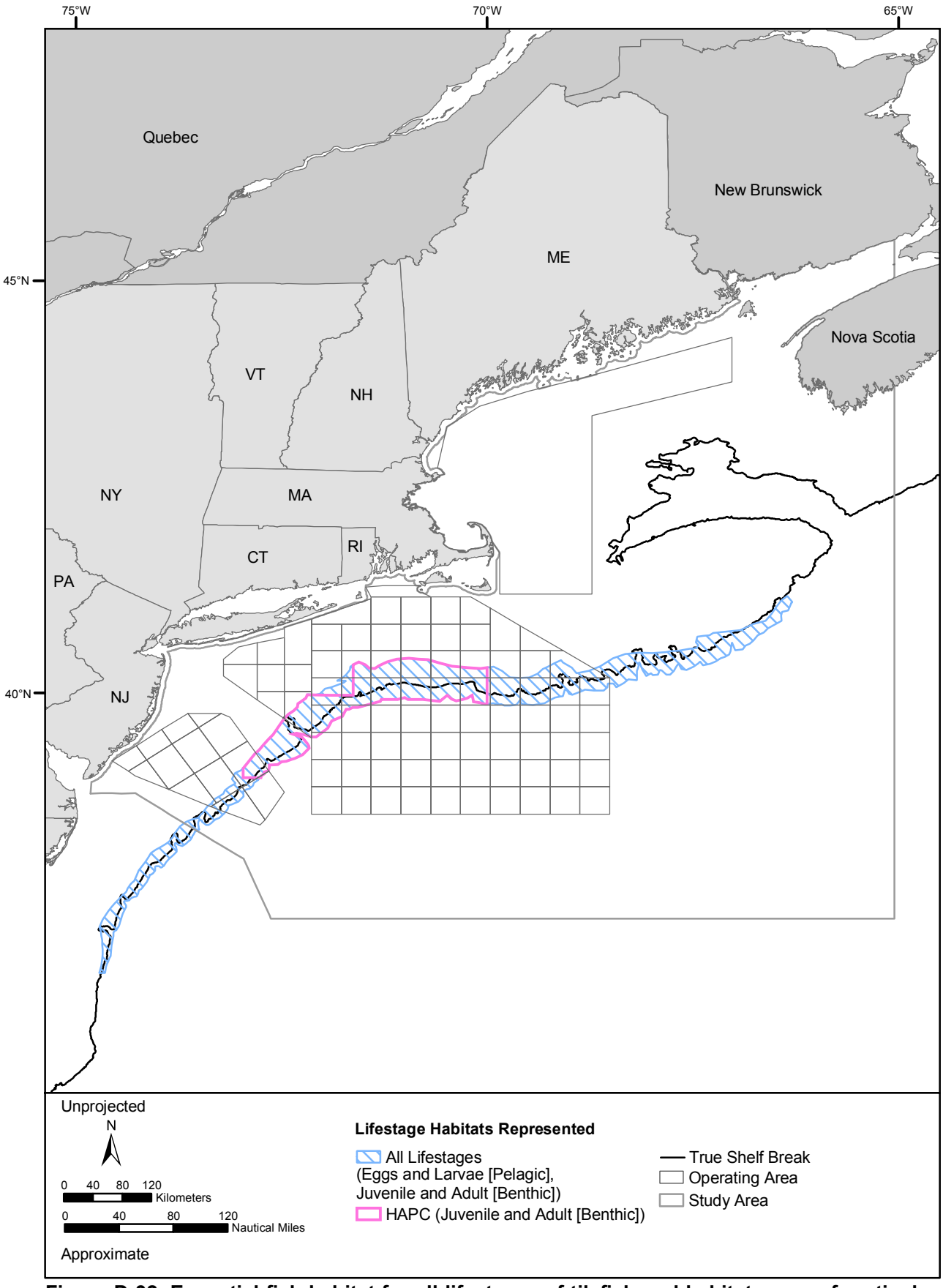

Figure D-32. Essential fish habitat for all lifestages of tilefish and habitat areas of particular concern (HAPC) designated in the study area for the NE OPAREAs. Source map (scanned): MAFMC (2000).

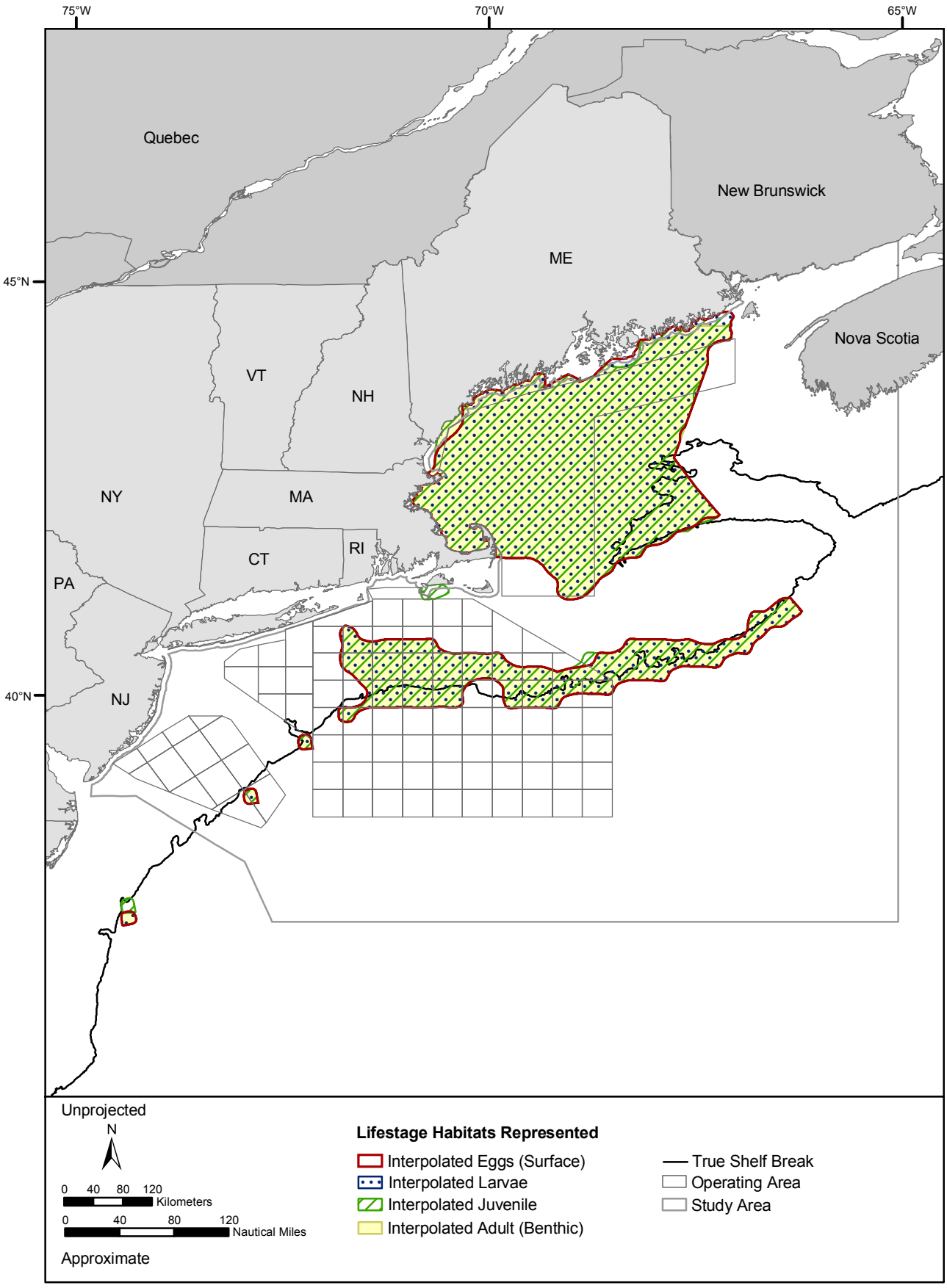

Figure D-33. Essential fish habitat for all lifestages of white hake designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

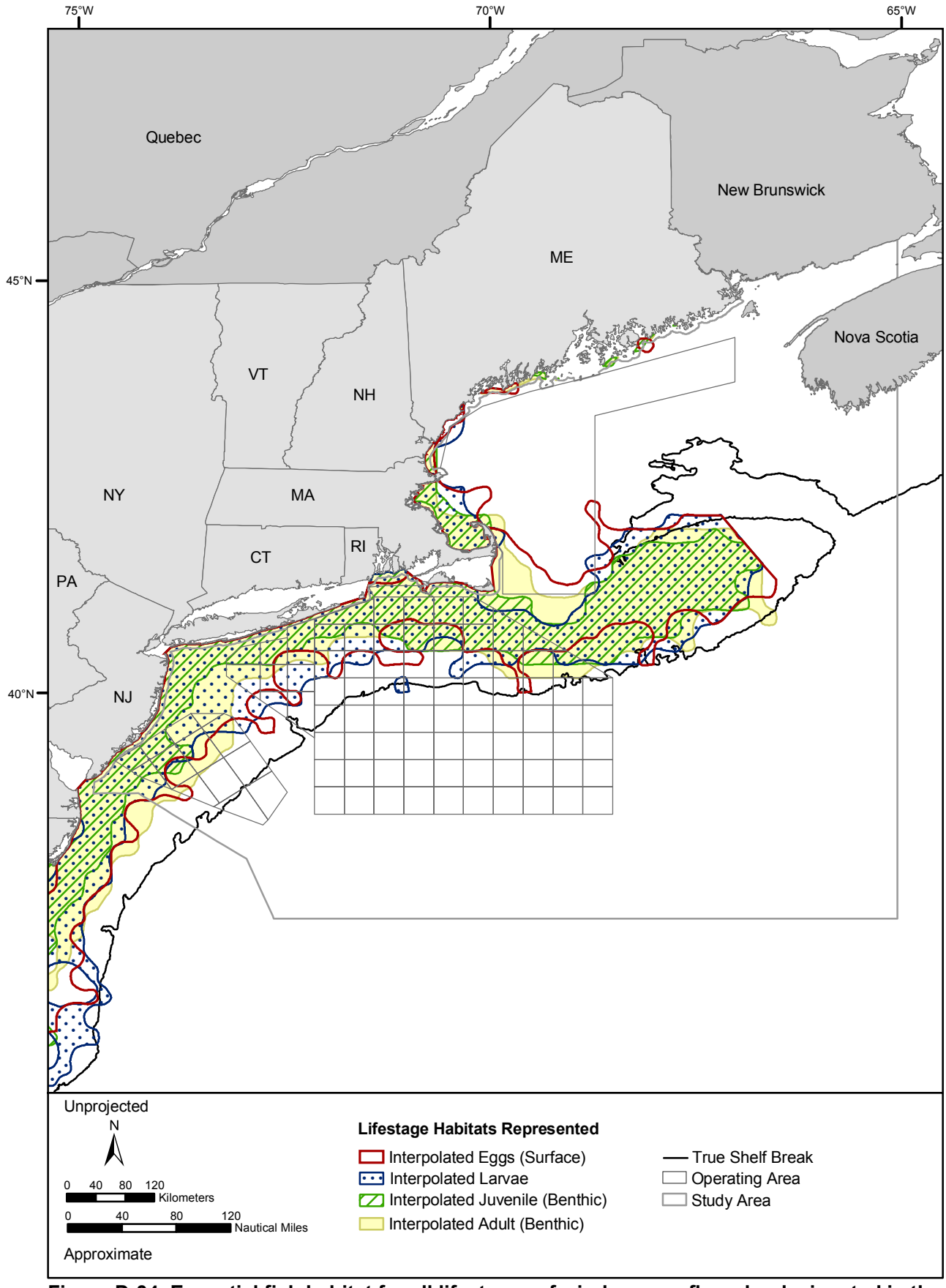

Figure D-34. Essential fish habitat for all lifestages of windowpane flounder designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

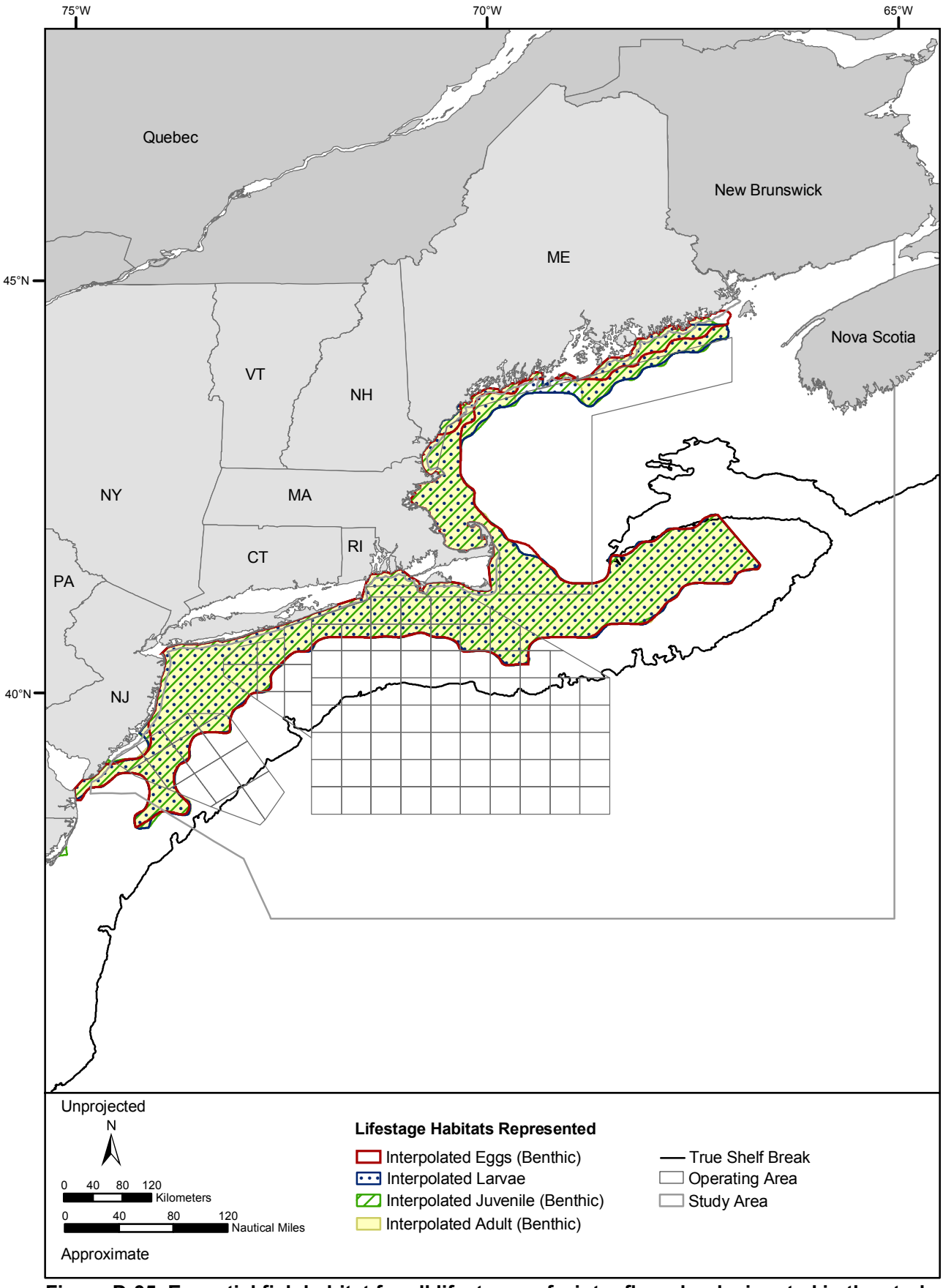

Figure D-35. Essential fish habitat for all lifestages of winter flounder designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

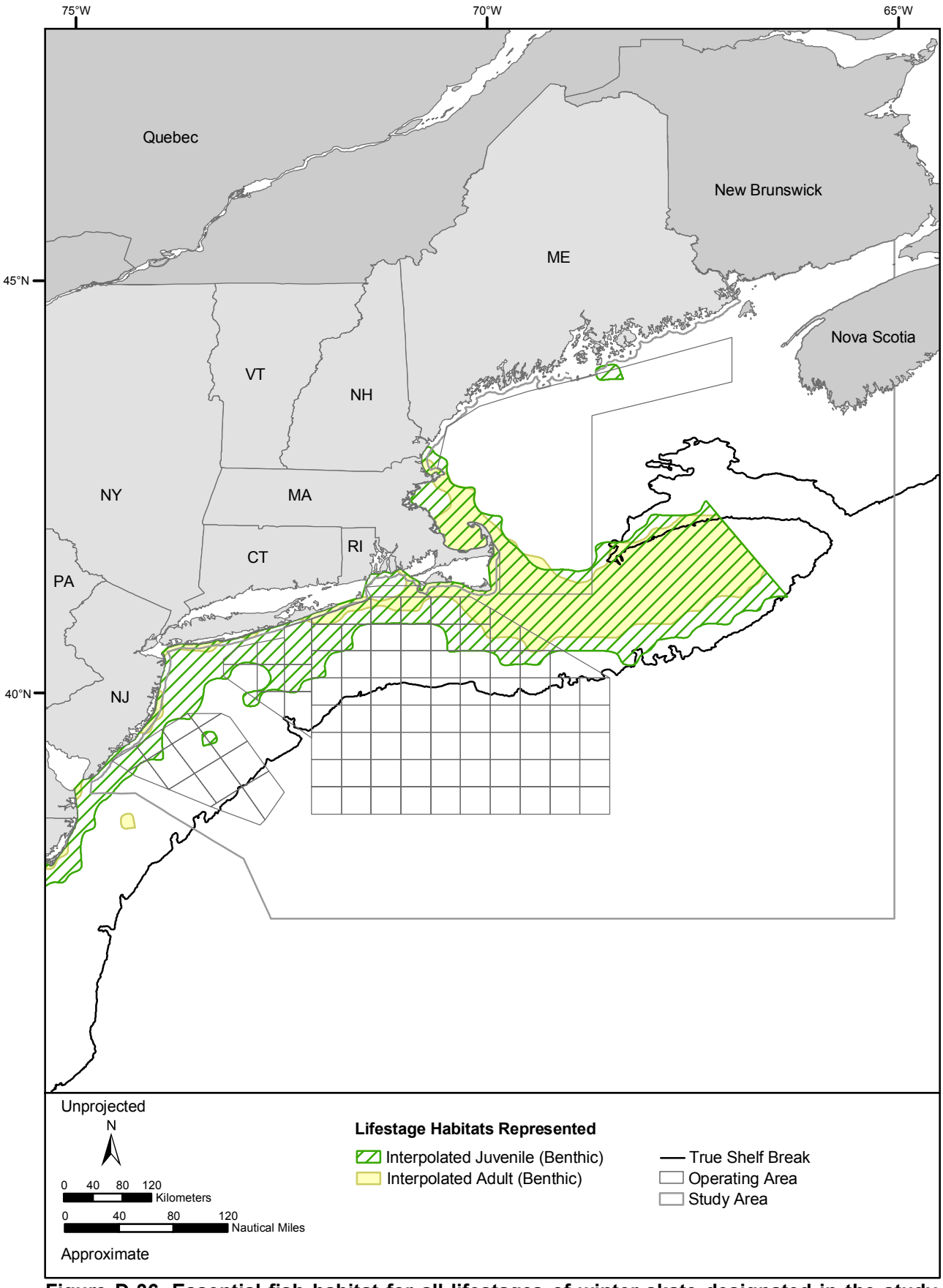

Figure D-36. Essential fish habitat for all lifestages of winter skate designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (2003a).

