UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
Office of Protected Resources

PETITION FOR PROMULGATION OF REGULATIONS AND REQUEST FOR LETTER OF AUTHORIZATION PURSUANT TO SECTION 101 (a) (5) (A) OF THE MARINE MAMMAL PROTECTION ACT

for the

Taking of Marine Mammals Incidental to Fisheries and Ecosystem Research

Conducted and Funded by the Northeast Fisheries Science Center

50 C.F.R. Part 216, Subpart R

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ACRONYMS AND ABBREVIATIONS

Acronym/ Abbreviation	**Definition**
ACDP	Acoustic Doppler Profiler
ASL	above sea level
BMP	Best Management Practice
CFR	Code of Federal Regulations
cm	centimeter
COAST	Collaborative Optical Acoustical Survey Technology
CPR	Continuous Plankton Recorder
CS	Chief Scientist
CTD	Conductivity, Temperature, and Depth
CV	Coefficient of Variation
D	Depleted under the MMPA
DAS	days at sea
dB	decibels
DON	Department of the Navy
DPS	Distinct Population Segment
E	Endangered under the ESA
EEZ	Exclusive Economic Zone
EO	Executive Order
ESA	Endangered Species Act
FAU	Florida Atlantic University
fm	fathom
FONSI	Finding of No Significant Impact
FR	Federal Register
ft	feet
GPS	Global Positioning System
HMS	Highly Migratory Species
Hz	hertz
ICUN	International Union for Conservation of Nature
IHA	Incidental Harassment Authorization
in.	inch
ITA	Incidental Take Authorization
ITR	Incidental Take Regulation
kg	kilograms
kHz	kilohertz
km	kilometers
km^2	square kilometers
LME	Large Marine Ecosystem
LOA	Letter of Authorization
m	meters
MA	Massachusetts
MD	Maryland
ME	Maine

mi	miles
MLLW	Mean low lower water
mi^2	square miles
MMED	Marine Mammal Exclusion Device
MMPA	Marine Mammal Protection Act
M/SI	Mortality/Serious Injury
NEFSC	Northeast Fishery Science Center
NEPA	National Environmental Policy Act
NH	New Hampshire
NJ	New Jersey
NL	Not listed under the ESA
NS	Not strategic under the MMPA
nm	nautical mile
NY	New York
NMFS	National Marine Fisheries Service
MML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
OBIS-SEAMAP	Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations
OMAO	Office of Marine Aviation and Operations
OOD	Officer on Deck
OPR	Office of Protected Resources
PBR	Potential Biological Removal
PEA	Programmatic Environmental Impact Statement
ppt	parts per thousand
PSIT	Protected Species Incidental Take
PTS	Permanent Threshold Shift
rms	root mean square
ROV	Remotely Operated Vehicle
RSA	Research Set-Aside
S	Strategic under the MMPA
SAR	Stock Assessment Report
SCDNR	South Carolina Department of Natural Resources
Secretary	U.S. Secretary of Commerce
SI	serious injury
TTS	Temporary Threshold Shift
UNF	University of North Florida
UME	Unusual Mortality Event
U.S.	United States
VA	Virginia
μPa	microPascal

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1. DESCRIPTION OF ACTIVITIES

1.1. Nature of Request

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) based in Woods Hole, Massachusetts (MA) and within NMFS' Northeast Region, is responsible for conducting science-based management, conservation, and protection of living marine resources within the U.S. Economic Exclusion Zone (EEZ) in the Atlantic Ocean. Through seven research facilities the NEFSC conducts research in U.S. waters from the Canadian border south to Cape Hatteras, North Carolina and also conducts occasional surveys on highly migratory species (HMS) extending to Florida (Figure 1-1).

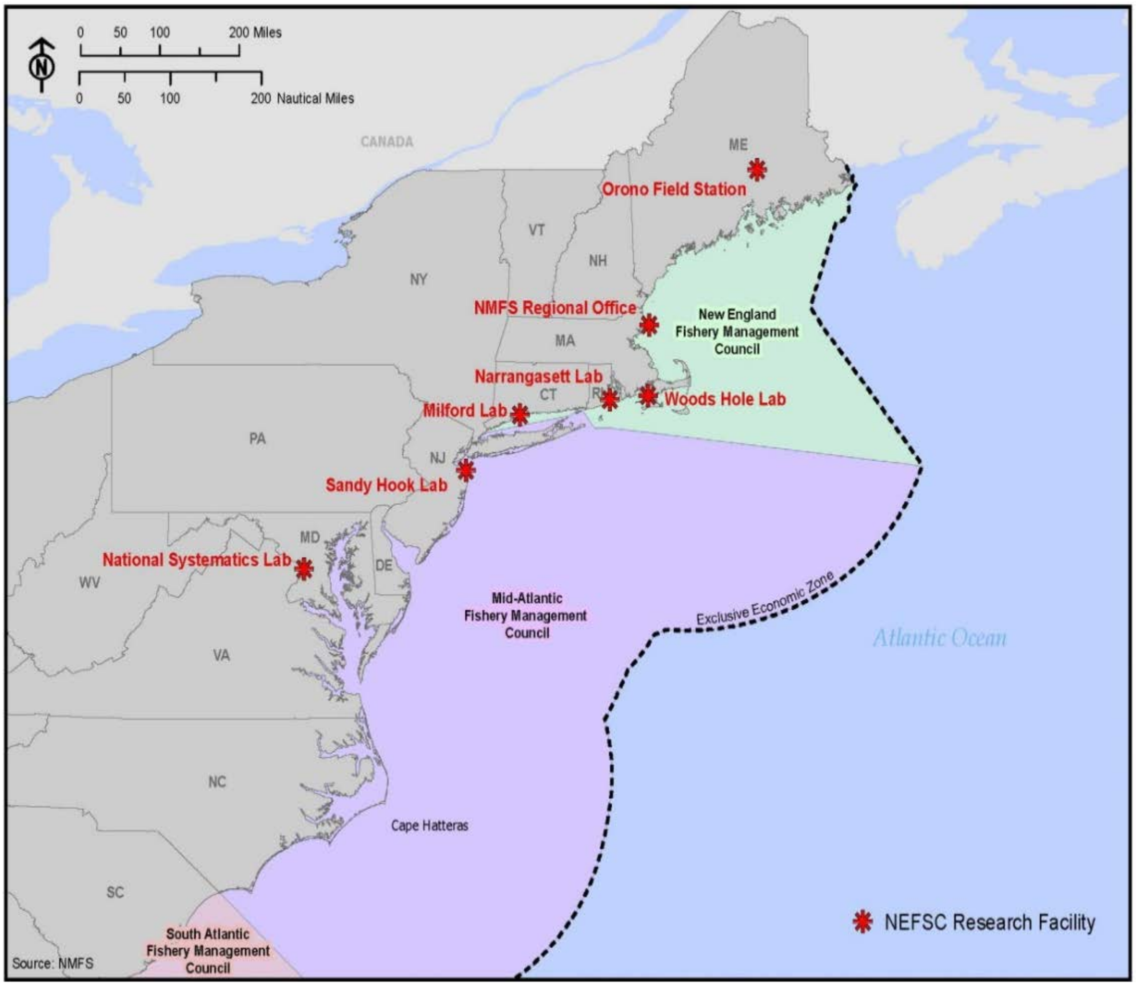
The NEFSC previously analyzed the potential environmental effects of fisheries and ecosystem research and on August 11, 2016 NMFS Office of Protected Resources (OPR) promulgated regulations (81 FR 53061) and subsequently issued a 5-year Letter of Authorization (LOA) (81 FR 64442) on September 20, 2016 for the incidental taking of marine mammals pursuant to Section 101(a)(5)(A) of the MMPA. In compliance with the National Environmental Policy Act (NEPA) and to support the MMPA authorization as well as other applicable laws, in July of 2016 the NEFSC published a Final Programmatic Environmental Assessment (PEA) Fisheries Research Conducted and Funded by the NEFSC (NMFS 2016a). The 2016 PEA (NMFS 2016) was determined to be sufficient and a Finding of No Significant Impact (FONSI) was signed on August 3, 2016.

The NEFSC plans to continue fisheries and ecosystem research for the period 2021–2026, and is in the process of preparing a Supplemental PEA to evaluate new research activities and issues that were not previously analyzed in the 2016 PEA (NMFS 2016). Therefore, the purpose of this request by NEFSC is for NMFS OPR to develop regulations and issue a 5-year LOA, effective September 21, 2021 through September 2026. The LOA would allow for the potential incidental taking of small numbers of marine mammals during fisheries and ecosystem research conducted and funded by the NEFSC.

1.2. Regulatory Context

The MMPA, Section 101(a)(5) directs the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing), if certain findings are made.