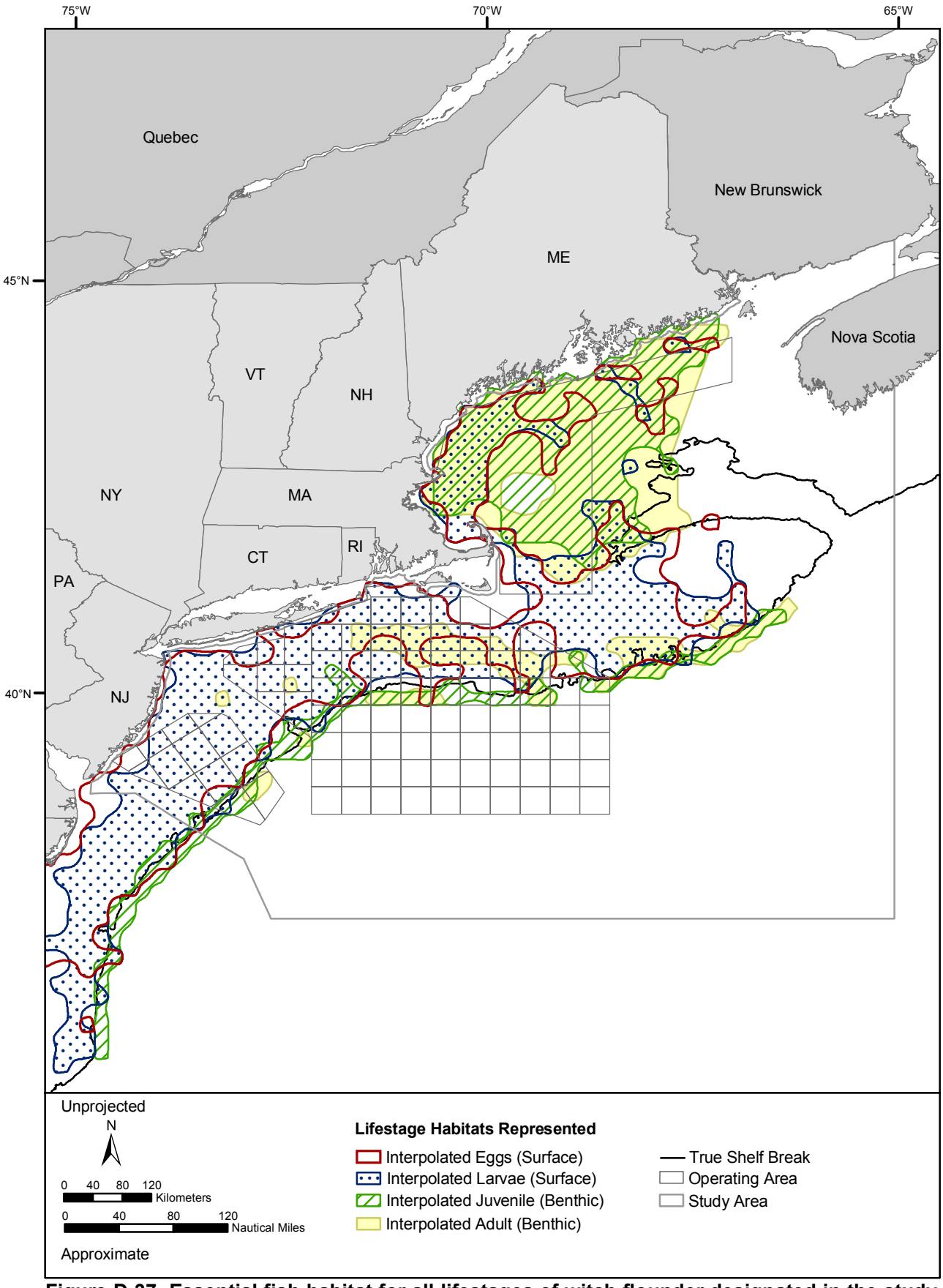

Figure D-37. Essential fish habitat for all lifestages of witch flounder designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

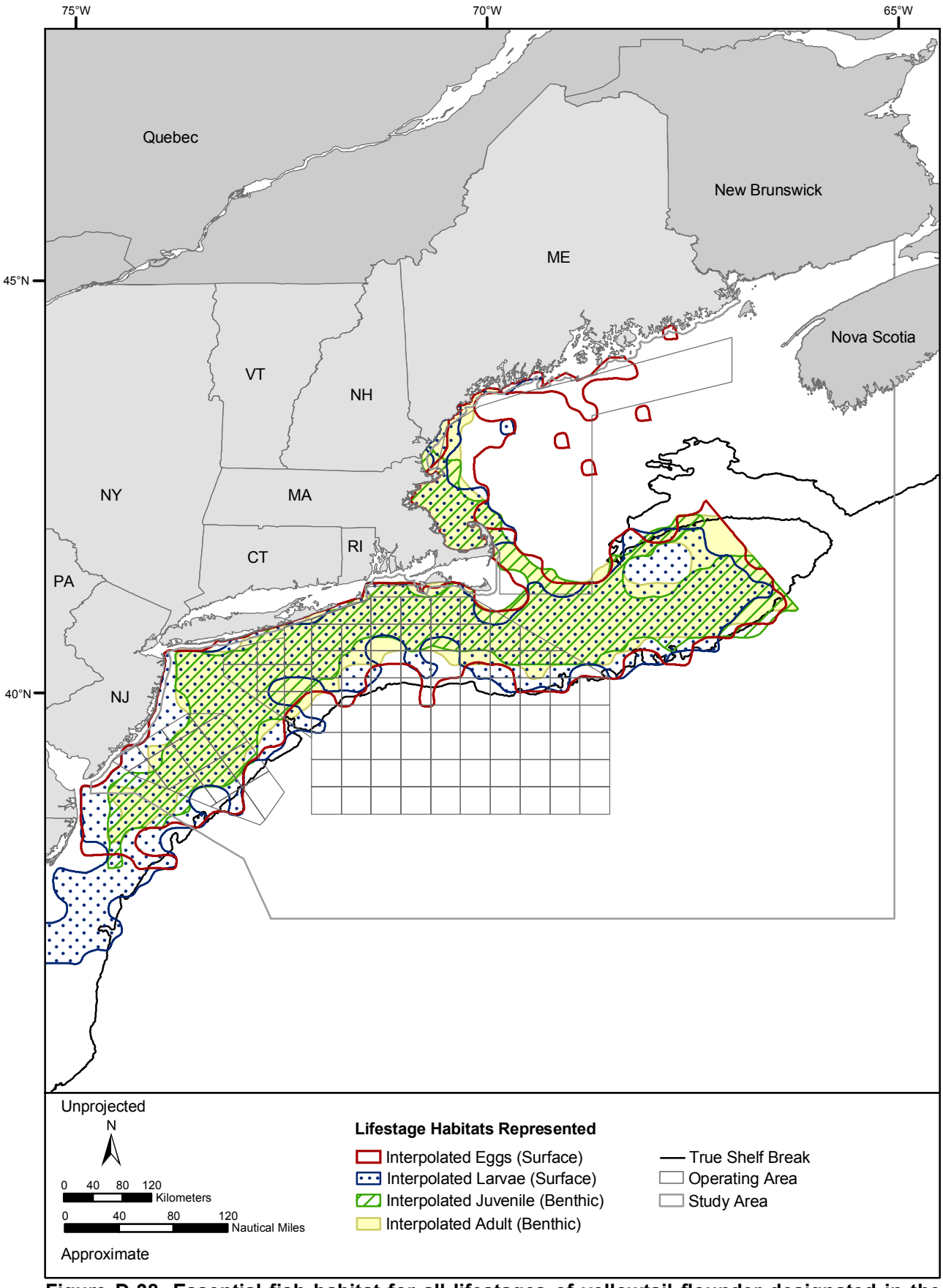

Figure D-38. Essential fish habitat for all lifestages of yellowtail flounder designated in the study area for the NE OPAREAs. Source map (scanned): NEFMC (1998).

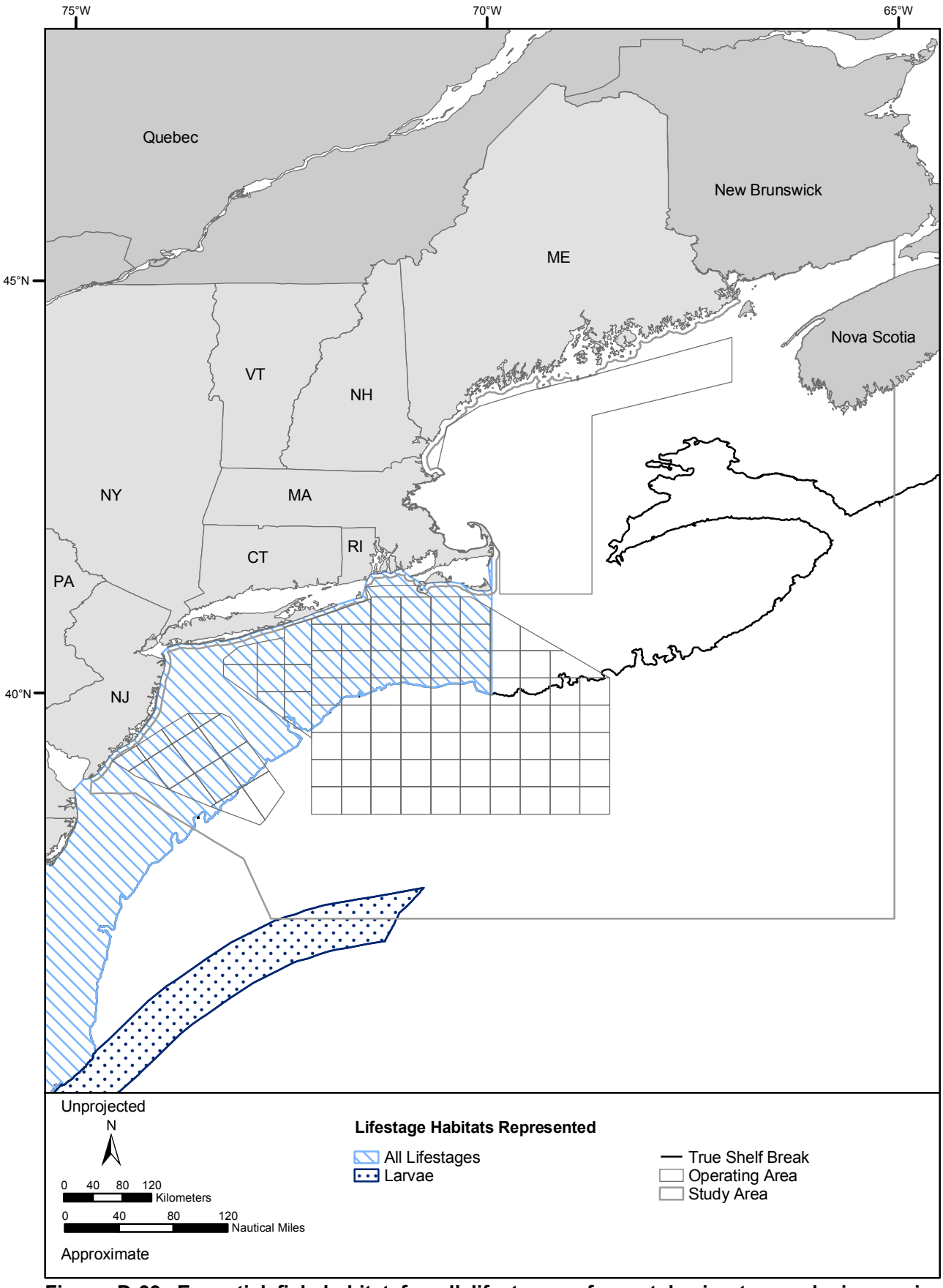

Figure D-39. Essential fish habitat for all lifestages of coastal migratory pelagic species designated in the study area for the NE OPAREAs. Map adapted from: SAFMC (1998).

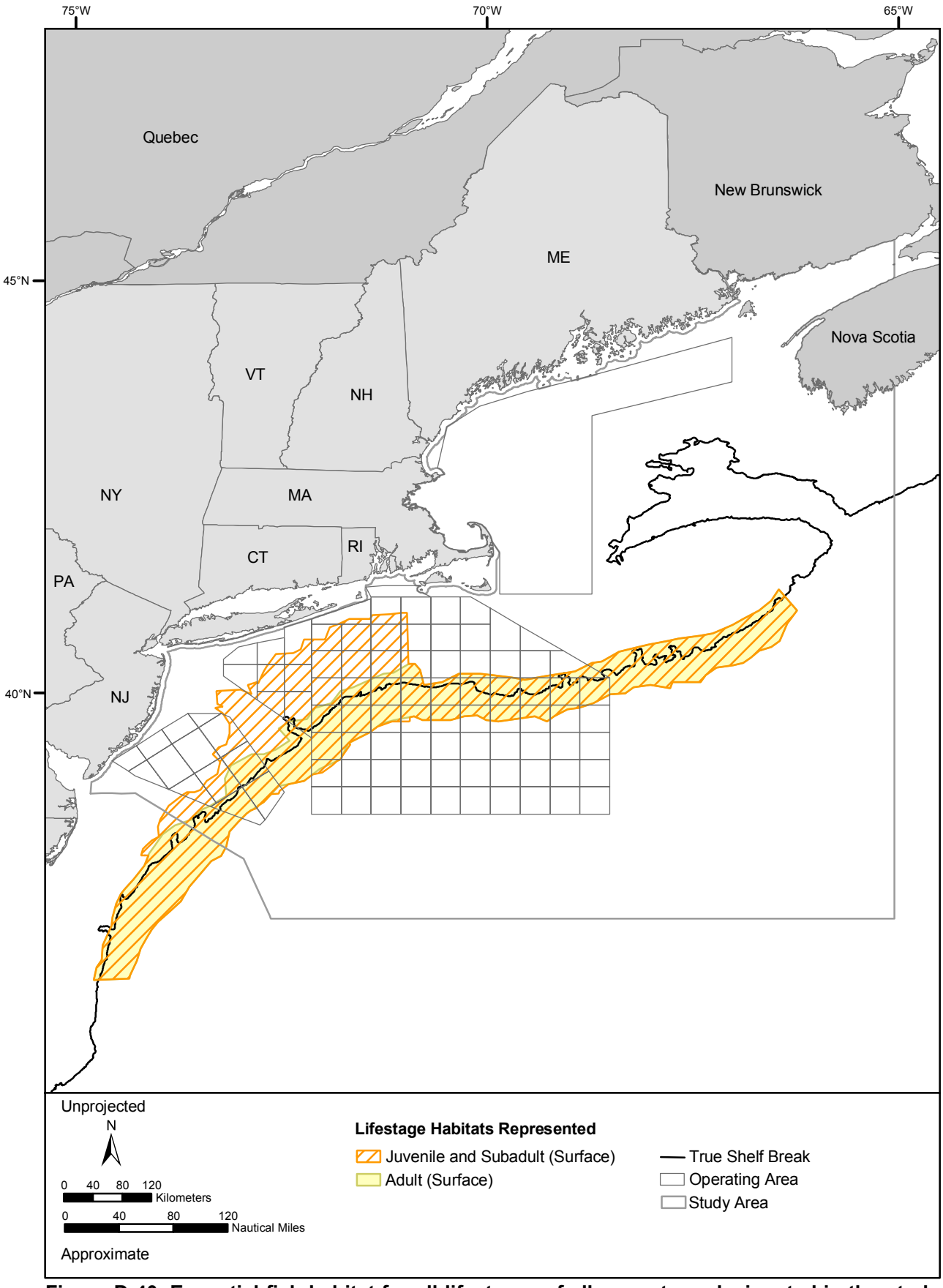

Figure D-40. Essential fish habitat for all lifestages of albacore tuna designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

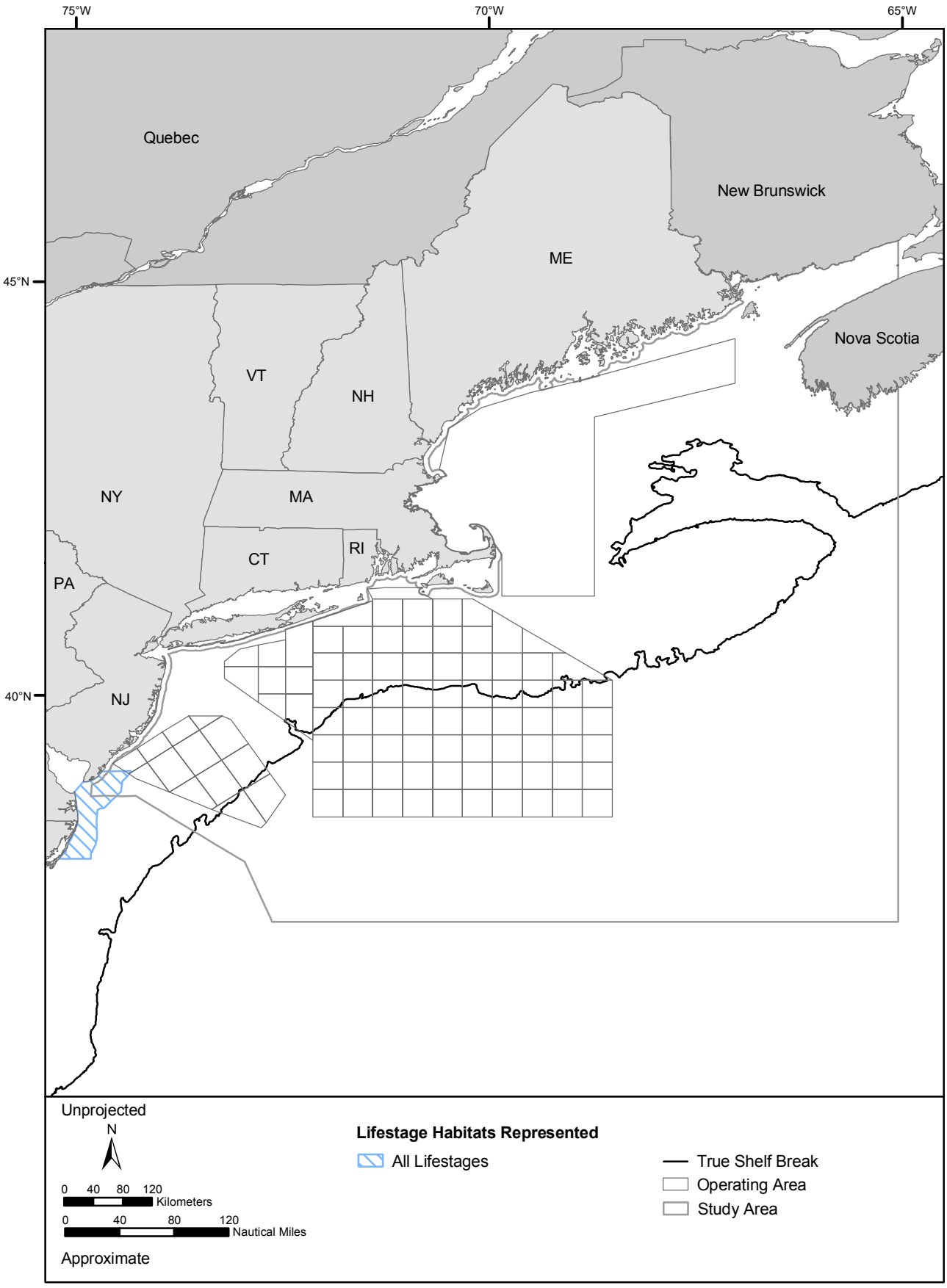

Figure D-41. Essential fish habitat for all lifestages of Atlantic angel sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

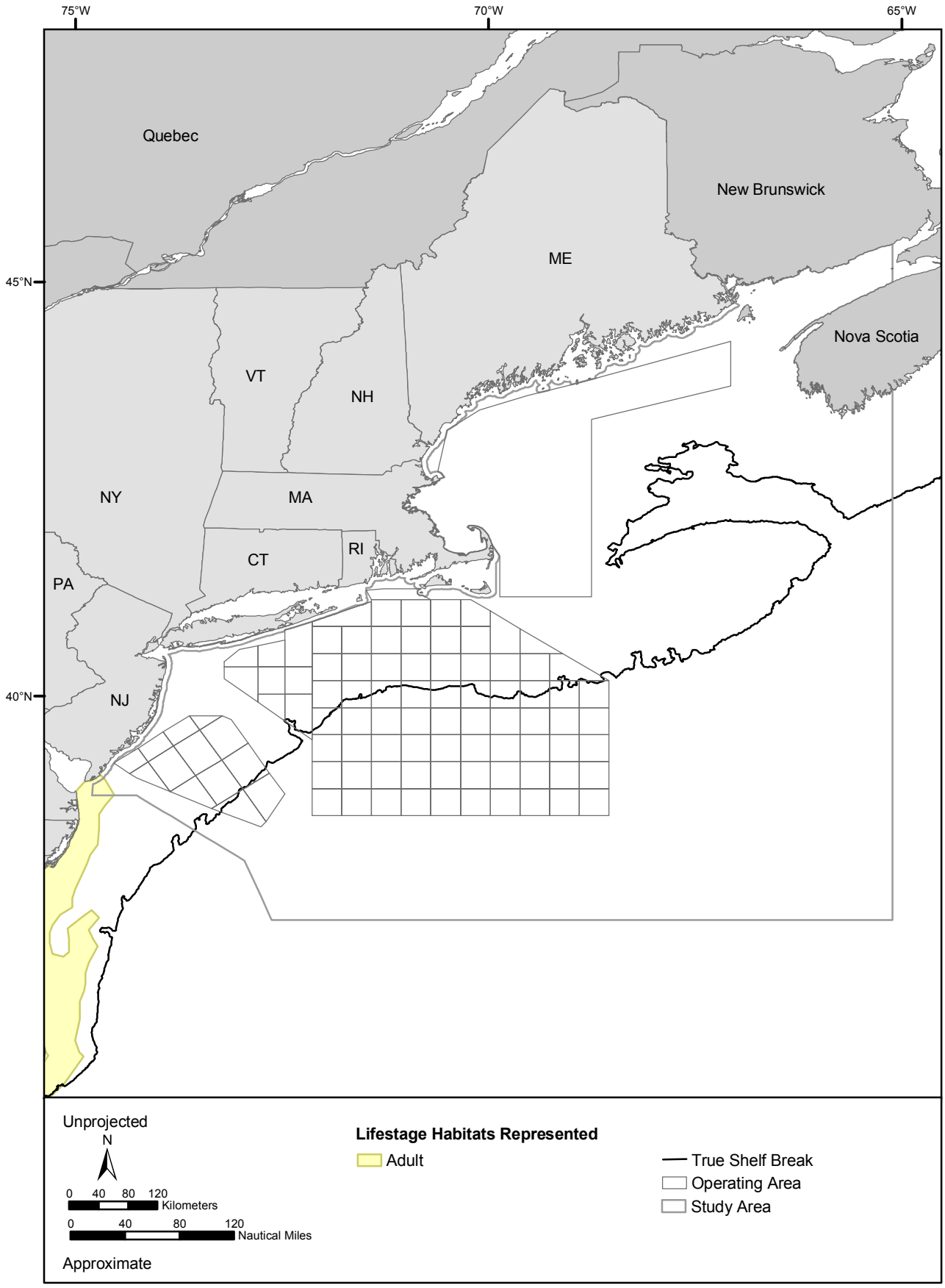

Figure D-42. Essential fish habitat for all lifestages of Atlantic sharpnose sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

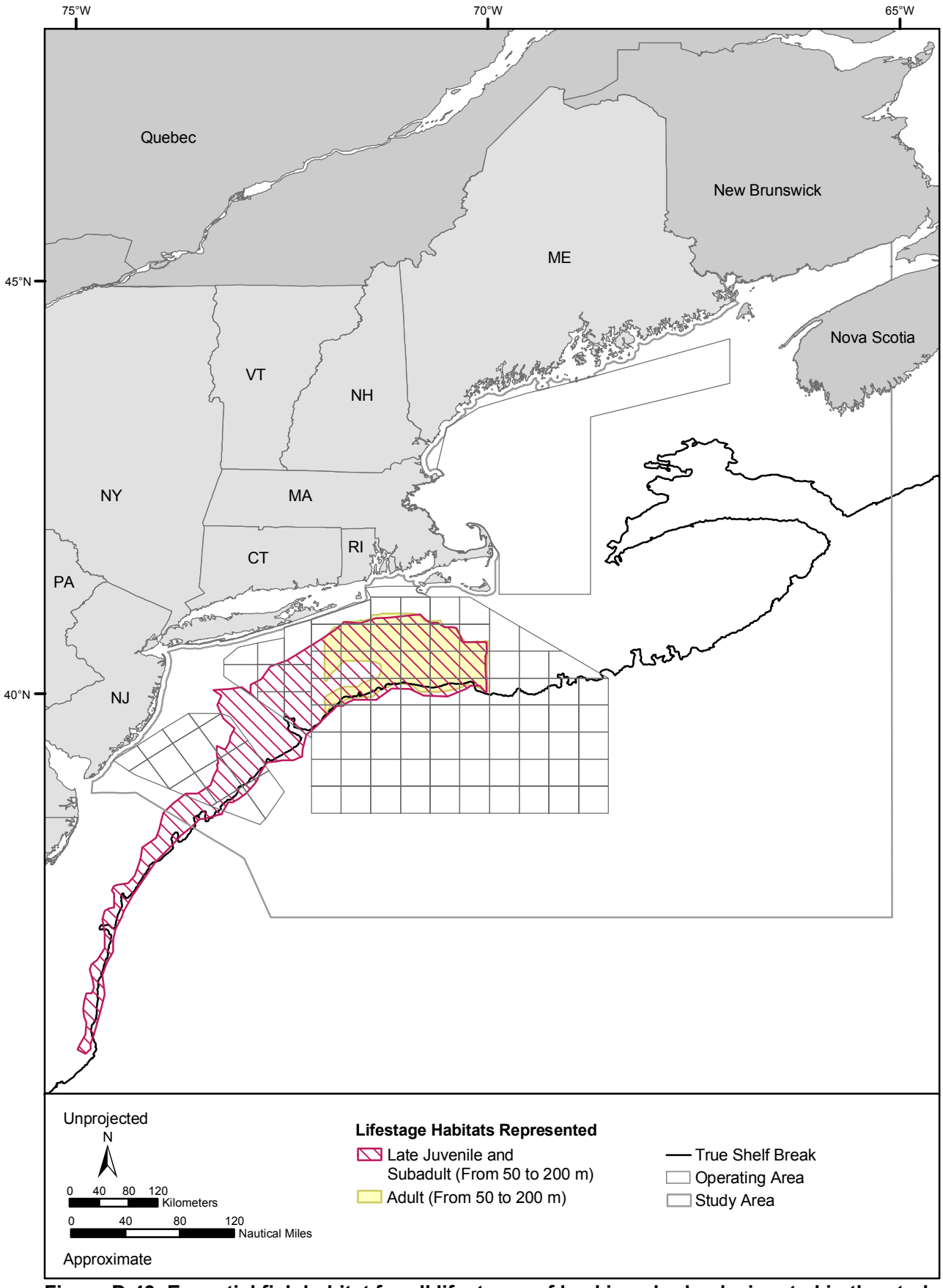

Figure D-43. Essential fish habitat for all lifestages of basking sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

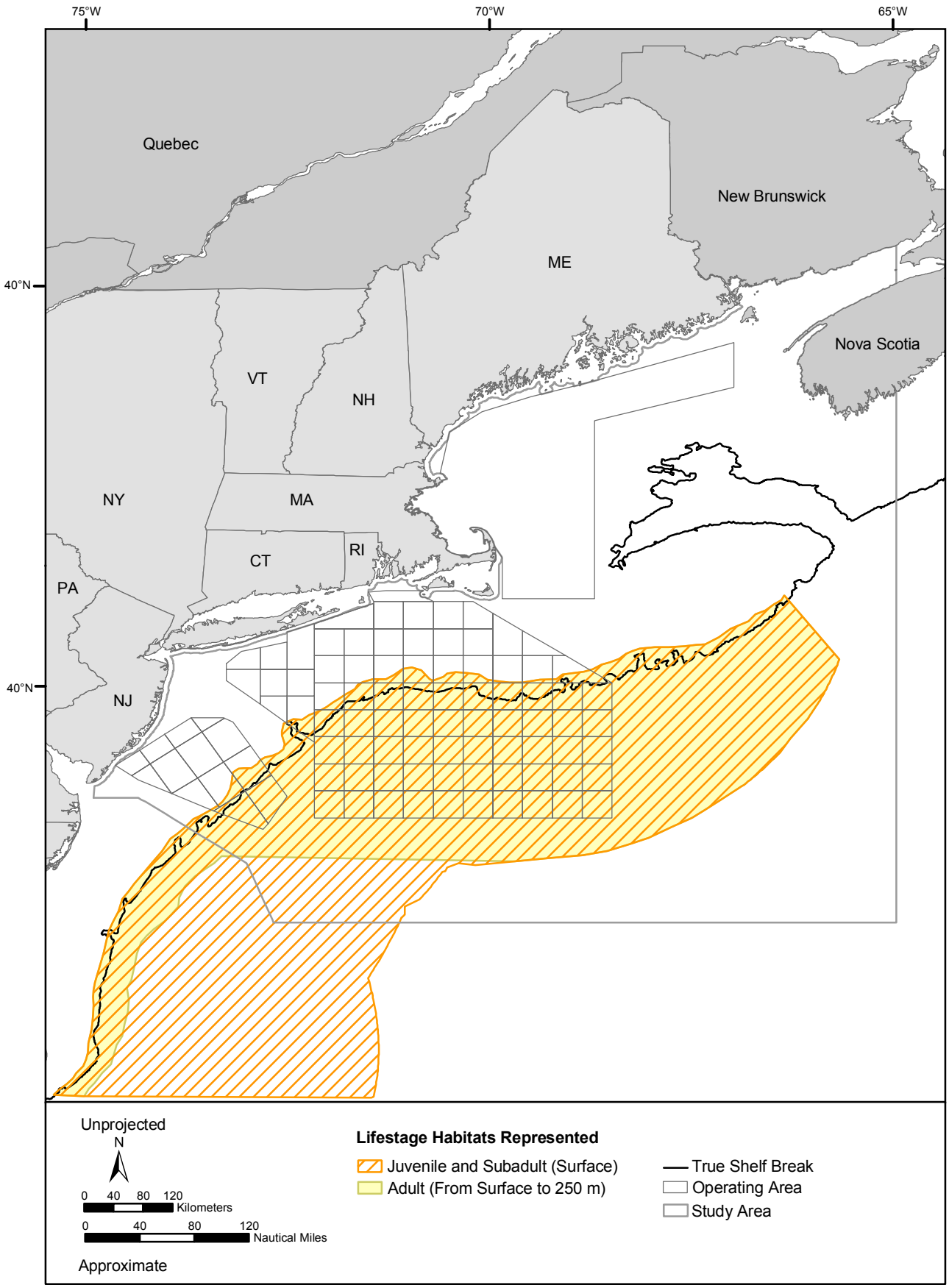

Figure D-44. Essential fish habitat for all lifestages of bigeye tuna designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

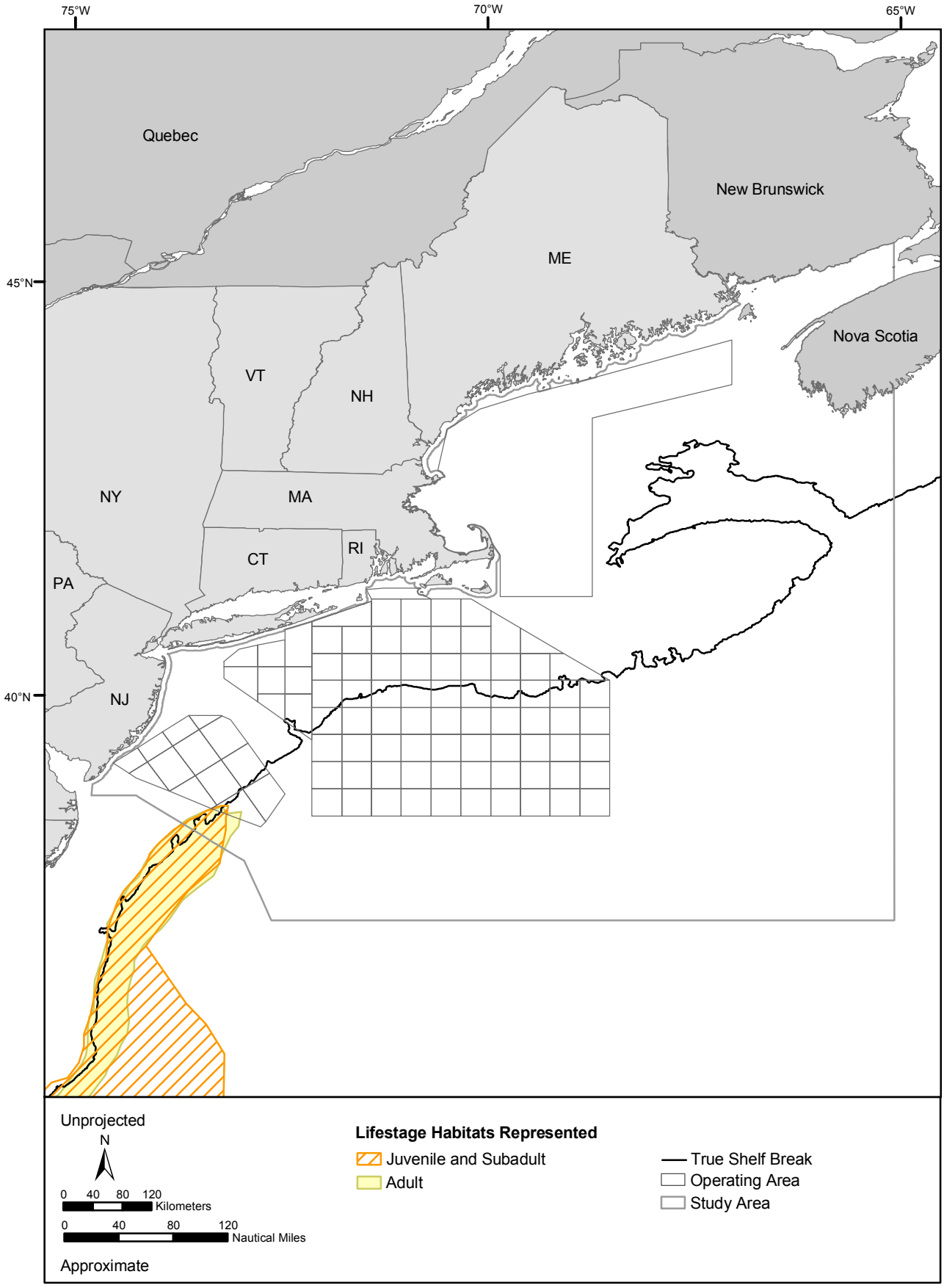

Figure D-45. Essential fish habitat for all lifestages of blue marlin designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