There are two types of Incidental Take Authorizations (ITAs) that can be issued by NMFS: an LOA under Section 101(a)(5)(A) and an Incidental Harassment Authorization (IHA) under Section 101(a)(5)(D) of the MMPA. Under Section 101(a)(5)(A), for multi-year activities NMFS must issue regulations through an LOA. The activities must be well planned with enough detailed information provided to allow for an analysis of potential takes over the duration of the activity. Incidental Take Regulations (ITRs) can be valid for up to five consecutive years and an LOA can be issued each of those years; NMFS recommends following the rulemaking/LOA process for multiple-year projects (such as annual ice roads, trails and pads) even when serious injury or mortality is not anticipated. IHAs are generally only requested when the project is short-term in nature (12 months or less) and expected to result in harassment, not serious injury or mortality. Table 1-1 provides guidelines used to determine which ITA is appropriate



Source: NMFS (2016)

FIGURE 1-1. NEFSC RESEARCH AREAS AND FACILITIES

TABLE 1-1. GUIDELINES FOR DETERMINING APPROPRIATE ITA PROCESS

If the proposed action has potential to:	Then:
Result in **“harassment”** only (i.e., injury or disturbance)	Apply for an IHA (effective up to 1 year)
Result in harassment only (i.e., injury or disturbance) AND is planned for multiple years	Request rulemaking and apply for multiple LOAs (effective up to 5 years)
Result in **“serious injury”** or mortality	Request rulemaking and apply for multiple LOAs (effective up to 5 years)

Fisheries and ecosystem research could result in taking of small numbers of marine mammals by harassment. Serious injury or mortality of marine mammals could occur due to entanglement. Therefore, the NEFSC is submitting this application for promulgation of an ITR and LOA effective in 2021 that would allow the potential taking of small numbers of marine mammals by serious injury or mortality as well as harassment incidental to the proposed research activities (see Section 1.3).

1.3. Description of the Activity

1.3.1. Definition of Action Area

NMFS defines the outer boundary of an Action Area for a project as the point where no detectable or measurable effect from the project would occur. Therefore, for purposes of this request for rulemaking, the Action Area is defined consistent with ESA regulations as the area within which all relevant direct and indirect effects of fisheries and ecosystem research would occur. Over the five year period that is the subject of this request, NEFSC will primarily conduct research in nearshore and offshore areas extending from the U.S.-Canada border to Cape Hatteras. See Section 2.2 for additional information on the region of activity.

1.3.2. Proposed Action

The proposed action is the continuation of NEFSC fisheries research activities conducted along the east coast of the United States (U.S.) to produce scientific information necessary for the management and conservation of living marine resources in those areas. The NEFSC deploys a wide variety of gear to sample the marine environment during these research cruises. While these types of gear are not considered to pose a risk to marine mammals that may occur throughout the Action Area, the NEFSC implements a series of mitigation and monitoring measures to reduce the risk of encounters with marine mammals. Table 1-2 summarizes the proposed NEFSC research activities to be covered under the ITR and LOA. For projects involving trawl, longline and gillnets, there is very low likelihood for incidental marine mammal take; however, the potential still exists and has been accounted for in the request for take (see Section 6). Other projects use active acoustics that may result in minor behavioral harassment which has also been accounted for in the take request in Section 6. The far right column of Table 1-2 indicates whether there is potential for incidental take under the MMPA. NEFSC no longer conducts beach seine surveys in Maine and New Jersey, which were previously analyzed in the 2016 MMPA LOA application. To provide a comprehensive evaluation of proposed research activities, this application includes proposed surveys planned for the North Atlantic for the period 2021 to 2026.

Forty-two of the 59 total surveys/projects involve gear and equipment with the potential to take marine mammals as defined under the MMPA. Gear types include towed trawl nets fished at various levels in the water column, dredges, gillnets, traps, longline and other hook and line gear. Surveys using any type of seine net (e.g., gillnets), trawl net, or hook and line (e.g., longlines) have the potential for marine mammal interaction (e.g., entanglement, hooking) resulting in M/ SI harassment. In addition, the NEFSC conducts hydrographic, oceanographic, and meteorological sampling concurrent with many of these surveys which requires the use of active acoustic devices (e.g., side-scan sonar, echosounders). These active sonars result in elevated sound levels in the water column, resulting in the potential to behaviorally disturb marine mammals resulting in Level B harassment.

The research listed in Table 1-2 is the same as that analyzed in the 2016 LOA with, with the following exceptions which are considered “new” since the 2016 final rule (81 FR 53061):

- *Ropeless Lobster Trap Research* – Acoustic/mechanical releases for ropeless lobster gear and float lines, 50-100 DAS. Traditional crab and lobster traps lie on the ocean floor attached by vertical lines to surface buoys[1]. The lines and buoys remain in the water, creating a hazard for marine life. Ropeless technology, eliminates vertical lines and buoys by using acoustic release technology; a sound signal is sent from the boat to the pot. The pots are tethered to a bag that contains rope and buoys, which are released from the bag by the acoustic signal. The pots are retrieved once the buoys reach the surface. When the pots are not actively being fished, they lie on the seafloor without ropes or buoys, reducing entanglement risk. Therefore, marine mammal takes are not requested for this research.
- *Rod and Reel Tagging of Atlantic Salmon* – over the course of the study 200-500 tags applied on sub-adult Atlantic salmon (*Salmo salar*) off the southwest coast of Greenland by NEFSC researchers in cooperation with researchers from the Department of Fisheries and Oceans Canada (DFO) and the Atlantic Salmon Federation. Fish are collected using recreational rod and reel trolling gear. Trolling is a fishing method that drags lures through the water. The method is usually associated with recreational fishing as catch are much lower than gillnets[2]. Activities are planned in international waters where trolling would occur within the Igaliku Fjord in southwest Greenland. This research is a follow-up study to work originally conducted in 2010 through 2012 that was not specifically analyzed in the 2016 PEA. This research project was conducted in 2018 and targets Atlantic salmon from non-listed populations that migrate to Greenland as sub-adults and spend two years in marine waters foraging off the Greenland coast before returning to natal streams primarily in Canada and Europe. Given the nature of this work and the region where it occurs, associated takes of marine mammals are not included in this LOA application.
- *Continuous Plankton Recorder (CPR) Transect Surveys in the GOM* – towed array 24 DAS. The CPR is towed from the stern of a ship and can capture plankton samples over large ocean areas. It works by filtering plankton from the water on continuously moving bands of filter silk[3]. The internal mechanism of the CPR is a self-contained cassette that is loaded with the filtering silk. After towing, the silk is removed from the mechanism in the laboratory and divided into samples representing 10 nautical miles of towing. The plankton on these samples are then analyzed according to standard procedures. This gear is towed in close proximity to the vessel at relatively shallow depths, thereby minimizing entanglement risks. Therefore, marine mammal takes associated with CPR are not considered further.

[1]https://www.forbes.com/sites/ariellasimke/2020/03/14/new-pop-up-fishing-gear-could-reduce-whale-entanglements/#489723c12b8c
[2]https://nefsc.wordpress.com/2018/10/09/back-to-greenland-tagging-adult-atlantic-salmon/
[3]https://www.cprsurvey.org/services/the-continuous-plankton-recorder/

- *Deepwater Biodiversity* – gear has changed to a Deep-Sea acoustic/optic/oceanographic/eDNA system, and trawl camera system. Acoustic and optic systems are integrated into a dead-weight platform towed approximately 20 ft behind the vessel. The platform includes wideband echosounders, stereo and holographic cameras, environmental and light sensors, and eDNA instruments towed at the depths of the meso and bathypelagic communities enabling high-band-width data telemetry and real-time control. Gear previously used was a 4-seam, 3-bridle net bottom trawl, Superior midwater trawl, and acoustics which were previously evaluated in the 2016 final rule (81 FR 53061).

International research such as the rod and reel tagging of sub-adult Atlantic salmon described above, may also be conducted by NEFSC. While work in territorial waters does not require authorization under the MMPA or ESA, NMFS must follow the applicable laws of the lead country (for example, studies led by DFO). Additionally, Executive Order (EO) 12114 (January 1979) Environmental Effects Abroad of Major Federal Actions requires that federal agencies taking major federal actions outside of the geographical boundaries of the U.S. and its territories and possessions shall exchange information concerning the environment on a continuing basis.

The need for additional surveys could arise, or some of the identified surveys could be eliminated or reduced in effort. Research activities associated with the requested LOA are not necessarily limited to the specific surveys shown in Table 1-2 however, would not be significantly different from the research analyzed herein or result in a change in the take request presented in Section 6. For a complete list of proposed mitigation and monitoring measures, please see Sections 11 and 13.