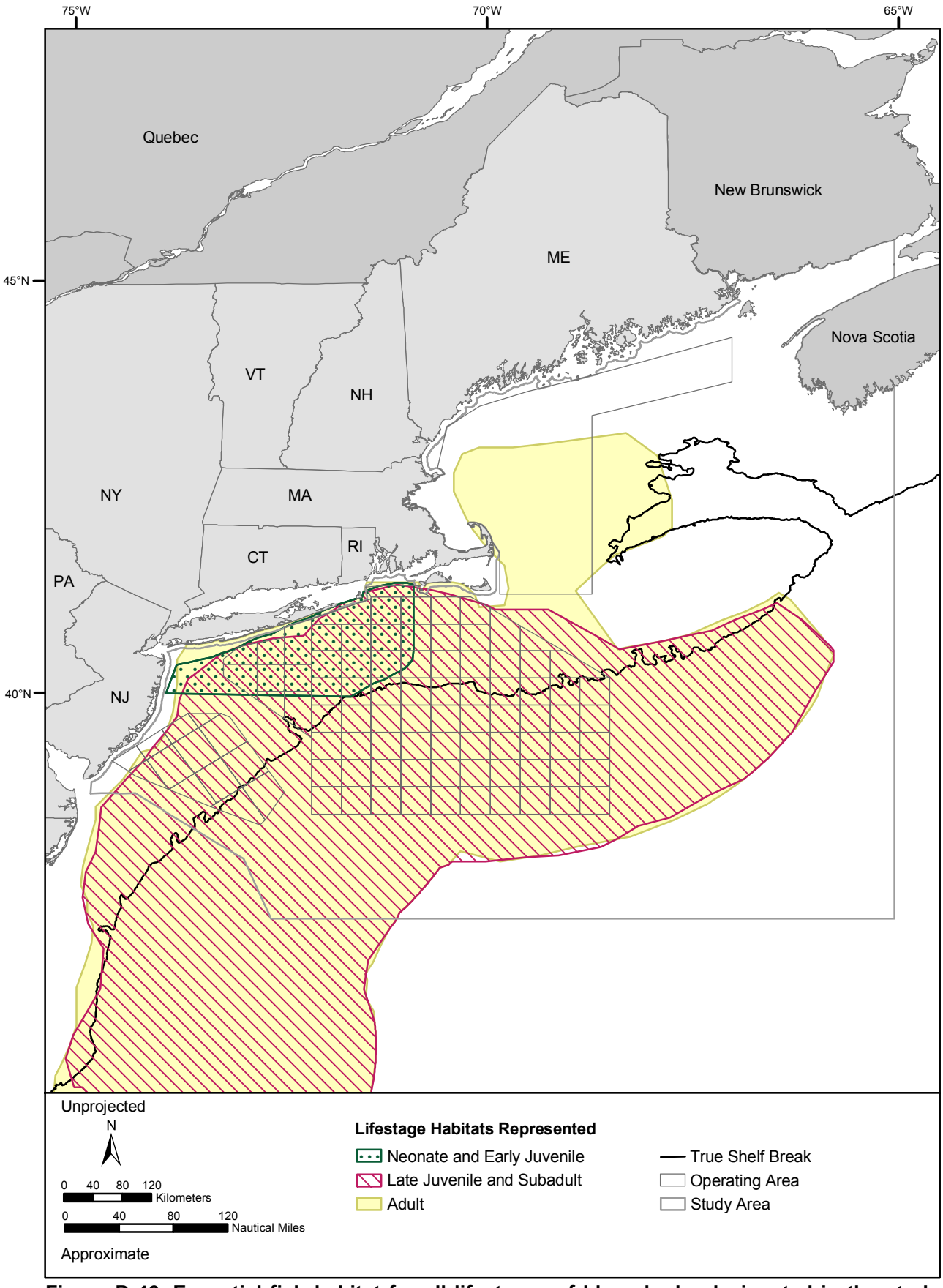

Figure D-46. Essential fish habitat for all lifestages of blue sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

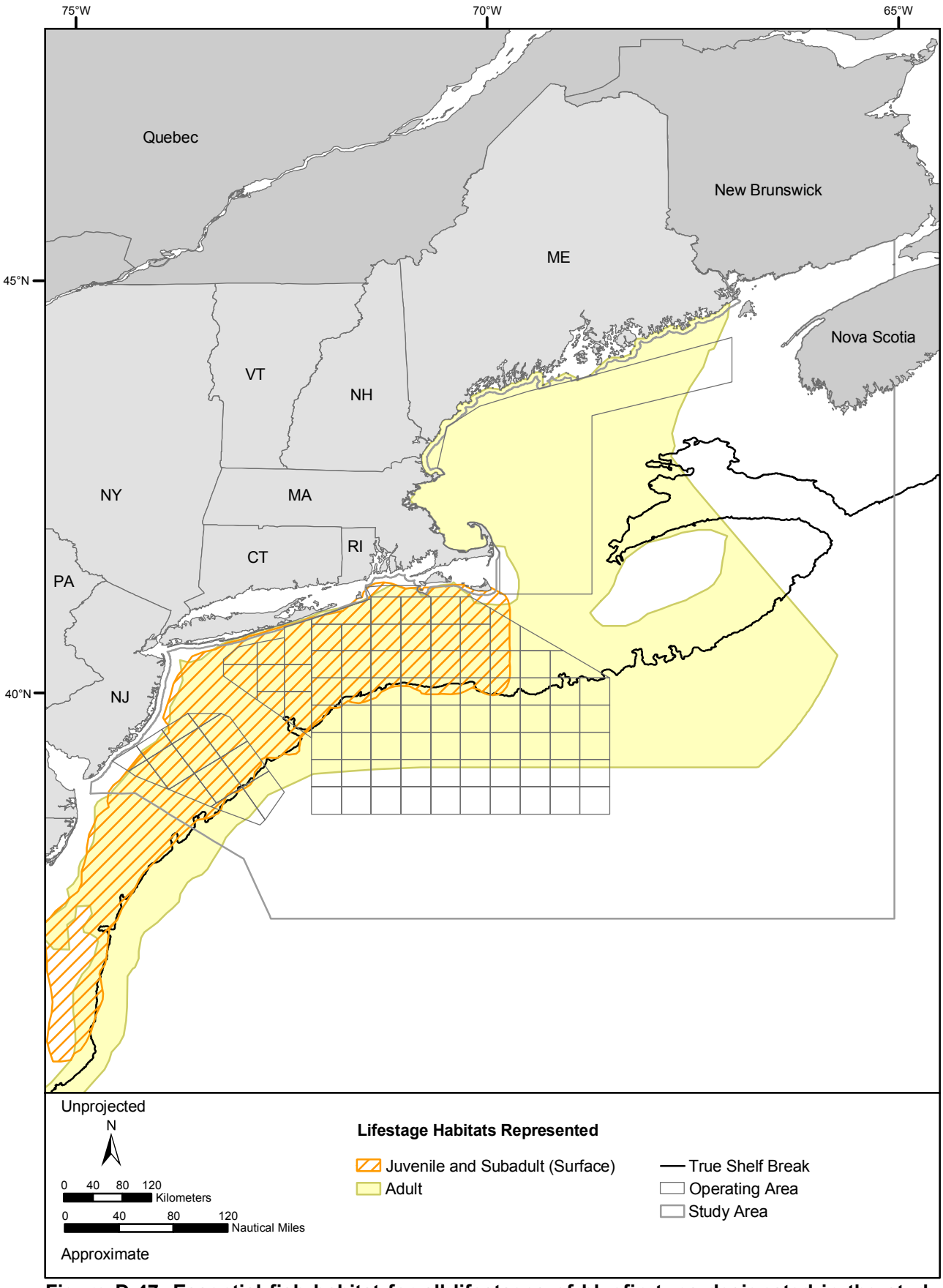

Figure D-47. Essential fish habitat for all lifestages of bluefin tuna designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

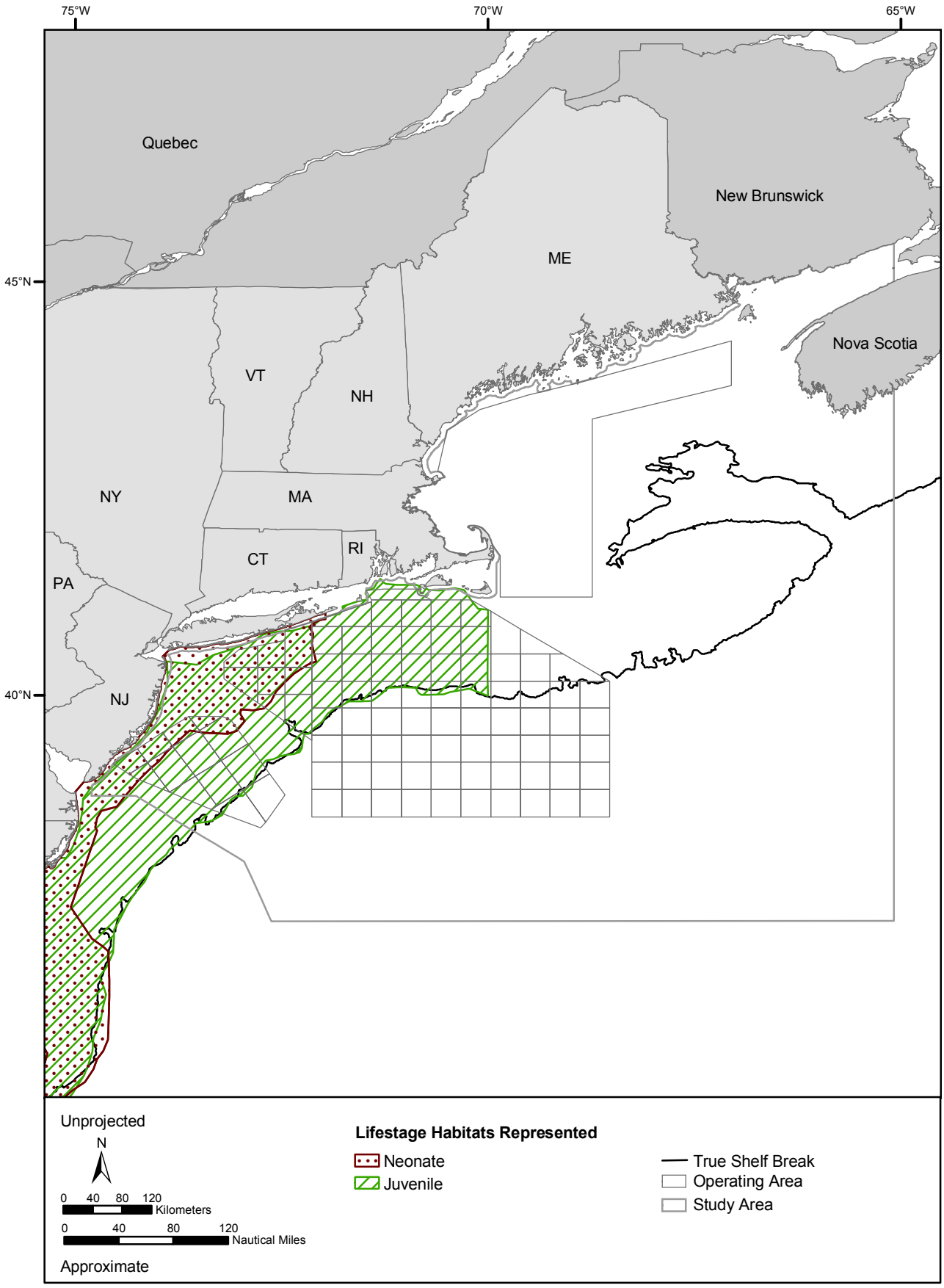

Figure D-48. Essential fish habitat for all lifestages of dusky sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

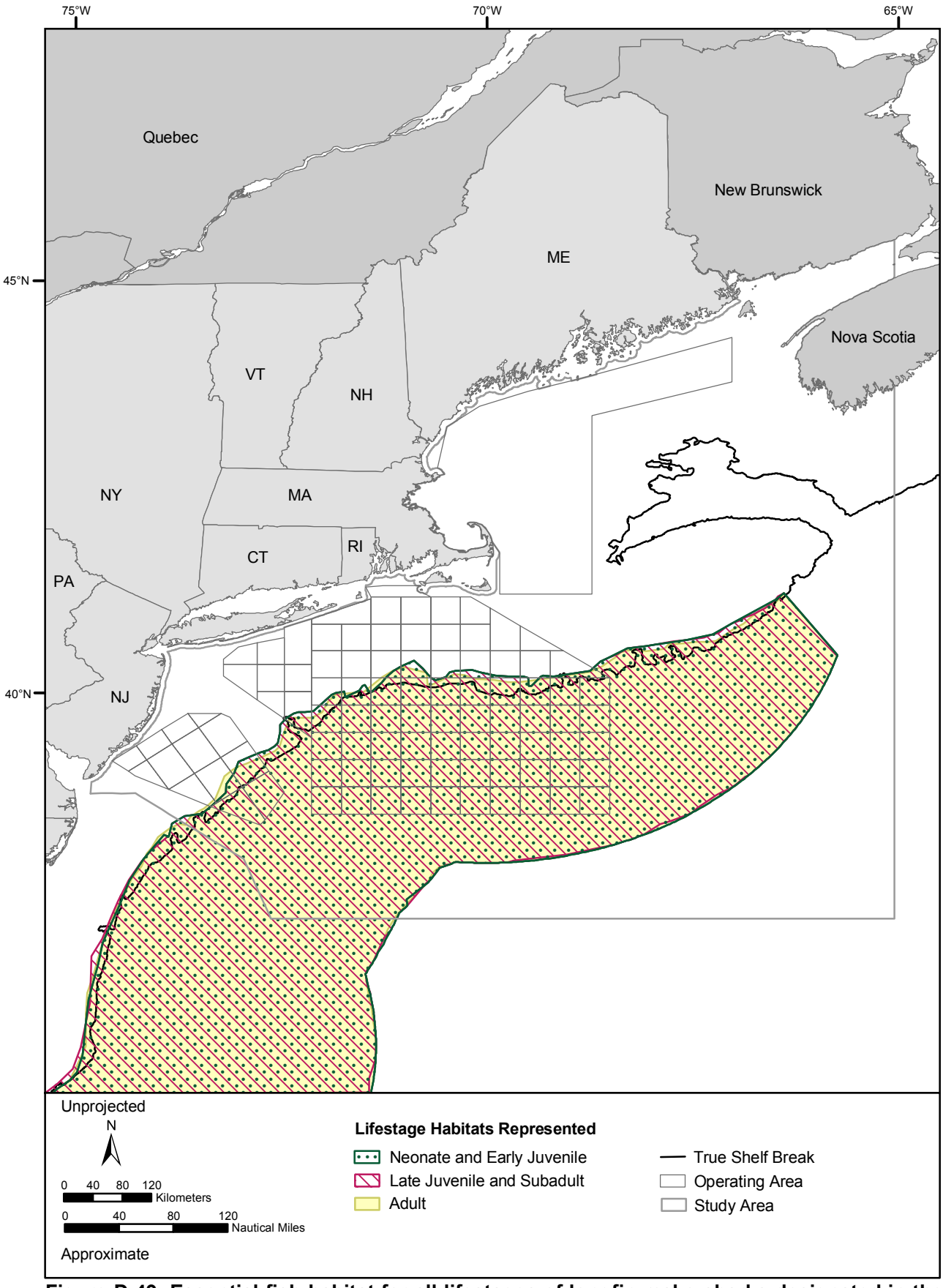

Figure D-49. Essential fish habitat for all lifestages of longfin mako sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

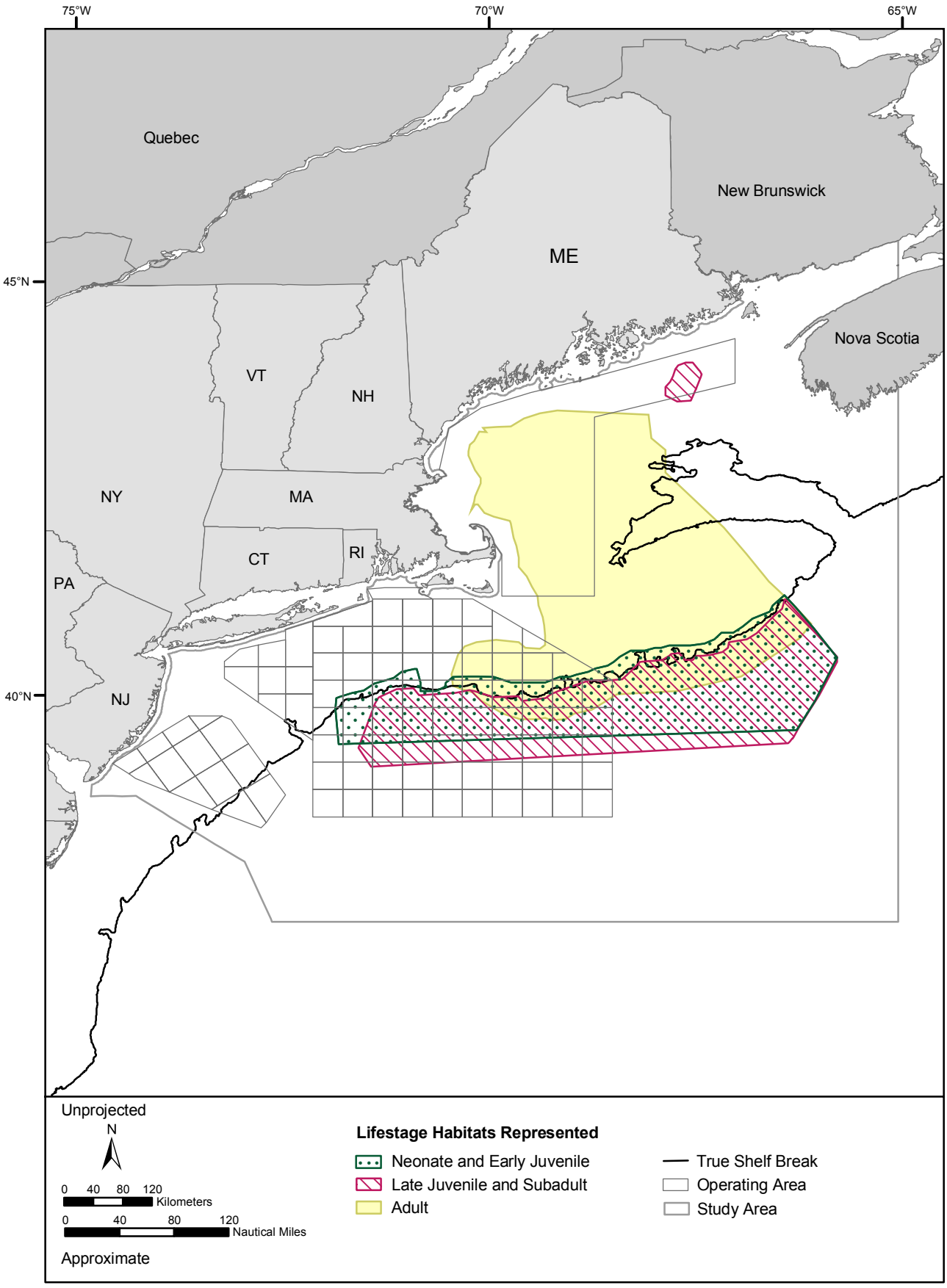

Figure D-50. Essential fish habitat for all lifestages of porbeagle sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

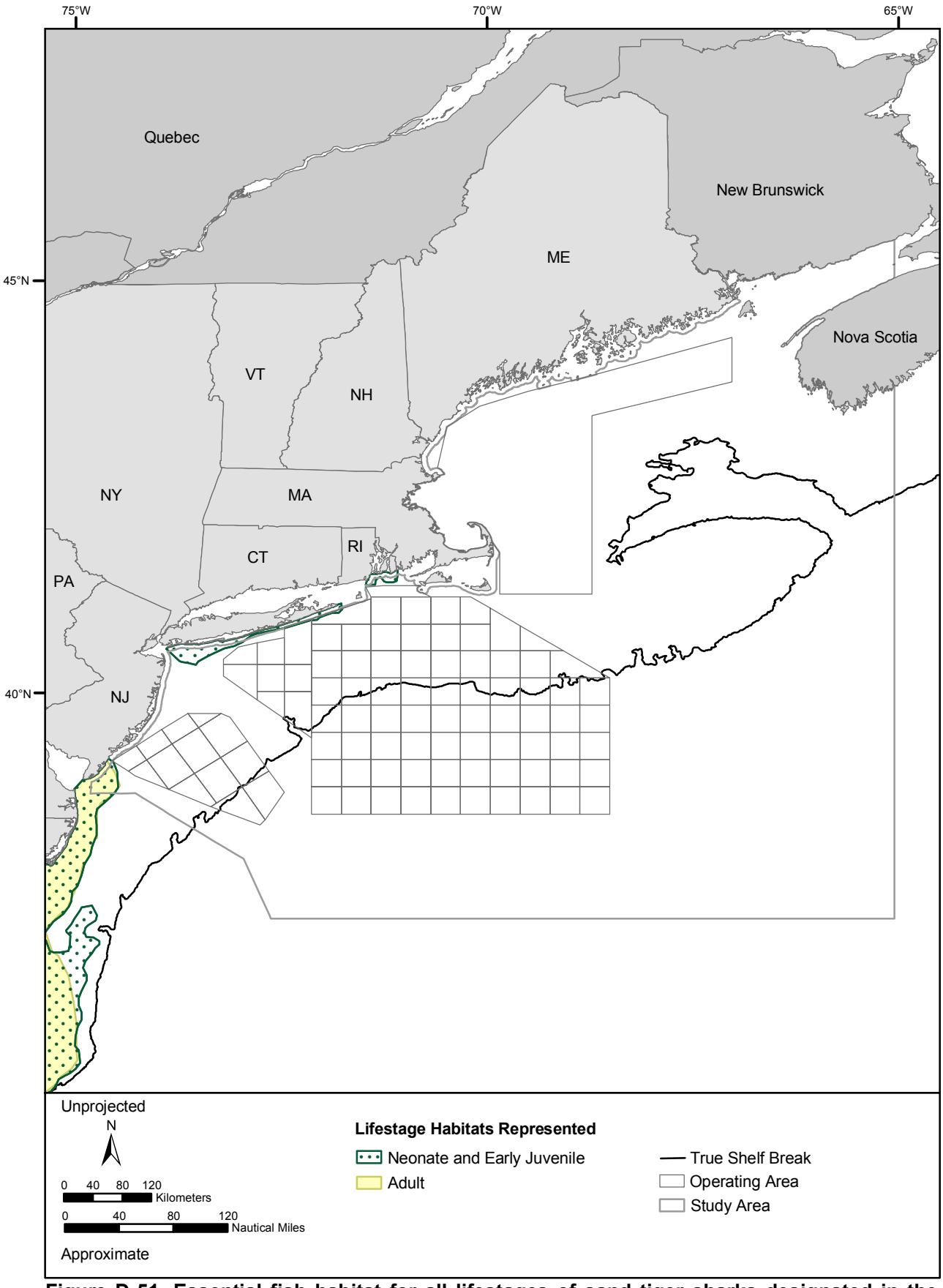

Figure D-51. Essential fish habitat for all lifestages of sand tiger sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

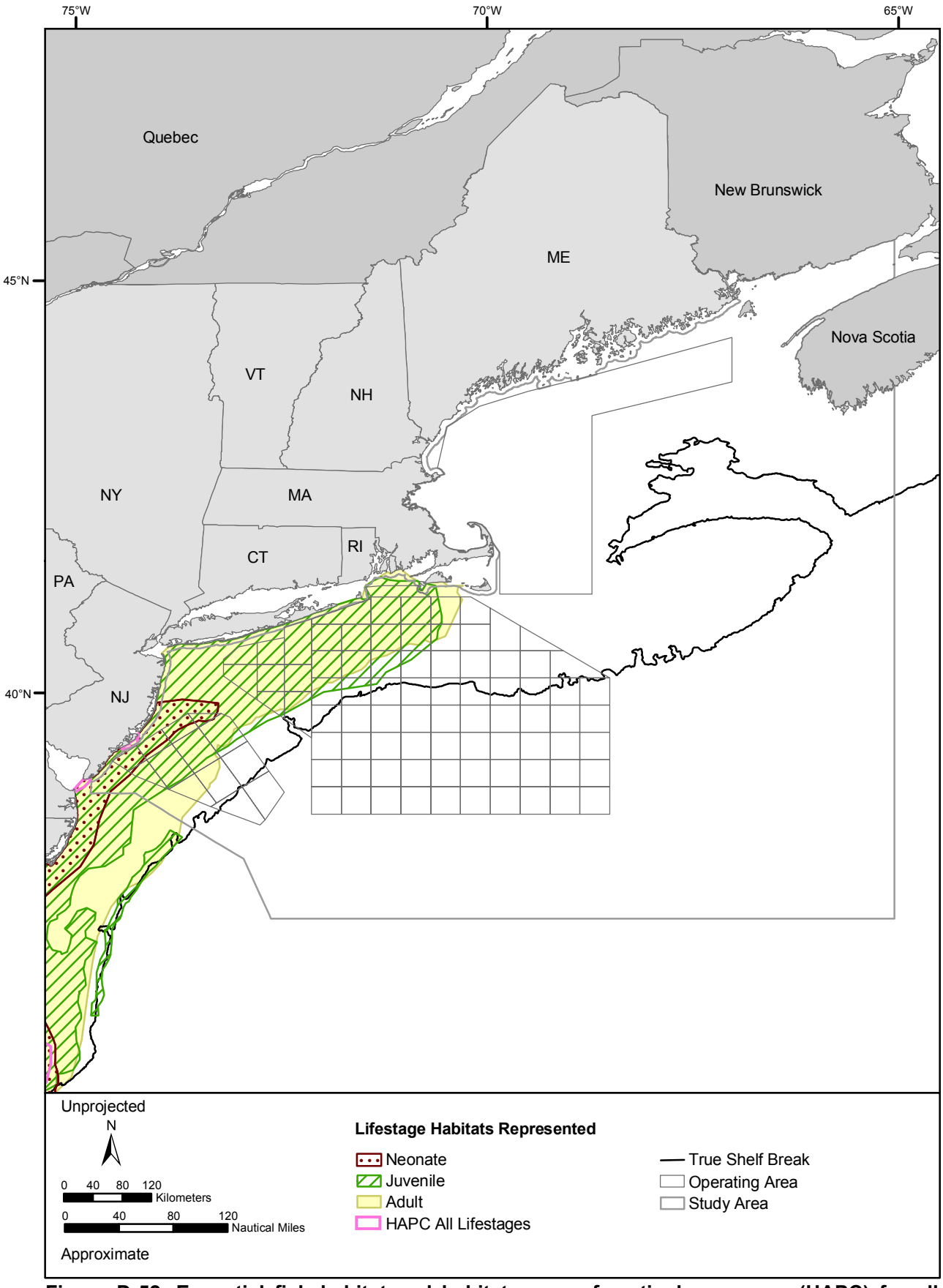

Figure D-52. Essential fish habitat and habitat areas of particular concern (HAPC) for all lifestages of sandbar sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

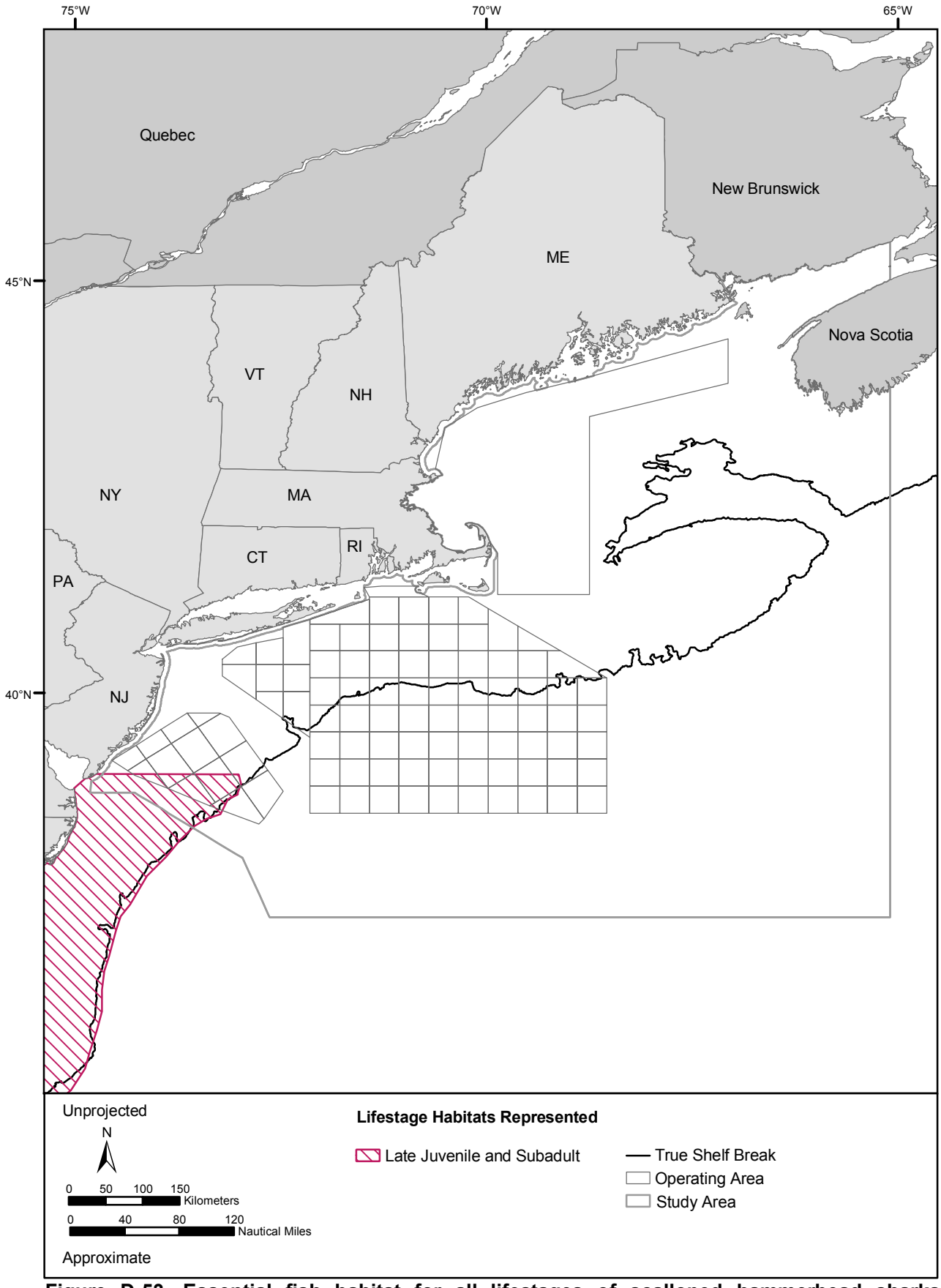

Figure D-53. Essential fish habitat for all lifestages of scalloped hammerhead sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

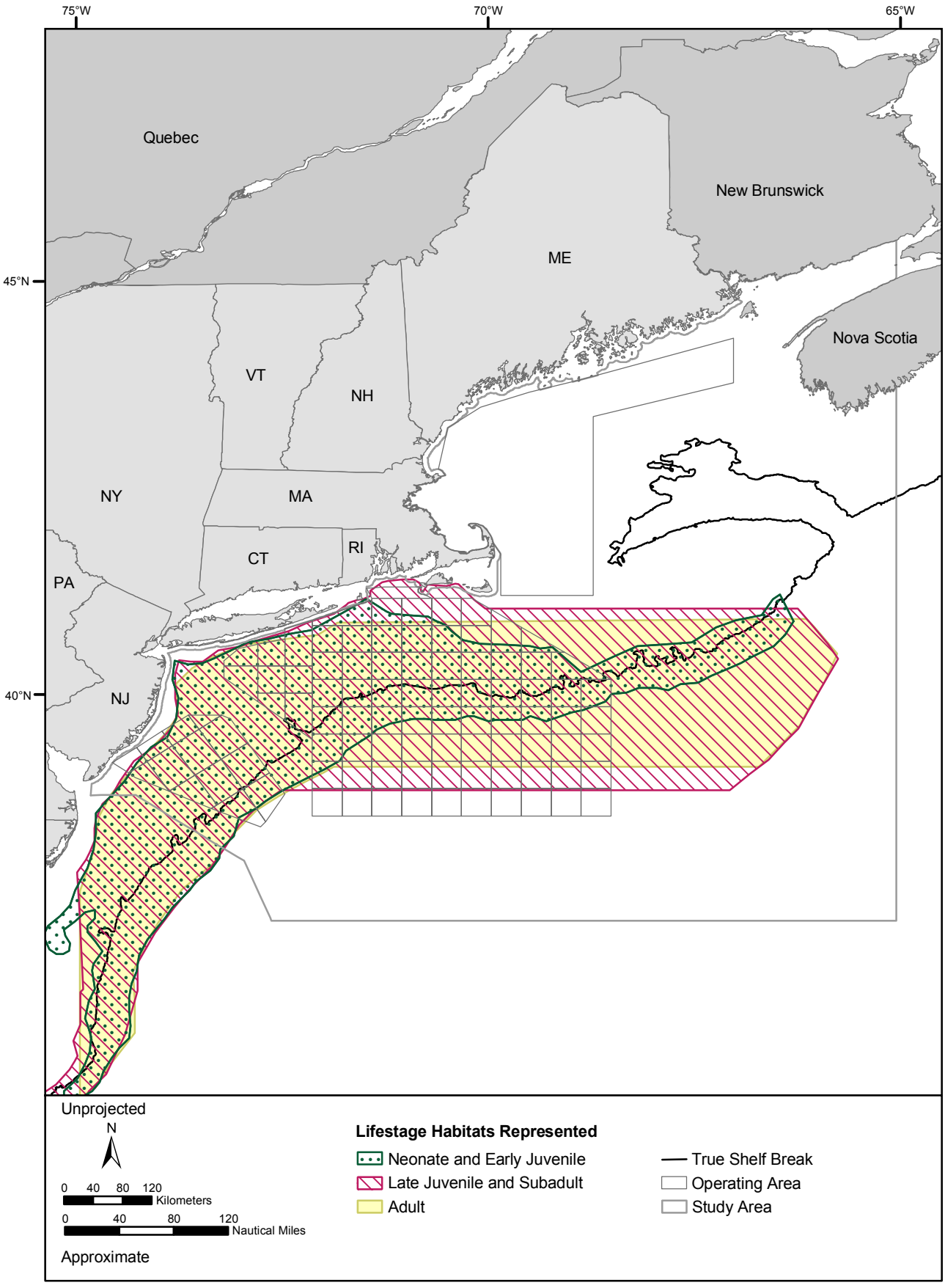

Figure D-54. Essential fish habitat for all lifestages of shortfin mako sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