TABLE 1-2. PROPOSED NEFSC RESEARCH ACTIVITIES BY GEAR TYPE

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
Long-Term Research							
Benthic Habitat Survey	The objective of this project is to assess habitat distribution and condition, including disturbance by commercial fishing and changes as the benthic ecosystem recovers from chronic fishing impacts. Also serves to collect data on seasonal migration of benthic species, collect bottom data for mapping, and provide indications of climate change through species shifts.	Bottom Trawl	Conductivity, Temperature, and Depth (CTD), Van Veen, Plankton trap, Beam Trawl, Dredge, Camera, Sonar	Georges Bank (GB)	Summer or Fall	20	Y
Fish Collection for Laboratory Experiments	Trawling/hook and line collection operations undertake to capture high quality fish for laboratory experiments.	Bottom Trawl	Net and twine shrimp trawl, fishing poles	New York Bight, Sandy Hook Bay	April–November	10	Y
Habitat Mapping Survey	This project maps shallow reef habitats of fisheries resource species, including warm season habitats of black sea bass, and locate sensitive habitats (e.g. shallow temperate coral habitats) for habitat conservation.	Bottom Trawl	4-seam, 3 bridle bottom trawl, beam trawl, CTD, Van Veen, Plankton trap, dredge, camera, sonar	Ocean Shelf off MD	Summer	11	Y
Living Marine Resources Survey	This project undertakes to determine the distribution, abundance, and recruitment patterns for multiple species.	Bottom Trawl	4-seam, 3 bridle bottom trawl, beam trawl, CTD, Van Veen, sonar	Cape Hatteras to NJ	Spring	11	Y
Massachusetts Division of Marine Fisheries Bottom Trawl Surveys	The objective of this project is to track mature animals and determine juvenile abundance.	Bottom Trawl	Otter trawl	Territorial waters from RI to NH borders	Spring and Fall	60–72	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
NEAMAP Near Shore Trawl Program – Northern Segment	This project provides data collection and analysis in support of single and multispecies stock assessments Gulf of Maine. It includes the Maine/New Hampshire inshore trawl program, conducted by Maine Department of Marine Resources (MDMR) in the northern segment.	Bottom Trawl	Modified Gulf of Maine (GOM) shrimp otter trawl net	U.S.-Canada border to NH-MA border from shore to 300 ft depth	Spring and Fall	30-50	Y
NEAMAP Near Shore Trawl Program – Southern Segment	This project provides data collection and analysis in support of single and multispecies stock assessments in the Mid-Atlantic. It includes the inshore trawl program NEAMAP Mid-Atlantic to Southern New England survey, conducted by Virginia Institute of Marine Science, College of William and Mary (VIMS) in the southern segment.	Bottom Trawl	4-seam, 3-bridle net bottom trawl cookie sweep	Montauk, NY to Cape Hatteras, NC from 20 to 90 ft depth	Spring and Fall	30-50	Y
NEFOP Observer Bottom Trawl Training Trips	Certification training for new NEFOP Observers is provided by this operation.	Bottom Trawl	Contracted vessels' trawl gear	Mid-Atlantic Bight (MAB) and GB	April–November as needed (day trips)	18	Y
NEFSC Northern Shrimp Survey	The objective of this project is to determine the distribution and abundance of northern shrimp and collect related data.	Bottom Trawl	4 seam modified commercial shrimp trawl, positional sensors, mini-log, CTD	GOM	Summer	22	Y
NEFSC Standard Bottom Trawl Surveys (BTS)	This project monitors abundance and distribution of mature and juvenile fish and invertebrates.	Bottom Trawl	4-seam, 3-bridle bottom trawl	Cape Hatteras to Western Scotian Shelf	Spring and Fall	120	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
NEFSC Bottom Trawl Survey Gear Trials	Testing and efficiency evaluation of the standardized 4-seam, 3-bridle bottom trawl (doors, sweeps, protocols).	Bottom Trawl	4-seam, 3-bridle bottom trawl, twin trawls	Cape Hatteras to Western Scotian Shelf	Fall	14–20	Y
Atlantic Herring Survey	This operation collects fisheries-independent herring spawning biomass data and also includes survey equipment calibration and performance tests.	Pelagic Trawl	4-seam, 3-bridle net bottom trawl, midwater rope trawl, acoustics	GOM and Northern GB	Fall	34	Y
Atlantic Salmon Trawl Survey	This is a targeted research effort to evaluate the marine ecology of Atlantic salmon.	Pelagic Trawl	Modified mid-water trawl that fishes at the surface via pair trawling	Inshore and offshore GOM	Spring	21	Y
Deepwater Biodiversity	This project collects fish, cephalopod and crustacean specimens from 500 to 2000 m for tissue samples, specimen photos, and documentation of systematic characterization.	Pelagic Trawl	Deep-Sea acoustic/optic/oceanographic/eDNA system, trawl camera system	Western North Atlantic	Summer or Fall	16	Y
Penobscot Estuarine Fish Community and Ecosystem Survey	The objective of this project is fish and invertebrate sampling for biometric and population analysis of estuarine and coastal species.	Pelagic Trawl	Mamou shrimp trawl modified to fish at surface	Penobscot Estuary and Bay, ME	Spring Summer and Fall	12	Y
Northeast Integrated Pelagic Survey	The objective of this project is to assess the pelagic components of the ecosystem including water currents, water properties, phytoplankton, micro-zooplankton, mesozooplankton, pelagic fish and invertebrates, sea turtles, marine mammals, and sea birds.	Pelagic Trawl	Mid-water trawls, bong nets, CTD, Acoustic Doppler Profiler (ADCP), acoustics	Cape Hatteras to Western Scotian Shelf	Summer and Fall	80	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
NEFOP Observer Mid-Water Trawl Training Trip	This program provides certification training for NEFOP Observers.	Pelagic Trawl	Various commercial nets	MAB and GB	April–November as needed (day trips)	5	Y
Apex Predators Pelagic Longline Shark Survey	The objectives of this survey are to: 1) monitor the species composition, distribution, and abundance of pelagic sharks in the U.S. Atlantic from Maryland to Canada; 2) tag sharks for migration and age validation studies; 3) collect morphological data and biological samples for age and growth, feeding ecology, and reproductive studies; and 4) provide time-series of abundance from this survey for use in Atlantic pelagic shark assessments.	Longline	Yankee and current commercial pelagic longline gear. Configured according to NMFS HMS Regulations	MD to Canada	Spring	30	Y
Apex Predators Bottom Longline Coastal Shark Survey	. The objectives of this survey are to: 1) monitor the species composition, distribution, and abundance of sharks in coastal Atlantic waters from Florida to Delaware; 2) tag sharks for migration and age validation studies; 3) collect morphometric data and biological samples for age and growth, feeding ecology, and reproductive studies; and 4) provide time-series of abundance from this survey for use in Atlantic coastal shark assessments.	Longline	Florida style bottom longline	RI to FL within 40 fathoms	Spring	47	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
Apex Predators Pelagic Nursery Grounds Study	This project uses opportunistic sampling on board a commercial swordfish longline vessel to: 1) monitor the species composition and distribution of juvenile pelagic sharks on the Grand Banks; 2) tag sharks for migration and age validation studies; and 3) collect morphometric data and biological samples for age and growth, feeding ecology, and reproductive studies. Data from this survey helps determine the location of pelagic shark nurseries for use in updating essential fish habitat designations.	Longline	Standard commercial pelagic longline gear. Configured according to NMFS Highly Migratory Species (HMS) Regulations	GB to Grand Banks off Newfoundland, Canada	Fall	21-55	Y
Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Longline and Gillnet Surveys	This project determines the location of shark nurseries, species composition, relative abundance, distribution, and migration patterns. It is used to identify and refine essential fish habitat and provides standardized indices of abundance by species used in multiple species specific stock assessments. NEFSC conducts surveys in Delaware, New Jersey, and Rhode Island estuarine and coastal waters. Other areas are surveyed by cooperating institutions and agencies. In the NE Large Marine Ecosystem (LME), the Virginia Institute of Marine Science (VIMS) is a cooperating partner. South of Cape Hatteras the South Carolina Departmetn of Natural Resources (SCDNR), University of North Florida (UNF), and Florida Atlantic University (FAU) are partners.	Longline and Gillnet	Bottom Longline Gear, Anchored Sinking Gillnet	FL to RI	Summer	25 or 40	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
Cooperative Research Gulf of Maine Longline Project	The objective of this project is to conduct commercial cooperative bottom longline sets to characterize demersal species of the Western Gulf of Maine traditionally difficult to capture with traditional or research trawl gear due to the bottom topography.	COOP Western-Central Gulf of Maine hard bottom longline survey	Longline	Western GOM focused on sea mounts	Spring and Fall	60 stations/ year eastern Maine, 90 stations/ year western-central GOM	Y
NEFOP Observer Bottom Longline Training Trips	This program provides certification training for NEFOP observers.	Longline	Commercial bottom longline gear	MAB and GB	April–November as needed (day trips)	5	Y
Annual Assessments of Sea Scallop Abundance and Distribution	These Atlantic Sea Scallop Research Set-Aside (RSA) rotational area surveys endeavor to monitor scallop biomass and derive estimates of Total Allowable Catch (TAC) for annual scallop catch specifications. Additionally, the surveys monitor recruitment, growth, and other biological parameters such as meat weight, shell height and gonadal somatic indices.	Dredge	Scallop dredges, drop cameras, Other Habitat Camera (HabCam) Versions	GPM, Georges Bank, Mid-Atlantic	Dredge surveys Apr-Sept, Camera surveys June-Sept.	50–100	N
NEFOP Observer Scallop Dredge Training Trips	This program provides certification training for NEFOP observers.	Dredge	Turtle deflector dredge	MAB and GB	April–November as needed (day trips)	6	N
Annual Standardized Sea Scallop Survey	The objective of this project is to determine distribution and abundance of sea scallops and collect related data for Ecosystem Management from concurrent stereo-optic images. It is conducted by the NEFSC.	Dredge	New Bedford dredge, HabCam V4	NC to GB	Summer	36	N

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
Surfclam and Ocean Quahog Dredge Survey	The objective of this project is to determine distribution and abundance of Surfclam/ocean quahog and collect related data.	Dredge	Hydraulic-jet dredge	Southern VA to GB	Summer	15	N
Coastal Maine Telemetry Network	The objective of this project is to monitor tagged animals entering the Penobscot Bay System and exiting the system into the Gulf of Maine.	Other	Fixed position acoustic telemetry array receivers on moorings spaced 250-400 m apart	Penobscot River estuary and bay, GOM	Year round in GOM and Apr.-Nov. in nearshore areas	10	Y
Deep-sea Coral Survey	The objective of this program is to determine the species diversity, community composition, distribution and extent of deep sea coral and sponge habitats.	Other	Remotely Operated Vehicles (ROVs), CTD, towed cameras, ADCP, acoustics	Continental shelf margin, slope, and submarine canyons and deep basins: GOM to Virginia	Summer	16	Y
Diving Operations	The objective of this project is to collect growth data on hard clams, oysters and bay scallops.	Other	Wire mesh cages, lantern nets	Long Island Sound	Year round	20	N
Gulf of Maine Ocean Observing System Mooring Cruise	This project services oceanographic moorings operated by the University of Maine.	Other	ADCP on vessel and moorings	GOM and Northern GB	Summer	12	N
Hydroacoustics Surveys	This project consists of mobile transects conducted throughout the estuary and bay to study fish biomass and distribution.	Acoustic only	Split-beam and DIDSON	Penobscot Bay and estuary	Spring	25	Y
Marine Estuaries Diadromous Survey	This project is a fish community survey at fixed locations.	Other	1 m and 2 m fyke nets	Penobscot Bay and estuary	April–November	100	N

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
NEFOP Observer Gillnet Training Trips	This program provides certification training for NEFOP Observers.	Other	gill net gear	MAB and GB	April–November as needed (day trips)	10	N
Nutrients and Frontal Boundaries	The objective of this project is to characterize nutrient patterns associated with distinct water masses and their boundaries off of coastal New Jersey and Long Island in association with biological sampling.	Other	ADP, CTD, Hydroacoustics	MAB	Feb., May-June, Aug, and Nov.	10	N
Ocean Acidification	The objective of this project is to develop baseline pH measurements in the Hudson River water.	Other	CTD, YSI, multinutrient analyzer, Kemmerer bottle	Hudson River Coastal waters	Spring	10	N
AUV Pilot Studies	This program provides gear and platform testing.	Other	AUV	MA state waters, GB	June	5	N
Rotary Screw Trap (RSTs) Survey	This project is designed to collect abundance estimates of Migrating Atlantic salmon smolts and other anadromous species.	Other	RST	Estuaries on coastal Maine rivers	April 15-June 15	60	N
Trawling to Support Finfish Aquaculture Research	The objective of this project is to collect broodstock for laboratory spawning and rearing and experimental studies.	Other	Combination bottom trawl, shrimp trawl, gillnet	Long Island Sound	Summer	30	Y
DelMarVa Habitat Characterization	The objective of this project is to characterize and determine key hard bottom habitats in coastal ocean off the DelMarVa Peninsula as an adjunct to the DelMarVa Reef Survey.	Other	ADCP, CTD, YSI, Plankton net, video sled, Ponar grab, Kemmerer bottle, sonar	Coastal waters off DE, MD and VA	August	5	N

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
DelMarVa Reefs Survey	The objective of this project is determination of extent and distribution of rock outcrops and coral habitats and their use by black sea bass and other reef fishes	Other	HABCAM, CTD	Coastal waters off DE, MD and VA	August	5	N
Miscellaneous Fish Collections and Experimental Survey Gear Trials	The James J. Howard Sandy Hook Marine Laboratory occasionally supports short-term research projects requiring small samples of fish for various purposes or to test alterations of survey gear. These small and sometimes opportunistic sampling efforts have used a variety of gear types other than those listed under Status Quo projects. The gears and effort levels listed here are representative of potential requests for future research support.	Other	Bottom trawl, lobster and fish pots, beam trawl, seine net, trammel nets	New York Bight estuary waters	Spring and Fall	not stated	Y
Opportunistic Hydrographic Sampling	This program consists of opportunistic plankton and hydrographic sampling during ship transit.	Other	Plankton net, expendable bathythermograph	Southeast LME depths < 300 m	Early Summer	not stated	N
Monkfish RSA	Monkfish Research Set-Aside (RSA) surveys endeavor to monitor Monkfish biomass and derive estimates of Total Allowable Catch (TAC) for annual Monkfish catch specifications. Additionally, the surveys monitor recruitment, growth, and other biological parameters.	Other	Commercial gillnets of various sizes, short durations for sets.	Mid-Atlantic and Georges Bank	April–December (end of fishing year)	100–200 sets/year. Sets left for 2–3 days	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
Short-Term Projects							
Survey Projects	Cooperative Industry based surveys to enhance data for flatfish utilizing cookie sweep gear on commercial platforms.	Trawl	Bottom Trawl	GOM, GB, SNE, MAB	Summer and Fall	550 tows/year	Y
Survey Projects	Cooperative Industry based catchability studies for Monkfish, Longfin squid, other.	Trawl	Pelagic Trawl	GOM, GB, SNE, MAB	Summer and Fall Summer and Fall	30 tows/year	Y
Trawl Comparison Research	Twin trawl and paired vessel comparisons of Standardized Bigelow Trawl to test rockhopper and cookie sweeps and varying trawl doors performance on commercial platforms.	Twin Bottom Trawl	Trawl nets with two types of sweeps or doors	GB, SNE, MAB	Summer and Fall	100 DAS	Y
Survey Projects	Pot and trap catchability studies for Scup and Black Sea bass.	Pot survey	Pots and Traps	SNE, Rhode Island Bight, Nantucket Sound, MAB waters from shore to shelf edge.	Spring and fall for black sea bass. Year round for scup	2,650 pot sets/year	Y
Conservation Engineering Projects	Gear and net conservation Cooperative work.	Trawl	Bottom Trawl	GOM, GB, SNE, MAB	Spring, Summer and Fall	~ 500 tows/year total for all bottom trawls	Y
Conservation Engineering Projects	Varied gear and efficiency testing of fisheries applications.	Trawl	Bottom Trawl	GOM, GB, SNE, MAB	Spring, Summer and Fall	~ 500 tows/yr. total for all bottom trawls	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
Conservation Engineering Projects	Cooperative Squid Trawls and studies for squid catchability and selectivity.	Trawl	Bottom Trawl & Beam trawl	GOM, GB, SNE, MAB	Spring, Summer and Fall	~ 500 tows/yr. total for all bottom trawls	Y
Conservation Engineering Projects	Commercial scallop dredge finfish and turtle excluder research. Scallop dredge finfish and turtle excluder research	Dredge	Dredge	GB, SNE, MAB	April–December (end of fishing year)	> 1,700 tows/year total for all dredges	N
Conservation Engineering Projects	Commercial hydrodynamic turtle deflector dredge testing.	Dredge	Hydrodynamic dredge	GB, SNE, MAB	April–December (end of fishing year)	> 1,700 tows/year total for all dredges	N
Tagging Projects	Winter Flounder tagging projects. Winter flounder migration patterns	Trawl	Bottom Trawl & Otter trawl	Coastal waters in GOM New Hampshire to Stonington/ Mt. Desert Island, ME	Spring and Summer	up to 650 trawls/ year	Y
Tagging Projects	Spiny dogfish tagging projects. Spiny dogfish tagging north and south of Cape Cod, and Cusk & NE multi-species tagging	Hook & Line; Gillnet	Hook & Line and Gillnet	GOM and GB waters adjacent to Cape Cod, MA	Spring Summer and Fall	Long line: 5 sets/trip, 15 total Gillnet: 5 sets/trip, 15 total	Y

Project Name	Survey Description	Main Gear Type	Specific Gear	Area of Operation	Season	Annual Days at Sea (DAS)	Potential for MMPA Take (Y/N)
Tagging Projects	Monkfish tagging projects.	Gillnet	Gillnet	GOM, SNE, MAB	September –December	18-20 DAS, 10 short-duration sets/day, 180-200 sets total	Y
Ropeless Lobster Trap Research	Research to develop ropeless gear/devices to mitigate/eliminate interactions with protected species (whales and turtles) by utilizing commercial lobster gear.	Lobster Pots/Traps	Acoustic/ mechanical releases for ropeless lobster gear and float lines	GOM, SNE, MAB (Inshore and Offshore)	Summer and Fall	50–100 DAS, ~500 sets, singles and up to 40 pots per set	N
Rod and Reel Tagging of Atlantic Salmon	Use of rod and reel to capture, tag, release Atlantic salmon in international and US waters	Rod and Reel	Acoustic tags	ME, Greenland	Summer and Fall	200–500 tags applied total	N
Continuous Plankton Recorder (CPR) Transect Surveys: GOM	A towed continuous plankton recording device is deployed from vessels of opportunity in the Gulf of Maine, monthly.	Towed array	CPR	ME to Nova Scotia	Summer and Fall	24 DAS	N

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1.4. Long-term Research Surveys Conducted By NEFSC

The following subsections discuss research activities covered under this LOA application as summarized in Table 1-2. Additional details on gear and vessels used by NEFSC are provided in Appendix A.