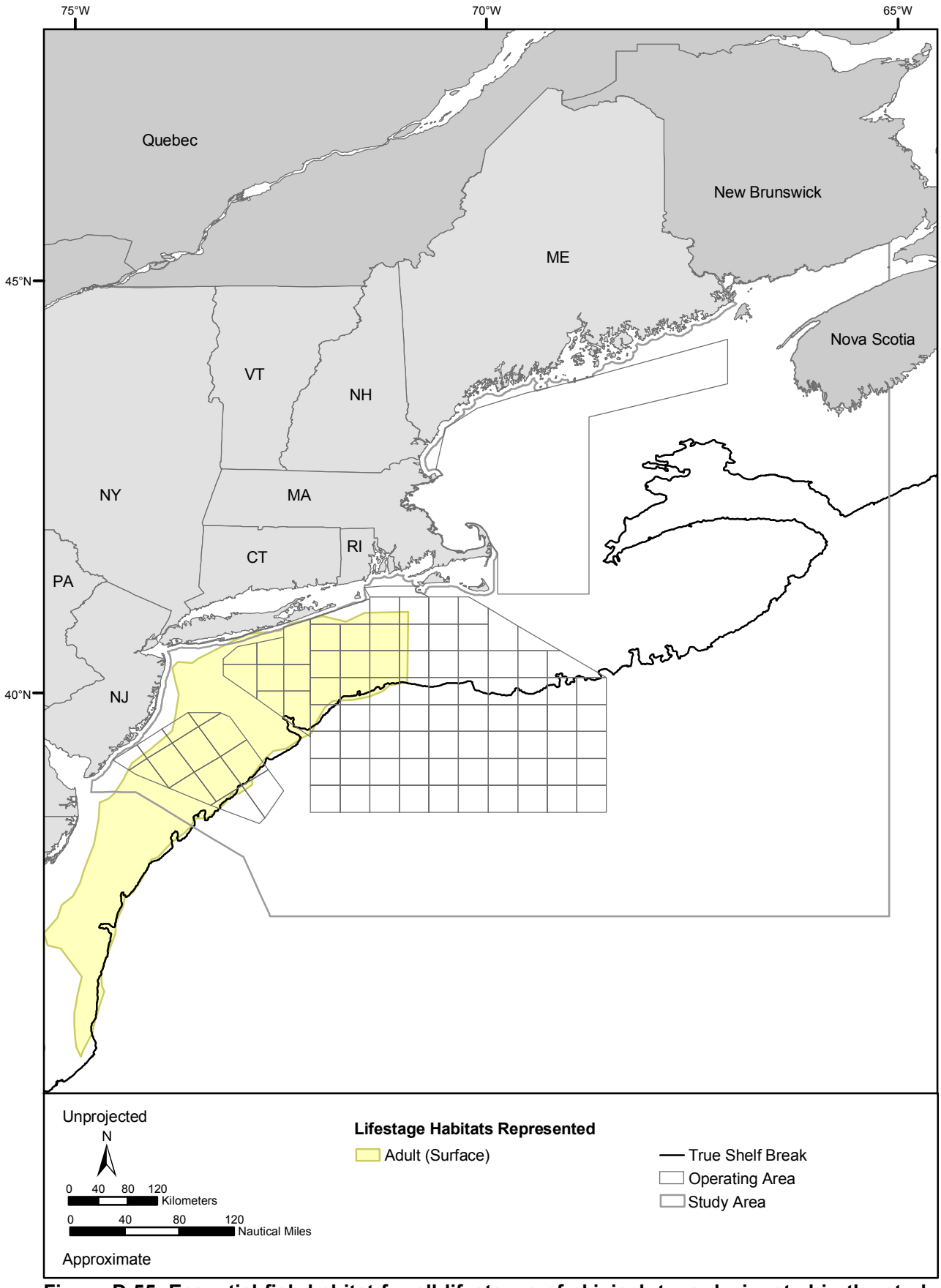

Figure D-55. Essential fish habitat for all lifestages of skipjack tuna designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

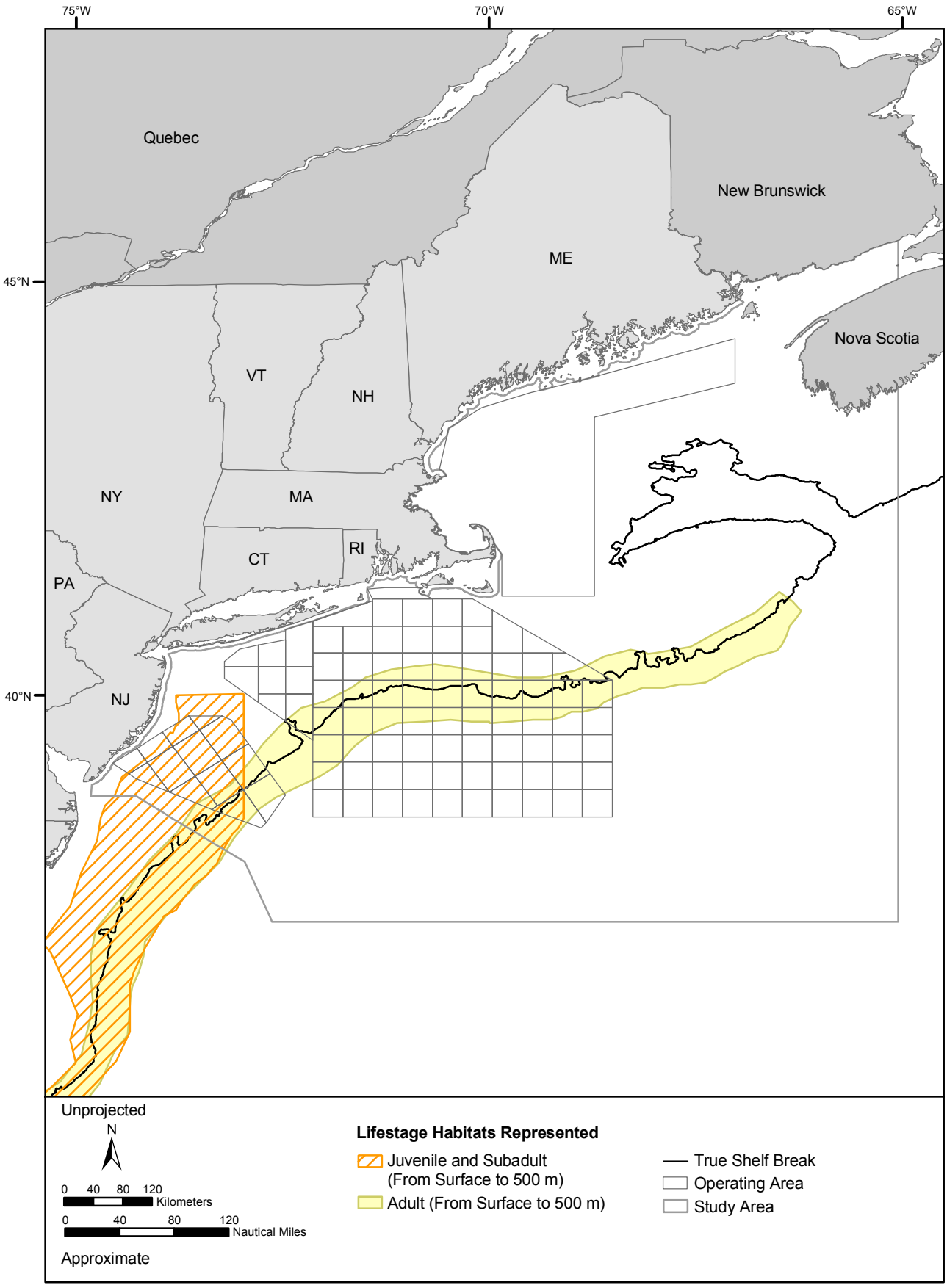

Figure D-56. Essential fish habitat for all lifestages of swordfish designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

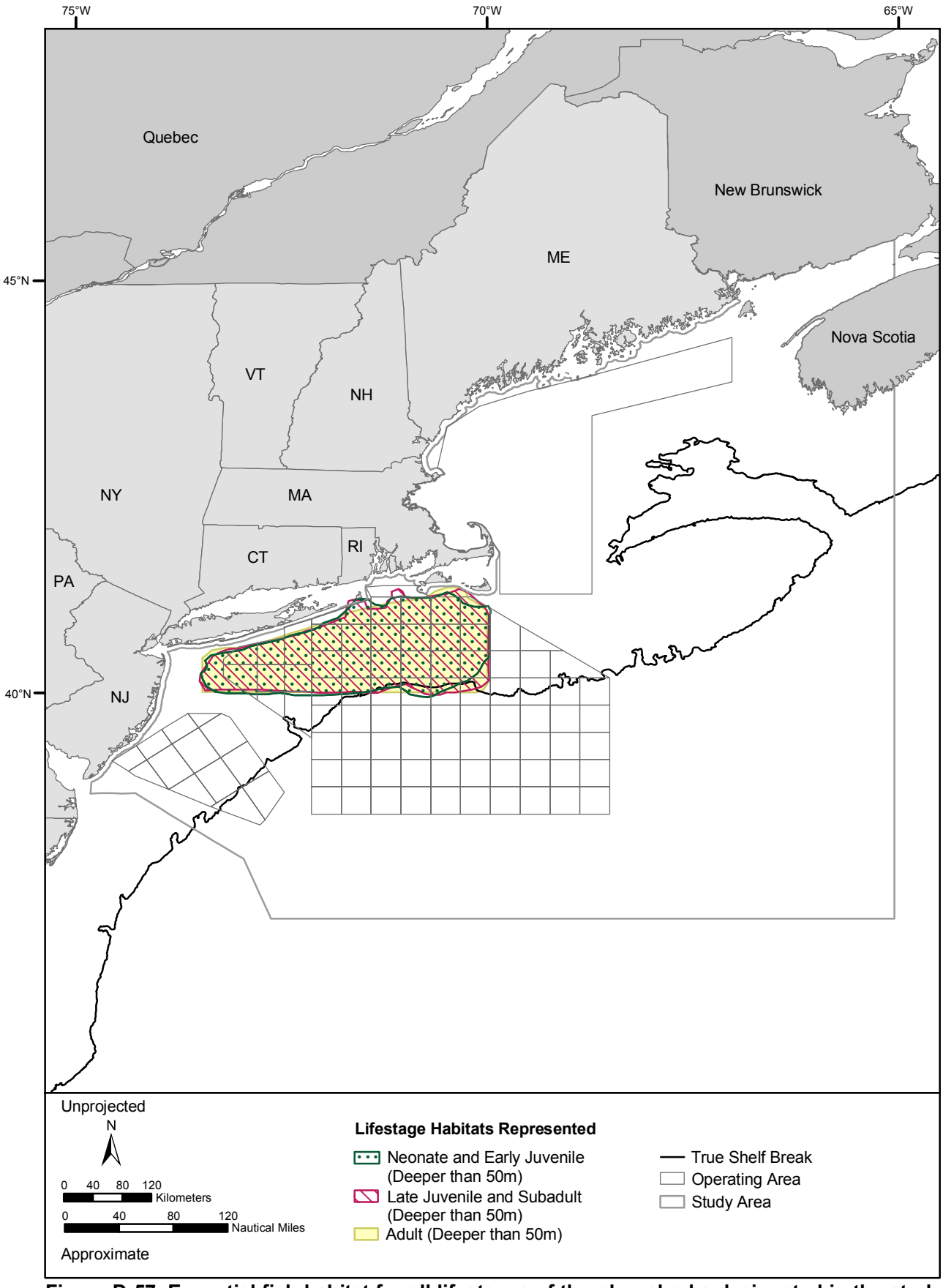

Figure D-57. Essential fish habitat for all lifestages of thresher sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

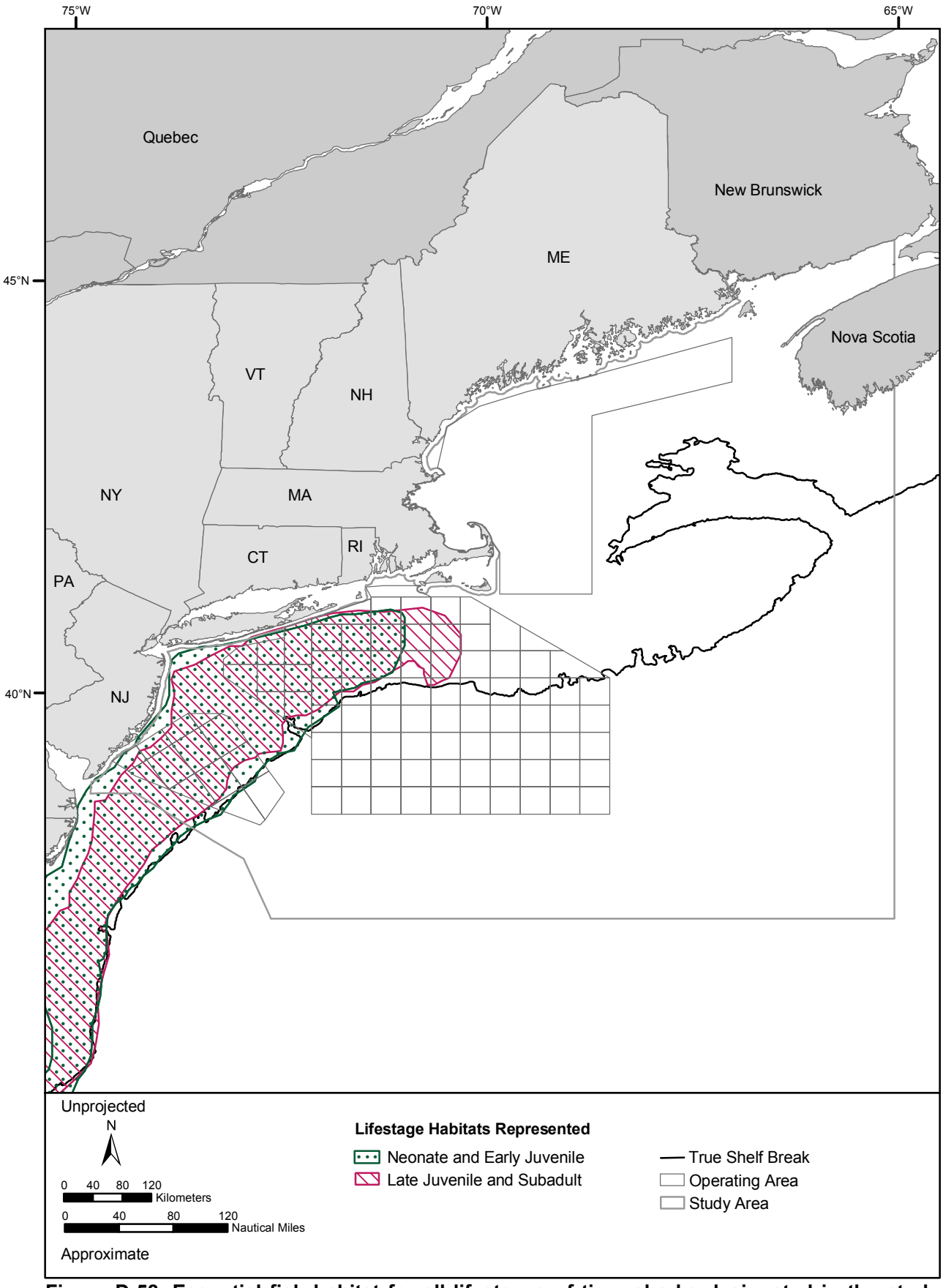

Figure D-58. Essential fish habitat for all lifestages of tiger sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