1.4.1. Benthic Habitat Survey

The benthic habitat survey is an annual survey that occurs during the summer (July) or fall (October) in an area that extends from the Hudson Canyon northeast to GB. The study considers seafloor disturbance by commercial fishing and records any changes as the benthic ecosystem recovers from chronic fishing impacts. The study also collects data on seasonal migration patterns, provides sea floor surface data for mapping, and indication of climate change through species shifts. It is conducted 24 hrs per day.

The Hudson Canyon survey conducted in July deploys a 4-seam, 3-bridle bottom trawl at approximately 2.5 knots (kts) for 30-minute tows at a target depth. The survey averages 54 tows per year and requires about 20 DAS using the R/V Henry B. Bigelow or other appropriate vessel. The 4-seam, 3-bridle bottom trawl gear includes a net (31 meters [m] long by 19 m wide by 5 m high) that retains the sampled animals, a headrope with floats and trawl doors/vanes to keep the net open while trawling; and a footrope with rollers to maintain contact with the seafloor.

Other sampling protocols include the use of a CTD profiler and rosette water sampler, plankton light trap, Van Veen sediment grab, beam trawl, naturalists dredge, and SEABOSS benthic observation system. Multi-frequency active acoustics are also used (output frequencies: 18, 38, 120, 200, 400, and 450 kilohertz (kHz).

1.4.2. Fish Collection for Laboratory Experiments

This survey catches high quality fish for laboratory experiments and occurs annually as needed from April to November in the New York Bight, Sandy Hook Bay, New Jersey. This survey occurs on a 24-hour schedule. The research is conducted by deploying 16-ft or 30-ft bottom trawl nets towed at approximately 2.5 kts for 10 min, or hook and line fishing. The exact number of tows varies depending on scientific need, but typically a sufficient number of trawls are conducted to collect 10-60 specimens. The survey requires approximately 10 DAS. Additional protocols include the deployment of a video sled, CTD, Tucker plankton net, an ADCP: 38, 120 kHz, Ponar grab, and Kemmerer water sampling bottles.

1.4.3. Habitat Mapping Survey

This survey maps shallow reef habitats of fisheries resource species, including black sea bass habitat and occurs annually during the summer in the ocean shelf off the Maryland coast. It also locates sensitive habitats (e.g. shallow temperate coral habitats) for habitat conservation and runs on a 24-hour schedule.

The survey deploys a 4-seam, 3-bridle bottom trawl (31 m long x 19 m wide x 5 m high) towed at 3.0 kts for 30 minutes at target depth. Level of effort is about 54 tows per year and approximately 11 DAS. Additional protocols include deployment of a CTD Profiler, split beam sonar, plankton light trap, beam trawl (tow speed 2.0 kts for 20 minutes), a naturalists dredge (tow speed 2.0–3.0 kts for 1 minute at depth), SEABOSS benthic camera vehicle, and continuous use of four multi-frequency acoustic devices (output frequencies: 18, 38, 120, 200, 400, and 450 kHz).

1.4.4. Living Marine Resources Center Survey

This survey is conducted annually during the spring in January from Cape Hatteras to New Jersey. The purpose of the research is to determine distribution, abundance, and recruitment patterns of multiple species. The survey operates on 24-hour schedule. The survey deploys a 4-seam, 3-bridle bottom trawl (31 m long x 19 m wide x 5 m high) towed at 3.0 kts for 30 min. The survey averages 25 tows per year and requires about 11 DAS using the R/V Henry B. Bigelow or a similar vessel type. Protocols also include the use of a 2-m wide beam trawl at 2.0 kts for 20 minutes at depth, Van Veen sediment grab, and CTD profiler. Additional protocols include the continuous use of multi-frequency active acoustics (output frequencies: 18, 38, and 120 kHz).

1.4.5. Massachusetts Division of Marine Fisheries (MADMF) Bottom Trawl Surveys

The MADMF surveys are conducted in May and September each year. They take place during daylight hours within 5 nm of the Massachusetts coast, from the Rhode Island to New Hampshire borders. The study tracks abundance of mature and juvenile fishes. The survey deploys an otter trawl at approximately 2.5 kts for 20-min. and averages 206 tows per year over 30–36 DAS. The otter trawl has a 39 ft headrope and 51 ft footrope, rigged with a 3.5 inch (in) rubber disc sweep and has a ½ in stretched nylon liner at the cod end to retain small fish. The net is spread by 72 in x 40 in 325 pound (lb) wooden trawl doors connected to the net via 63 ft 3/8 in chain bottom legs and 60 ft 3/8 in wire top legs. The MADMF survey is typically conducted using the R/V Gloria Michelle.

1.4.6. Northeast Area Monitoring and Assessment Program (NEAMAP) Near Shore Trawl

The NEAMAP survey is conducted annually from April–June and October–December in two segments (Northern and Southern) during daylight hours. The northern segment extends from the U.S.-Canada border to New Hampshire-Massachusetts from shore to the 300 ft depth; the southern segment extends from Montauk, New York to Cape Hatteras from 20 to 90 ft depth. The program collects data in support of single and multispecies stock assessments in the mid-Atlantic.

Survey sampling protocols in the northern segment include deploying a modified GOM shrimp otter trawl at a speed of approximately 2.2 kt for 20 min. The northern survey averages 200 tows per year and requires approximately 30–50 DAS. In the southern segment a 4-seam, 3-bridle bottom trawl is deployed at approximately 3.0 kts for 20 min. The trawl has a 58 ft headrope, 70 ft footrope, 24 ft side rope, with 1 in poly stretch mesh, and #7.5 Bison doors. The southern segment survey averages 300 tows per year over approximately 30–50 DAS.

1.4.7. Northeast Observer Program (NEFOP) Bottom and Mid-water Trawl Training

This is a certification training program for new NEFOP observers that occurs in the Mid-Atlantic Bight (MAB) and GB on an annual basis. The one-day trips take place from April to November as needed, for a total of about 18 DAS for the bottom trawl training and 5 DAS for the midwater trawl training. Training occurs on contracted commercial fishing vessels. The protocol for training includes deployment of a commercial fishing net (net size, tow speed, and other details vary depending on the vessel and gear used). No active acoustic gear is used as part of the training. About 108 tows may occur per year.

1.4.8. Northern Shrimp Survey

This annual survey is conducted in July in the GOM during daylight hours. The purpose of the Northern Shrimp Survey is to determine the distribution and abundance of northern shrimp and to collect related water quality data. Survey protocols include deploying a 4-seam modified commercial shrimp bottom trawl (25 m length by 17 m width by 3 m high) at approximately 2–3 kts for 15 min. The surveys average 82 tows per year and require 22 DAS using the R/V Gloria Michelle.

1.4.9. NEFSC Standard Bottom Trawl Survey (BTS)

The BTS is conducted annually in spring (March to May, occasionally to June) and fall (September to November) from Cape Hatteras to the western Scotian Shelf, operating on a 24-hour schedule. Mature fish species and juvenile abundance are tracked over their ranges. Survey protocols include deploying a 4-seam, 3-bridle bottom trawl (31 m long, 19 m wide and 5 m high) at 3 kts for 20 min. Combined, the spring and fall surveys average 800 tows over 120 DAS using the R/V Henry B. Bigelow, or a similar vessel. Additionally, the survey uses a CTD profiler, bongo net equipped with CTD, ADCP (150 or 300 kHz), and split beam and multibeam active acoustics (output frequencies: 18, 38, 70, 120, and 200 kHz). As part of the BTS NEFSC also conducts gear trial using twin 4-seam, 3-bridle bottom trawls. The trials are conducted over 14–20 DAS in the same region as the BTS.