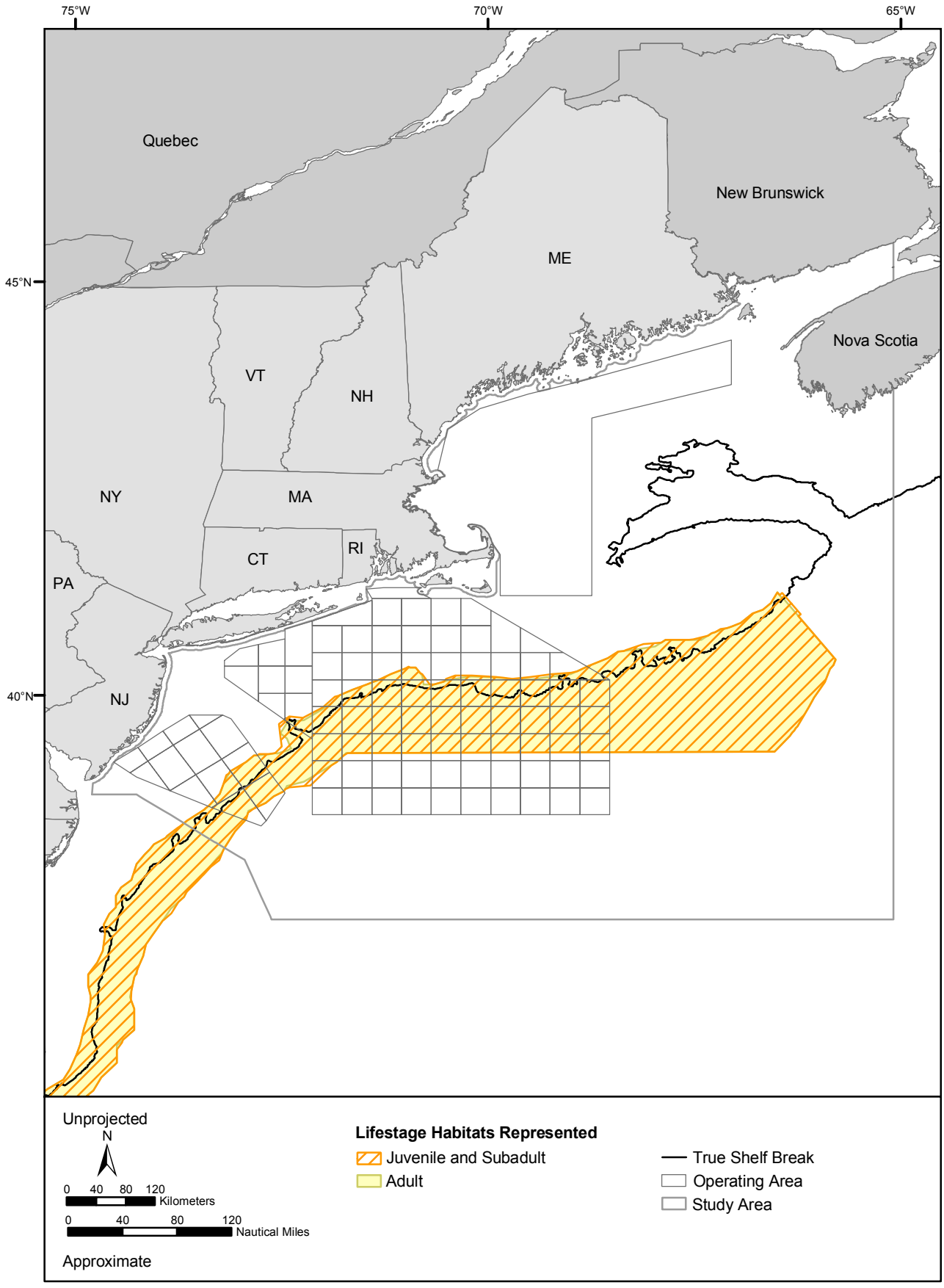

Figure D-59. Essential fish habitat for all lifestages of white marlin designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

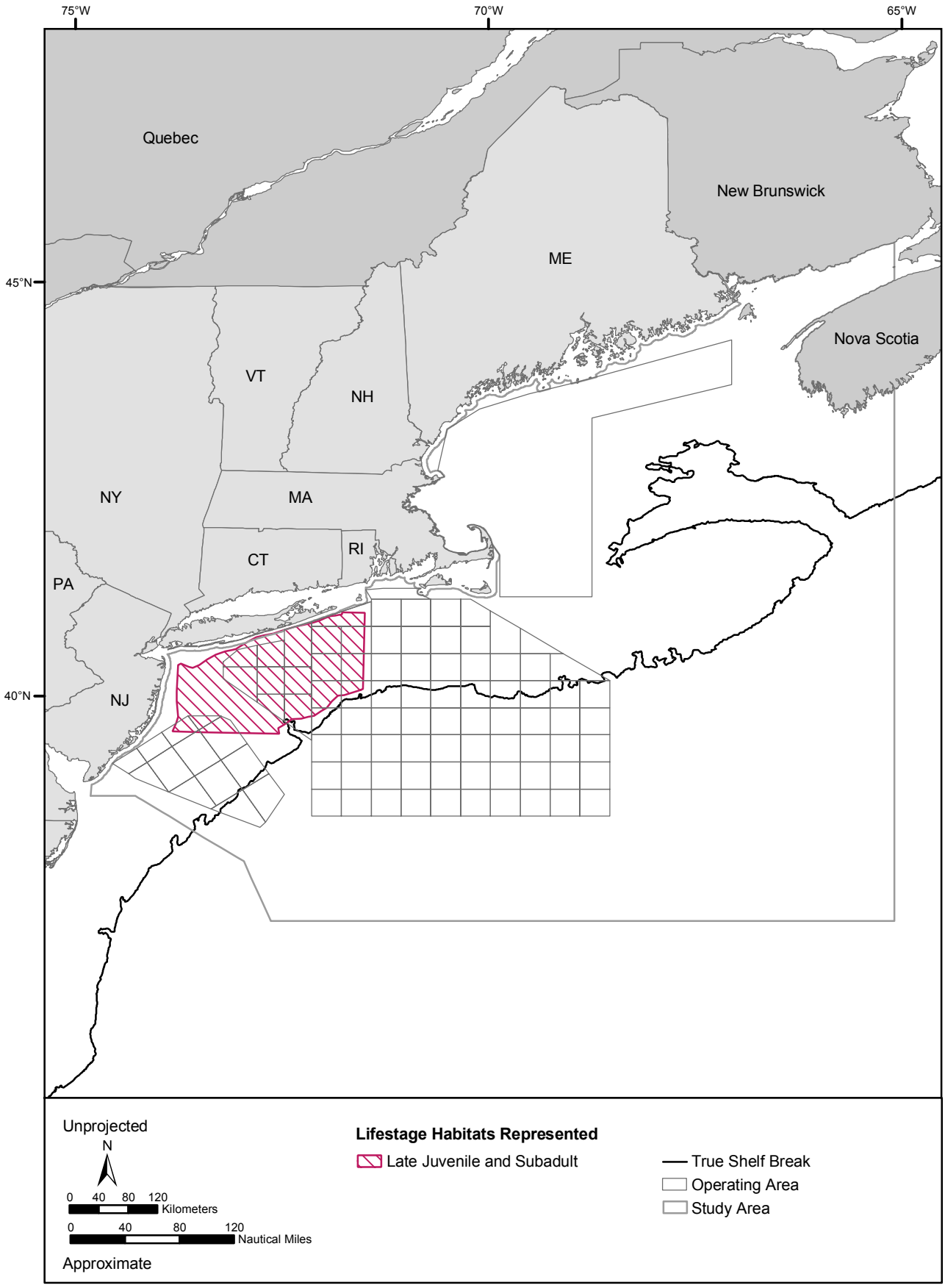

Figure D-60. Essential fish habitat for all lifestages of white sharks designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

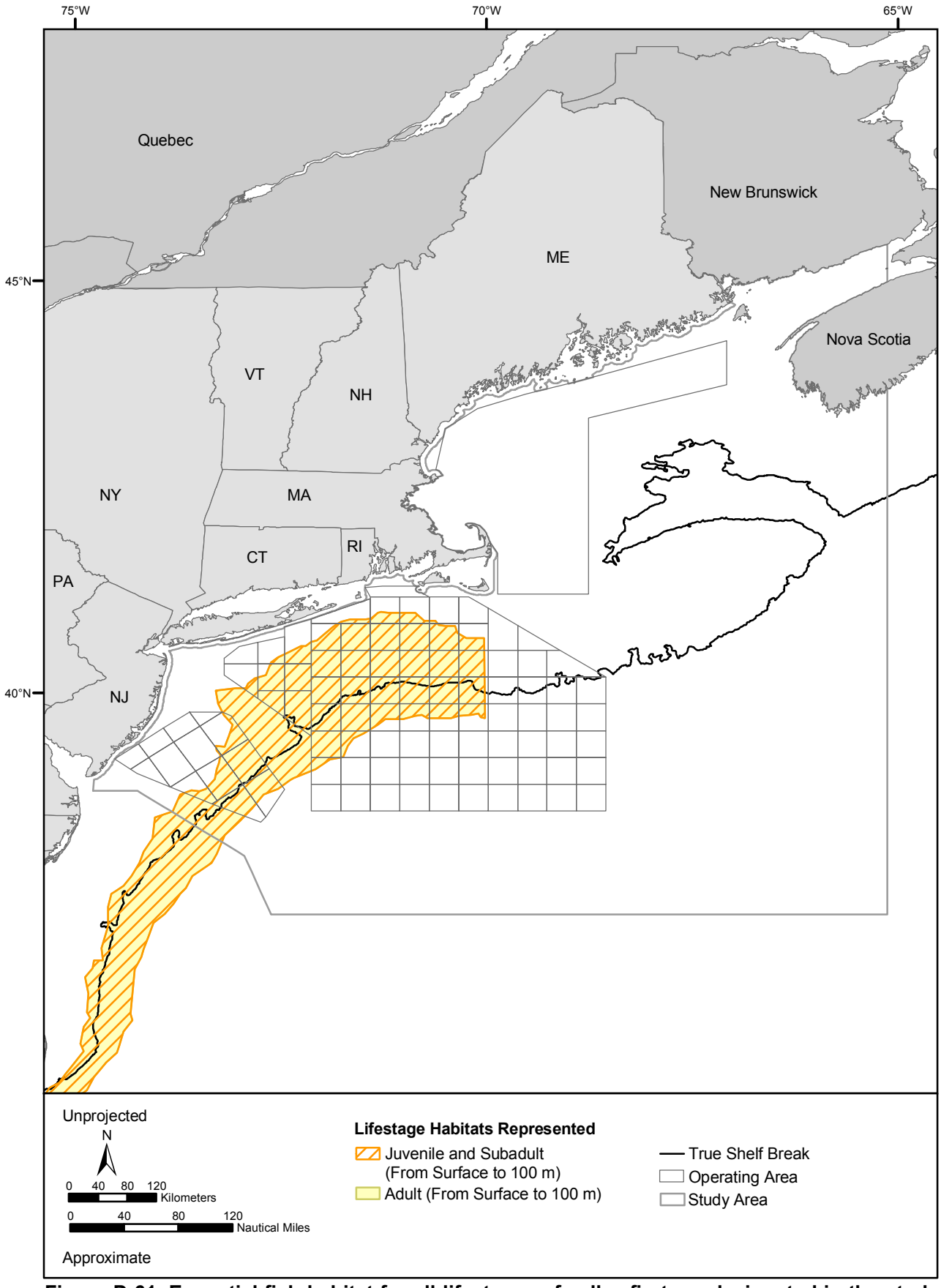

Figure D-61. Essential fish habitat for all lifestages of yellowfin tuna designated in the study area for the NE OPAREAs. Source data: NMFS (2003c).

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APPENDIX E: MYLARS

Title
Study area for the Northeast Operating Areas (NE OPAREAs)—Mono.
Study area for the Northeast Operating Areas (NE OPAREAs)—Quad.
Limited bathymetry of the study area for the NE OPAREAs—Mono.
Bathymetry of the study area for the NE OPAREAs—Mono.
Bathymetry of the study area for the NE OPAREAs—Quad.
Location of the Gulf Stream Current in the study area for the NE OPAREAs—Quad.

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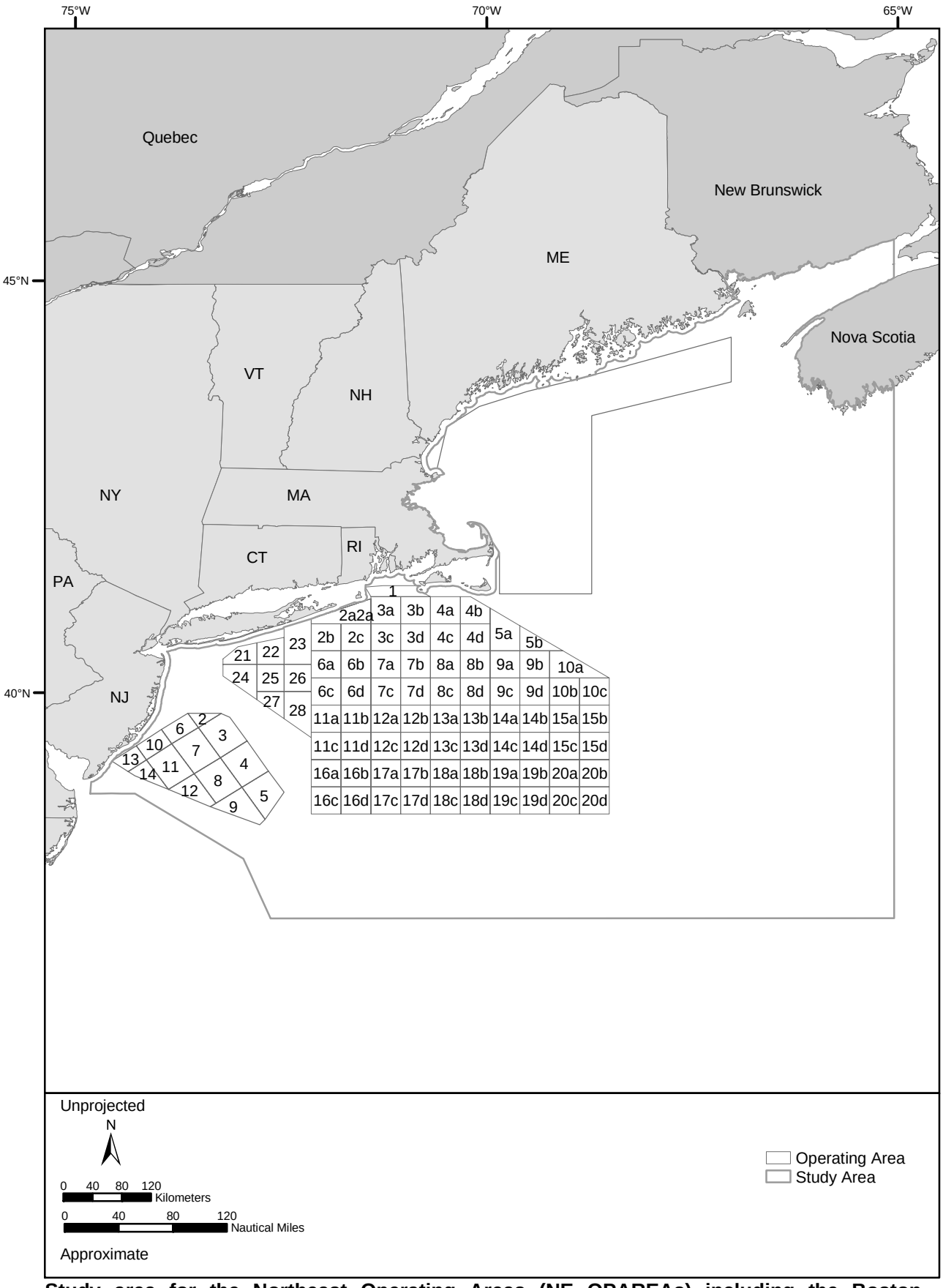
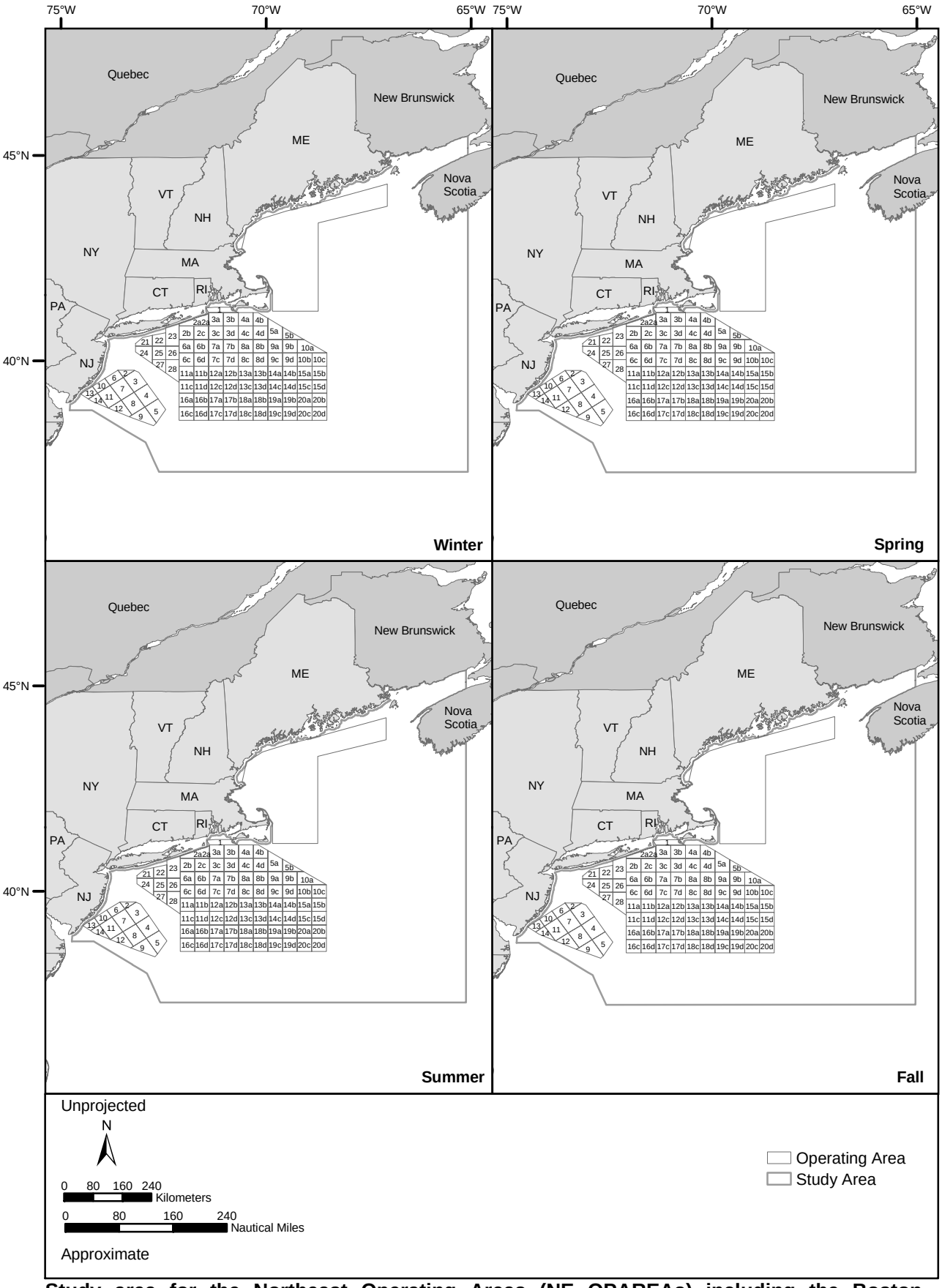
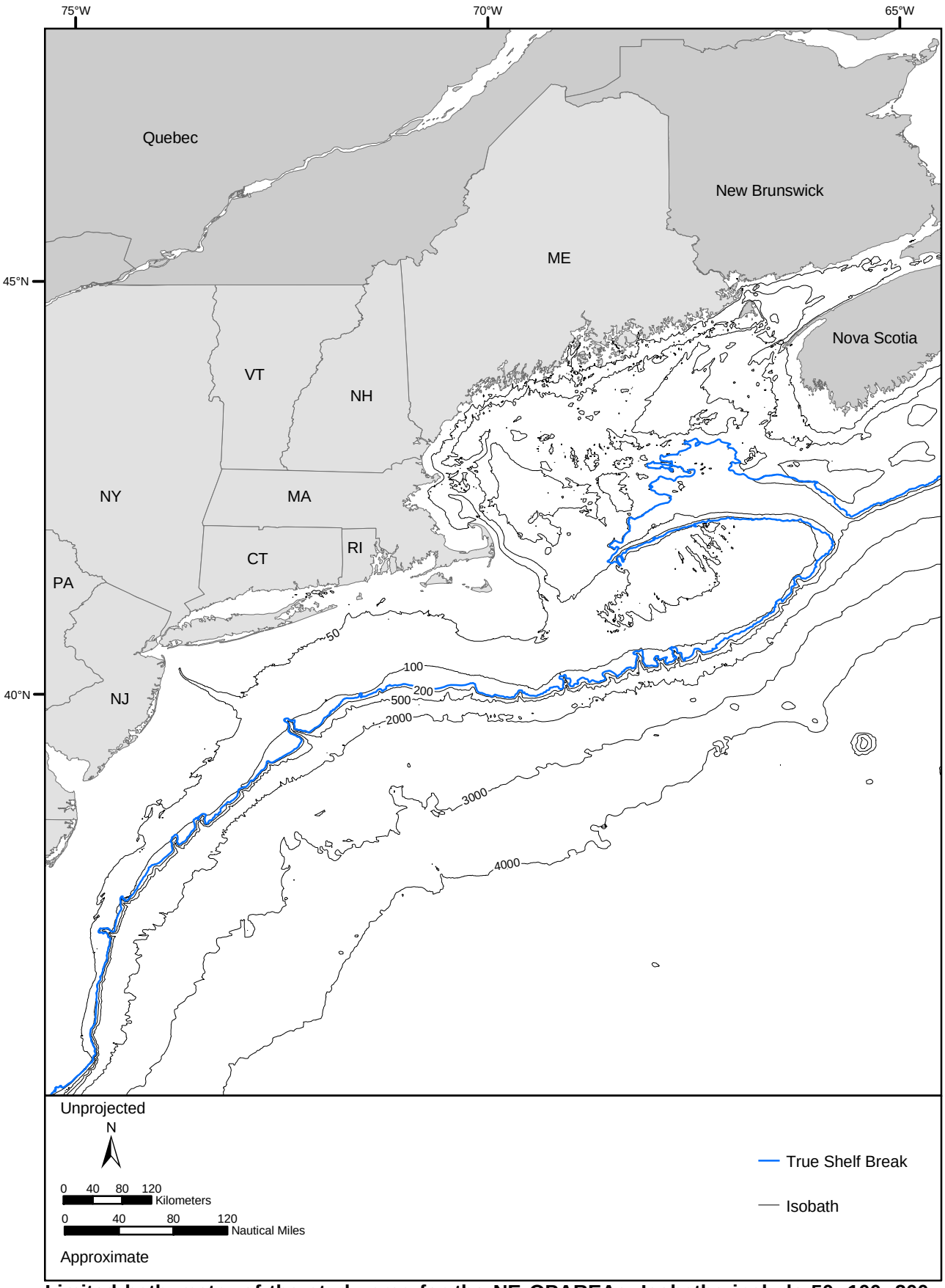