1.4.10. Atlantic Herring Survey

This survey is conducted on a 24-hr schedule in September and October, on GB and in the GOM. The survey collects fisheries independent herring spawning biomass data and also conducts survey equipment calibration and performance tests. The survey deploys 70 tows of the Gourock high speed midwater rope trawl at 4 kts for 5–30 minutes, requiring about 34 DAS using the R/V Henry B. Bigelow or similar size vessel. The midwater rope trawl used is 15 m high and 30 m wide. The Atlantic herring survey also includes 20 deployments of the 4-seam, 3-bridle bottom trawl at 3 kts for 10–20 minutes. The net size is 31 m long, 19 m wide, and 5 m high. Additional protocols include the continuous use of split beam and multibeam active acoustics (output frequencies: 18, 38, 70, 120, and 200 kHz).

1.4.11. Atlantic Salmon Trawl Survey

This survey has been conducted annually in May in inshore waters of the GOM and Penobscot Bay during daylight hours. It intended to evaluate the marine ecology of Atlantic salmon. The survey deploys a modified mid-water trawl that fishes at the surface via pair trawling at 2–6 kts for 30–60 min. Approximately 130 tows are made over about 21 DAS using contracted commercial vessels. While this survey is not currently planned in the near-term, NEFSC is including this research in the event it occurs in the future.

1.4.12. Deepwater Biodiversity Survey

This annual survey (referred to as Deep-Sea) is conducted during the summer months in deep-water offshore areas from Cape Hatteras to the mid-Atlantic Ridge (international waters). Survey operations occur on a 24-hour schedule. The biodiversity study collects fish, cephalopods and crustacean specimens from 500 to 2,000 m deep for tissue samples, specimen photos, and documentation of systematic changes. Protocols include deployment of towed platform fit with multiple instruments including acoustic/optic/oceanographic/eDNA system, and trawl camera systems. Tow speeds are typically 1.5–2.5 kts with duration of 180 minutes (in deep water each operation setting, fishing, and haulback requires 60 minutes). The surveys average 18 tows per year and require about 16 DAS (R/V Henry B. Bigelow, or equivalent). Additional survey equipment includes multi-frequency active acoustics (output frequencies: 18, 38, 70, 120, and 200 kHz). Gear previously used was a 4-seam, 3-bridle net bottom trawl and Superior midwater trawl. These trawls are no longer used for the study.

1.4.13. Penobscot Estuarine Fish Community and Ecosystem Survey

This estuarine and coastal species survey is conducted annually year round during daylight hours in Penobscot Estuary and Bay using a contracted commercial vessel. The survey collects samples of fish and invertebrates for biometric and population analyses. A Mamou shrimp trawl modified to sample at the surface is deployed and towed for 20 min at a speed of 2–4 kts. The trawl has a mouth opening 12 x 6 m. Approximately 200 trawl tows are conducted per year and require about 12 DAS.

1.4.14. Northeast Integrated Pelagic Survey

This annual survey is conducted during the summer and fall in an area that expends from Cape Hatteras to the western Scotian Shelf. The pelagic components of the ecosystem including: water currents, water properties, phytoplankton, micro-zooplankton, meso-zooplankton, pelagic fish and invertebrates, sea turtles, marine mammals, and sea birds are assessed. Survey operations are on a 24-hour schedule and require about 80 DAS and are conducted on one of several vessels including the R/V Henry B. Bigelow.

Several types of midwater fishing trawls are deployed during the survey:

- Hydroacoustic midwater rope trawl – The net is 15 m high, 30 m wide and towed at 4 kts for 5–30 minutes at depth; approximately 80 tows are conducted per year.
- Isaacs-Kidd midwater trawl – The net is 3 m and 4.5 m wide and towed at 2.5 kts for a maximum of 30 min; approximately 160 tows are conducted per year.
- Mid-water trawl – The trawl is for use in shallow water (>15 m depth). The net has an 8 m x 8 m opening and is towed at 2.5 kts for a maximum of 30 min; approximately 80 tows are conducted per year.

Protocols also include the use of CTD, rosette water sampler, and bongo net equipped with CTD. Continuous use of split beam and multibeam active acoustics (output frequencies: 18, 38, 70, 120, 200 kHz), and ADCP (300 or 150 kHz) is also included.

1.4.15. Apex Predators Pelagic Longline Coastal Shark

This survey is conducted bi-annually in April–May, extending from Maryland to Canada. It assesses pelagic shark populations, and includes monitoring of distribution, abundance, and species composition, and shark tagging. Survey operations are on a 24-hour schedule, over 30 DAS. Survey gear is configured to be consistent with Atlantic Highly Migratory gear operations and deployment restrictions (50 CFR 653.21). The pelagic gear uses only 18/0 or larger circle hooks with an offset not to exceed 10 degrees. The outer diameter of the circle hook at its widest point must be no smaller than 2.16 inches (55 mm) and the distance between the circle hook point and the shank (i.e., the gap) must be no larger than 1.13 inches (28.8 mm).

Hooks are baited and weights are attached at intervals to ensure that the gear fishes on the bottom. A 6 m flag buoy (‘high flyer’) equipped with radar reflectors and flashing lights is attached to each end of the mainline.

1.4.16. Apex Predators Bottom Longline Coastal Shark Survey

This survey is conducted bi-annually in April–May, extending from Florida to Delaware. The purpose of the study is to assess shark populations shark populations that are in sharp decline, including monitoring of distribution, abundance, and species composition, and tagging sharks. Survey operations are on a 24-hour schedule.

The survey includes deploying a Florida style bottom longline. ‘Florida’ commercial-style bottom longline gear consists of 940 lb test monofilament mainline with 3.6 m gangions made of 730 lb test monofilament with a longline clip at one end and a 3/0 shark hook at the other. Hooks are baited with chunks of spiny dogfish and are attached to the mainline at roughly 20 m intervals. Five lb weights are attached at 15 hook intervals, and 15 lb weights and small buoys are attached at 50 hook intervals. To ensure that the gear fishes on the bottom, 20 lb weights are placed at the beginning and end of the mainline after a length of line 2–3 times the water depth is deployed. A 6 m flag buoy (‘high flyer’) equipped with radar reflectors and flashing lights is attached to each end of the mainline. The gear is set at night without light sticks, soak time is 3 hours, and the gear is hauled during daylight. There are about 56 sets per survey, which require 47 DAS.

1.4.17. Apex Predators Pelagic Nursery Grounds Shark Survey

The nursery grounds survey is conducted aboard commercial swordfish vessels in October on GB and the Grand Banks off Newfoundland. This collaborative work offers NEFSC researchers the opportunity to sample and tag by caught sharks. Further, it offers a unique opportunity to sample and tag blue sharks and shortfin mako sharks in a potential nursery area on the Grand Banks. Sharks are released after tagging. Protocol for this research is based on commercial fishing operations and follows the requirements of 50 CFR 635.21. The commercial swordfish longline gear is set at night, with light sticks, and hauled in the morning—vessels operations are on a 24-hour schedule. Commercial trips require 21–55 DAS.

1.4.18. Cooperative Atlantic States Shark Pupping and Nursery Survey (COASTSPAN)

This annual survey is conducted from June–August in coastal Delaware, New Jersey, and Rhode Island waters. Occasionally, this work may occur as far south as Florida. It assesses shark nursery grounds and the species composition and habitat preferences of sharks that occur on these grounds. Survey operations are conducted during daylight hours. Survey protocols include using small juvenile/ large juvenile-adult shark longline gear, depending on the survey target. The gear characteristics for each target size are: mainline length: 1,000 ft/ 1,000 ft; gangion length: 5 ft/ 8 ft; gangion spacing: 20 ft/40 ft; hook size and type: 12/0 / 16/0 mustad circle hooks; hooks per set: 50/ 75; bait: mackerel or herring; soak time: 30 minutes /2 hours. The COASTSPAN work is completed from small watercraft (18-ft skiffs) or from the shoreline in 4 ft of water or less. Acoustics are not used. All COASTSPAN surveys obtain state permits for work within state waters. Gillnet and longline are set from small boats in these areas to depths as shallow as 1 ft. Neither gear is raked across the seafloor. Both gear consist of a length of line (1/4 in diameter) set on the seafloor and weighted and both ends. Longline gear has baited hooks attached at 20 ft intervals.

Annual planned COASTSPAN surveys in South Carolina estuaries conducted in cooperation with NEFSC by the South Carolina Department of Natural Resources (SCDNR) include: 150 drum lines (1 hook, 1 hour soak); 375 SEAMAP longline (40 hooks, 40 min soak); 100 juvenile longline (50 hooks, 30 min soak); 100 small gillnet (48.8 m, 30 min soak); and 100 long gillnet (22.9 m, 30 min soak). COASTSPAN surveys are also conducted in Georgia and Florida coastal and estuarine waters in cooperation with the University of North Florida (UNF): 200 juvenile longline (50 hooks, 30 min soak); 50 mixed longline (100 hooks, 30 min soak); 50 large gear longline (50 hooks, 30 min soak); and 100 drum lines (1 hook, 1 hour soak). Lastly, NEFSC coordinates with Florida Atlantic University to conduct COASTSPAN surveys in coastal and estuarine waters along the Atlantic coast in the vicinity of the Indian River lagoon: 100 gillnet (50 m, 30 min soak); 50 haul seine (30 min soak); 100 longline (50 hooks, 1 hour soak); and 50 drum lines (1 hook, 1 hour soak). These surveys south of Cape Hatteras occur mostly between April and September, with some year round work. Level of effort is expected to remain about the same as in previous years. The NEFSC-conducted surveys require 25 DAS, whereas the cooperating institutions surveys require about 40 DAS.

1.4.19. Cooperative Research GOM Longline Project

This research study uses commercial cooperative bottom longline sets to characterize demersal species of the Western GOM. It is focused on seamounts and the targeted species are traditionally difficult to capture with traditional or research trawl gear due to the bottom topography. Longline used during the spring and fall at 60 stations per year in eastern Maine, and 90 stations in western-central GOM.

1.4.20. NEFOP Observer Bottom Longline Training Trips

These trips are certification training for NEFOP observers. Trips would occur as needed in the MAB and GB annually from April to November for 5 DAS on contracted commercial fishing vessels using commercial bottom longline gear. The mainline length is approximately 3,000 ft with 600 hooks per set 2–3 sets per trip. Light sticks are not used in fishing operations during training trips.

1.4.21. Annual Research Set Aside Sea Scallop Survey and Research

The Atlantic Sea Scallop Research Set Aside (RSA) rotational surveys occur at various times over April–September, depending on the area studied. The survey region includes large areas on GB, Closed Areas I & II, Hudson Canyon, DelMarVa, Nantucket, GOM, Mid-Atlantic areas, and other scallop fishing grounds. The studies determine scallop biomass to derive estimates of Total Allowable Catch (TAC) for annual scallop catch specifications. Additionally, the surveys monitor recruitment, growth, and other biological parameters such as meat weight, shell height and gonadal somatic indices. The objective of this project is to determine distribution and abundance of sea scallops and collect related data for Ecosystem Management from concurrent stereo-optic images.

Survey gear includes commercial and standardized NMFS scallop dredges towed simultaneously on a 24-hour schedule. The NMFS survey dredge is 8 ft wide, has 2-in rings, 4-in diamond twine top, and 1.5 in diamond mesh liner. The commercial gear used consists of a 15 ft Coonamessett Farm Turtle Deflector Dredge (CFTDD) with 4-in rings, 10-in diamond mesh twine top and no liner. Turtle chains are used in configurations as dictated by the area surveyed and current commercial fishing regulations under the MSA. Tow speed is 3.8–4.0 kts for 15 minutes. About 100 dredge tows per year are completed in each rotational area when sampled using that method. Average number of dredge tows per year is about 200 in all areas.

Additional survey protocols include the use of a towed photographic and sonar hydroacoustic imaging system (HABCAM), drop cameras, and underwater video systems. The HABCAM photographic system has a 1-m field of view in each photograph, and records 5–10 frames per second with >50% overlap at 5 kts towing speed. This is coupled with two side scan sonars. Between 350 and 690 nm of transects using digital photography by HABCAM are assessed each year. The drop camera typically samples over 400 stations on a 1.57 km sampling grid.

1.4.22. NEFOP Observer Scallop Dredge Training Trips

Certification training for NEFOP observers occur in the MAB and GB annually, one-day trips (daylight tows) from April to November as needed. The training takes about 6 DAS on contracted commercial fishing vessels using commercial scallop gear such as a turtle deflector dredge (4 to 5 m wide). Tow duration is about 1 hr with 2–3 tows per trip and 12–18 tows total.

1.4.23. Annual Standardized Sea Scallop Survey

The sea scallop survey occurs annually during May–July in an area that extends from Cape Hatteras, North Carolina to the Scotian Shelf, Canada. The objective of the survey is to determine the distribution and abundance of sea scallops and collect related data for ecosystem management. Survey operations are on a 24-hour schedule.

A chartered vessel is used to deploy a New Bedford scallop dredge equipped with a 2-in. ring chain bag and lined with 1.5 in. mesh webbing liner to retain small scallops. The dredge is towed at 3.8 kts for 15-minute intervals with a 3.5:1 tow wire to depth ratio. Approximately 450 stations are sampled each year and requiring about 36 DAS.

Additional sampling equipment includes deploying a HABCAM imagery system to count and measure sea scallops and associated fauna. The camera system may be towed for about half of the DAS. The non-invasive vehicle is towed by a 2 in fiber optic cable that keeps the vehicle about 1.5 m off the sea floor. Between 350 and 690 nm of transects using digital photography by HABCAM are assessed each year.

1.4.24. Surf Clam and Ocean Quahog Dredge Survey

The NEFSC standard surf clam and quahog survey occurs every three years during June–August extending from southern Virginia to GB. The purpose of the study is to assess distribution and abundance of surf clams and quahogs and to collect related data. Survey operations occur over 24 hours. using commercial vessels. A standard, commercially sized hydraulic-jet clam dredge (13 ft blade width) is towed at 1.5 kts for 5 minutes with a 2:1 tow wire to depth ratio. About 150 tows are completed per survey, requiring 15 DAS.

1.4.25. Coastal Maine Telemetry Network

This 24-hour a day research program is conducted year round in the GOM and from April to November in the Penobscot River, estuary and bay. The purpose of the telemetry project is to monitor tagged Atlantic salmon, Atlantic sturgeon, and short-nose sturgeon that enter the Penobscot Bay system and exit the system into the GOM.

The 69 kHz frequency network relies on fixed position acoustic telemetry array receivers on 30 to 120 moorings attached to 10 to 100 m vertical lines (600 lb test with weak links) spaced 250–400 m apart. Data is acquired by hauling each buoy out of the water and downloading the data. A contracted commercial vessel is used to monitor and service the array, and the effort requires 10 DAS annually.

1.4.26. Diving Operations

Daylight diving operations are conducted on a year-round basis in Long Island Sound. Divers collect growth data on hard clams, oysters and bay scallops. The survey requires 20 DAS.

The survey protocol is to deploy wire mesh cages (1.5 in square mesh cages 60 in x 24 in x 18 in) that are staked to the substrate, and lantern nets (18 in diameter x 72 in long) that are anchored to the seabed with 4 four cinder blocks with the net oriented vertically.

1.4.27. Deep-sea Coral Survey

The deep-sea coral survey occurs annually during the summer months in deep water areas (greater than 500 meters) from the GOM to off the coast of Virginia. On a 24-hour schedule, the survey assesses the species diversity, community composition, distribution and extent of deep sea coral and sponge habitats along the continental shelf margin, and slope, and in submarine canyons. The survey is conducted on the R/V Henry B. Bigelow and requires an average of 16 DAS. The survey involves towing a tethered Remotely Operated Vehicle (ROV) (10 dives) at a speed of 3 kts, towing a camera system at 0.25 kt for 8 hours (18 dives); and deploying a CTD profiler with a Niskin 12-bottle rosette water sampler. Active acoustics (output frequencies: 18, 38, 70, 120, 200 kHz), and ADCP (300 or 150 kHz) are used during this survey.

1.4.28. Gulf of Maine Ocean Observing System Mooring Cruise

This mooring cruise occurs twice a year during May and October in the GOM and northern portion of GB. The effort services oceanographic moorings operated by the University of Maine. The R/V Henry B. Bigelow or similar vessel is used, and the work requires 12 DAS, operating on a 24-hour schedule. The ADCP (300 kHz) is operated as the vessel transits to moorings and services the ADCP (300 and 75 kHz) on the moorings.

1.4.29. Hydroacoustic Surveys

These surveys occur from April to November in the Penobscot Bay and estuary. The hydroacoustic component of the estuary survey describes the spatial and temporal patterns of fish distribution in the estuary with a focus on diadromous species. The objective is to inform abundance and habitat-use data gaps through systematic sampling using a variety of gears. The surveys operate during daylight hours and require 25 DAS. The protocol for these surveys requires use of the following active multi-frequency acoustics: split-beam (38 and 120 kHz) and sonar.

1.4.30. Maine Estuaries Diadromous Survey

This survey occurs annually from April to November in the Penobscot River estuary and assesses the fish community in the estuary. The survey operations occur on a 24-hour schedule. Survey protocols include setting a 2 m (2 m x 2 m; 1.9 centimeter [cm] mesh) or 1 m (1 m x 1 m; 0.6 cm mesh) fyke net inshore using small boats during daylight at low tide. The fyke net is allowed to soak overnight and is hauled the next day. A marine mammal excluder device consisting of a metal grate with 14 centimeter spacing between the bars is incorporated into the 2 m net, but not the 1 m net because the 1 m net has a throat opening of only 12.7 centimeters. From April to May the nets are set weekly, then twice per month through November. The survey averages 100 sets per year which requires about 100 days to complete.