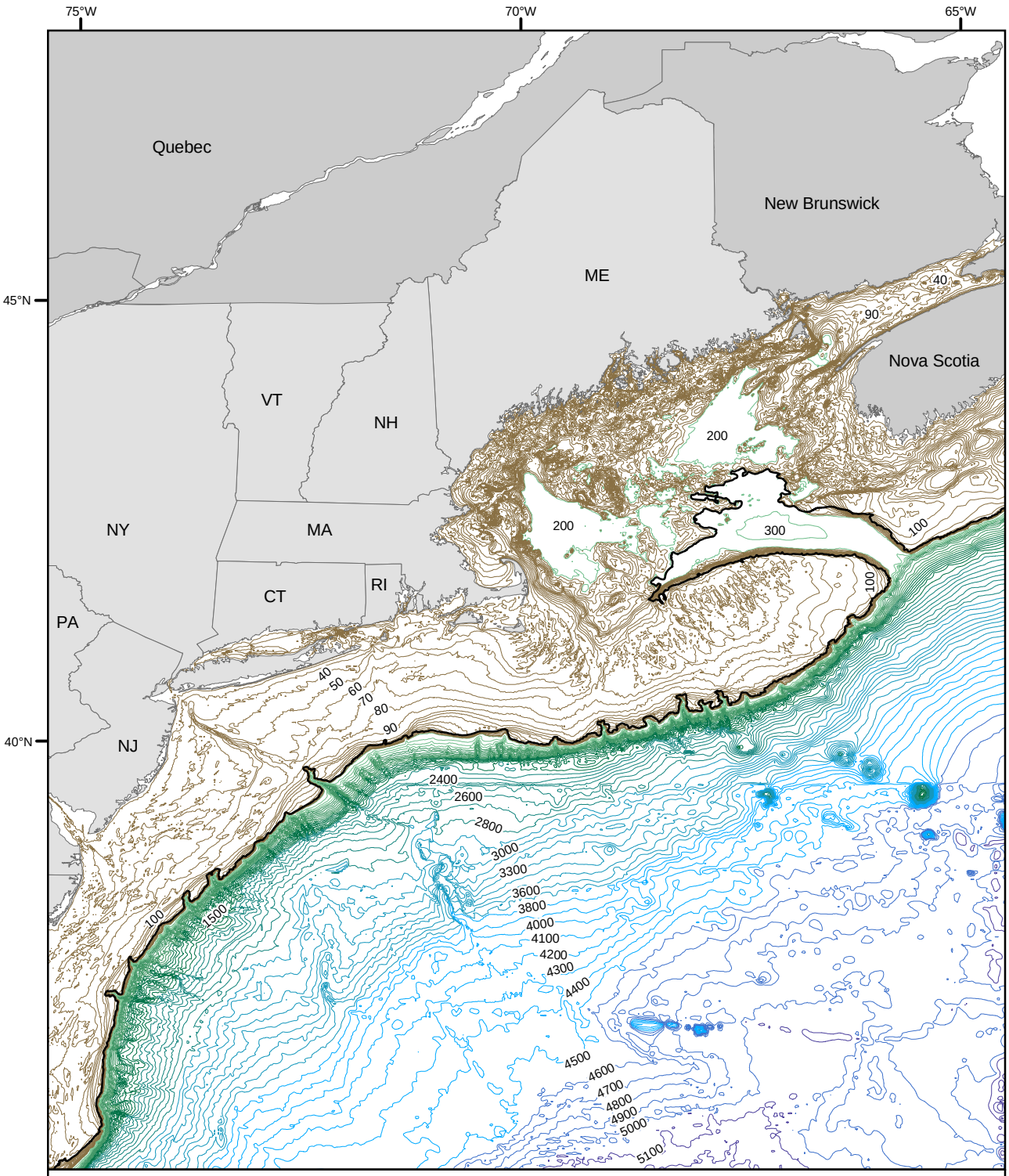
Study area for the Northeast Operating Areas (NE OPAREAs) including the Boston, Narragansett Bay, and Atlantic City OPAREAs.



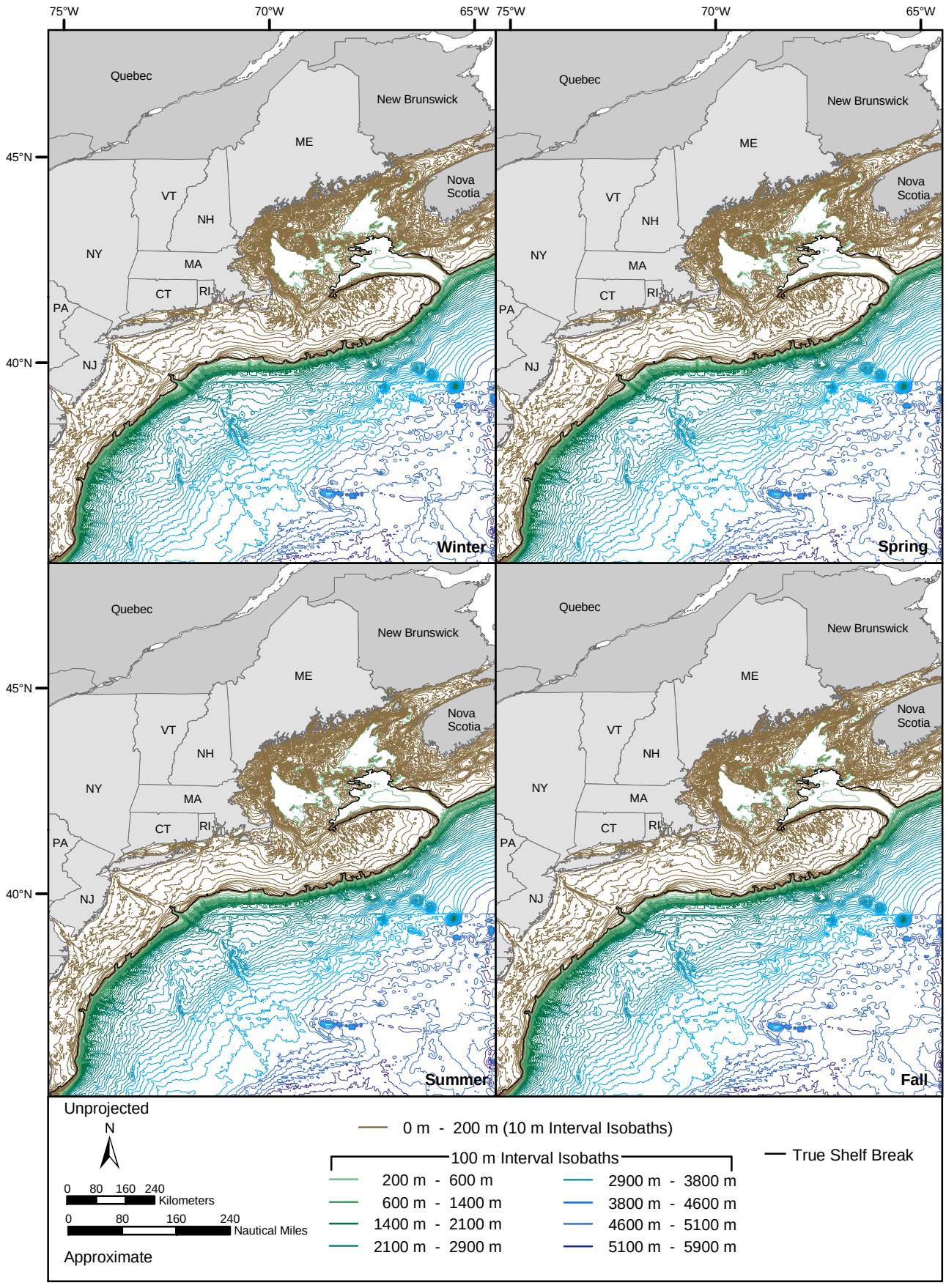
Study area for the Northeast Operating Areas (NE OPAREAs) including the Boston, Narragansett Bay, and Atlantic City OPAREAs.



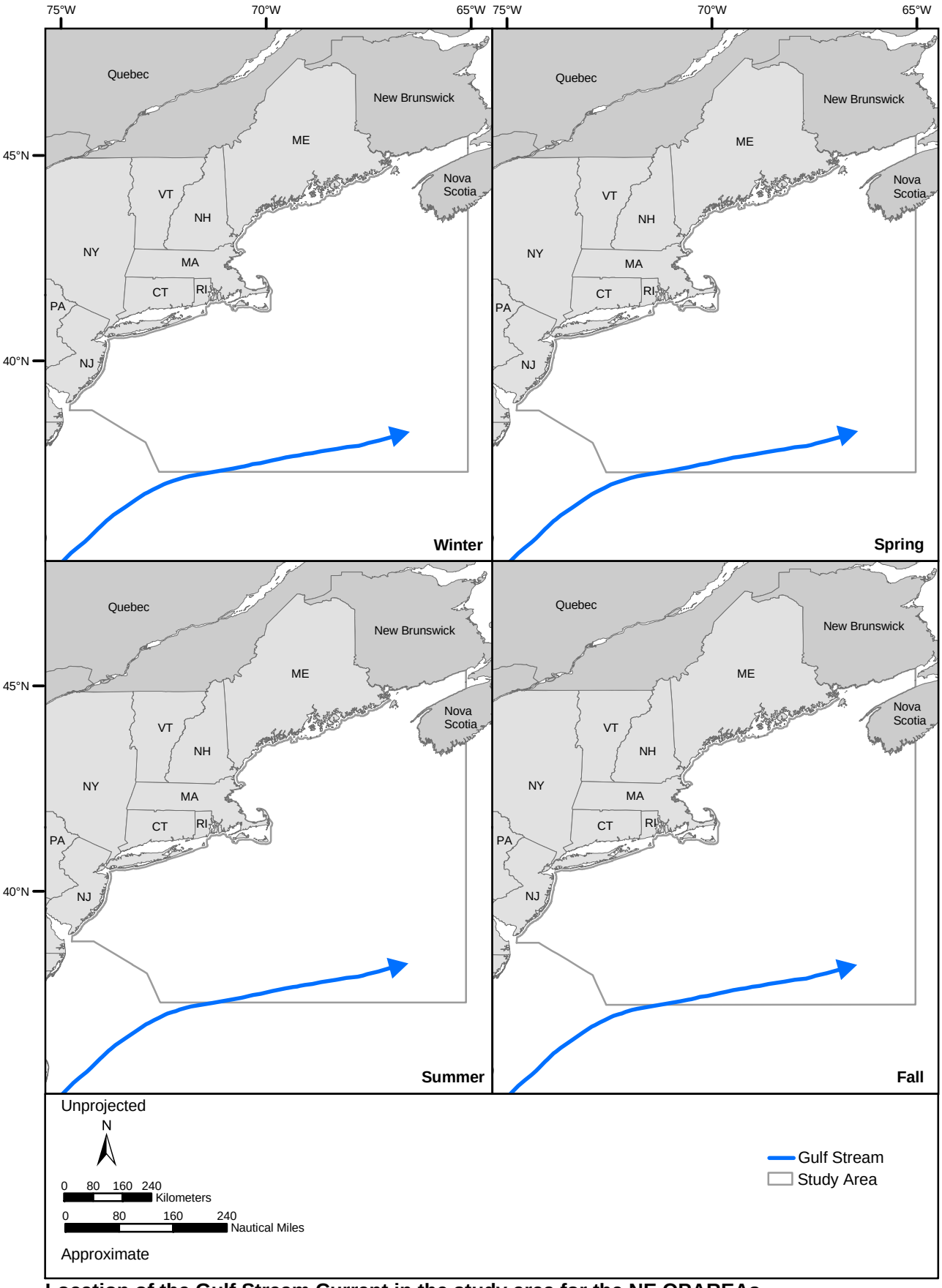
Limited bathymetry of the study area for the NE OPAREAs. Isobaths include 50, 100, 200, 500, 2,000, 3,000, and 4,000 m.



Bathymetry of the study area for the NE OPAREAs.



Bathymetry of the study area for the NE OPAREAs.



Location of the Gulf Stream Current in the study area for the NE OPAREAs.