1.4.31. NEFOP Observer Gillnet Training Trips

These are annual one day trips to provide training and certification for NEFOP observers in the MAB and GB for up to 10 DAS during April to November. The training is conducted on contracted commercial fishing vessels using the vessel's gillnet gear. The nets are strings of 3–5 panels each are soaked for 12–24 hours with 4 sets per trip, 40 sets total. There are no standard dimensions for commercial gillnets, but panels generally measure 3 m high and 91 m long.

1.4.32. Nutrients and Frontal Boundaries

This study is conducted quarterly in February, May–June, August, and November in the MAB (i.e., coastal New Jersey and Long Island waters). Sampling occurs day and night and requires 10 DAS. The survey protocol requires using a ADCP (600 kHz), multi-frequency active acoustic devices (38 and 120 kHz), and deployment of a CTD.

1.4.33. Ocean Acidification

These quarterly studies are conducted in the Hudson River and adjacent coastal waters. The purpose is to record baseline pH measurements in Hudson River waters. Sampling occurs day and night and requires 10 DAS. Equipment used include a YSI 6000, CTDs, Kemmerer bottles, and an EcoLAB2 multi-nutrient analyzer.

1.4.34. Autonomous Underwater Vehicle (AUV) Pilot Studies

This annual project is conducted in June in coastal waters off of Massachusetts or on GB. The purpose is to test AUV gear and platforms. The AUV is deployed from the R/V Gloria Michelle and requires 5 DAS.

1.4.35. Rotary Screw Trap (RSTs) Survey

Rotary screw trap sampling is conducted annually on a daily basis (mornings) from April to June, in the coastal Maine estuaries. The purpose of the study is to assess migrating Atlantic salmon smolts and other anadromous species within the estuaries and requires 60 DAS. The survey deploys 1–3 traps depending on the size of the sampling site. Trap dimensions are 1.2 m x 1.5 m x 2.4 m and tending schedules are adjusted according to conditions of the river/estuary and potential for interactions with protected species.

Sampling can be modified (period fishing), delayed, or concluded according to the potential for interactions with Atlantic salmon or other protected species.

1.4.36. Trawling to Support Finfish Aquaculture Research

This work is conducted annually from May through August in Long Island Sound. The purpose is to collect finfish broodstock for laboratory and experimental studies of spawning and rearing. Fish are collected using a combination bottom trawl with a net size (40 ft x 40 ft x 7 ft at 2.5 kts for a maximum duration of 30 min; or shrimp trawl (16 ft x 16 ft x 2ft) at 1.5 kts for a maximum of 30 min. Additional protocols include rod and reel (I/O circle and J hooks), and gillnets which are 150 ft long 8 ft high, with a 4 in stretched mesh. The combination trawl and shrimp trawl requires 50 tows; the rod and reel research requires 12 hooks fished for 1000 hr; and 15 gillnet sets. The survey requires 30 DAS.

1.4.37. DelMarVa Habitat Characterization

This survey would occur in coastal waters off Delaware, Maryland, and Virginia (DelMarVa). The survey is an adjunct to the DelMarVa Reef Survey (Section 2.1.38) and its purpose is to characterize and determine benthic habitats in coastal waters off the DelMarVa Peninsula. Survey operations take place during daylight hours and require 5 DAS. Equipment used in the survey includes ADCP, plankton nets, Ponor grabs and water sampling bottles. Periodic vertical CTD casts record water temperature, conductivity, chlorophyll a, and turbidity.

1.4.38. DelMarVa Reef Survey

The reef survey is conducted annually during August in coastal waters off of DelMarVa. The survey's objective is to determine the extent and distribution of rock outcrops and coral habitats and their use by black sea bass and other reef fishes. The survey is conducted using the R/V Hugh R. Sharp and requires 5 DAS. A HABCAM is deployed and towed at 5 kts. Water quality parameters are assessed by CTD casts.

1.4.39. Miscellaneous Fish Collections and Experimental Survey Gear Trials

These small scale and opportunistic projects are conducted year round during all seasons in New York Bight estuary waters. The survey gear varies by project and includes:

- Combination bottom trawl – net size: 23 ft head rope, 32 ft sweep, 7 ft rise; tow speed 2.5 kts for 20 minutes;
- Lobster and fish pots – 18 in x 24 in x 136 in wire pot connected by 3/8 in rope with 7 in x 14 in surface float. One to 60 posts are set for 24–96 hr between retrievals; three fish pots – 9 in x 9 in x 18 in wire pots with 1/8 in mesh liner are connected by 3/8 in rope with 7 in x 14 in surface floats. One to 60 pots are set for 24–96 hours between retrievals;
- 2 m beam trawl towed at 2 kts for 15 minutes, up to 5 tows per year;
- Seine net; and
- Trammel nets – multi trammel net, 12 in walling, 3 in mesh, 6 ft deep x 25 ft long.

1.4.40. Opportunistic Hydrographic Sampling

This program consists of opportunistic plankton and hydrographic sampling conducted during summer months in waters less than 300 m deep. Small plankton nets (1 m x 2 m) are deployed to a depth of 25 m and hydrographic data is recorded from expendable bathythermographs.

1.4.41. Monkfish RSA Surveys

These surveys are conducted from April to December in the MAB and GB to monitor monkfish biomass and derive annual TACs. Additionally, the surveys monitor recruitment, growth, and other biological parameters of monkfish. Commercial gillnets are used to count, collect and measure the fish. From 100 to 200 sets (which are left to soak for 2 to 3 days) are completed each year.

1.5. Short-Term Cooperative Research Projects

The Proposed Action includes a set of fisheries and ecosystem research activities which fall predominately within a category of activities known as short-term projects. The majority of these projects fall under the category of cooperative research. The NEFSC partners with other research entities for these activities. The specific projects are funded on an annual basis as needs arise for information to support particular fisheries or address emerging conservation concerns. Table 2-2 provides a summary of the collective scope of cooperative research projects that are anticipated to be funded in the next five years. The projects are broken out by category such as survey projects, conservation engineering projects and tagging projects.

1.5.1. Survey Projects

As shown in Table 2-1, NEFSC partners with the fishing industry and other researchers to survey flatfish, monkfish, squids, scup, and black sea bass. Flatfish are assessed by bottom trawl methods in the GOM, GB, SNE, and MAB. Up to 550 tows per year could be conducted. Monkfish and squid are assessed by pelagic trawl in the GOM, GB, SNE, and MAB. Effort for this survey is about 30 tows per year. Scup and black sea bass are collected using pots and traps in the SNE, Rhode Island Bight, Nantucket waters, and the MAB from shore to shelf. Over 2,600 pots could be set per year.

1.5.2. Conservation Engineering Projects

Potential Conservation Engineering Projects include the use of bottom trawls to determine gear efficiency and net conservation strategy, study redfish and other small net fisheries, and squid selectivity. Dredges are used to study the effectivity of finfish and turtle extruders, and to test the hydrodynamics of turtle deflection during dredging. The bottom trawl studies would occur in the GOM, GB, SNE, and MAB, with an effort of about 500 tows per year for all bottom trawl studies. Dredge studies would occur in the GB, SNE, and MAB, with an estimated total of over 1,700 dredge tows per year for all dredge projects.

1.5.3. Twin Trawl Comparison Research

This study consists of conducting twin trawl operations and paired vessel trawling operations to test cookie sweep and rockhopper efficiency. Two Bigelow 4-seam 3-bridle nets are used with different sweeps (one cookie and one rock hopper) to allow comparisons. The annual level of effort for this study is 100 twin tows for 20 minutes at a speed of 3 kts and 257 paired vessel tows for 20 minutes at a speed of 3 kts. 100 DAS would be required to complete the project.

1.5.4. Tagging Projects

Species slated for potential tagging projects include winter flounder, spiny dogfish, and monkfish. Winer flounder would be collected by bottom trawls and otter trawls in GOM coastal waters. About 650 trawls per year would be conducted to collect winter flounder for tagging. Spiny dogfish in GOM and GB waters adjacent to Cape Cod would be collected by hook and line and gillnets. Monkfish would be collected by gillnet in the GOM, SNE, and MAB in 18–20 DAS.

1.5.5. Projects Initiated After the 2016 BiOp

As described at the beginning of Section 2 and shown in Table 2-1, three projects have been initiated since 2016. Therefore, the potential effects of such projects were not assessed in the 2016 LOA: Ropeless Lobster Trap Research, Rod and Reel Tagging of Atlantic Salmon, and CPR transect surveys in the GOM. The ropeless lobster trap study occurs inshore and offshore in the GOM, SNE, and MAB over 50 to 100 DAS. Rod and reel tagging (200 to 500 tags total) of Atlantic salmon occurs in the waters off of Greenland and does not occur in U.S. waters. The CPR is towed in the GOM from Maine to Nova Scotia from vessels of opportunity. The duration of this study is 24 DAS. None of these projects pose risk to incidentally taking marine mammals given the gear used, the region where they operate and how relatively infrequently they occur. Therefore, incidental take under the MMPA is not requested for these projects.

2. DATES, DURATION, AND REGION OF ACTIVITY

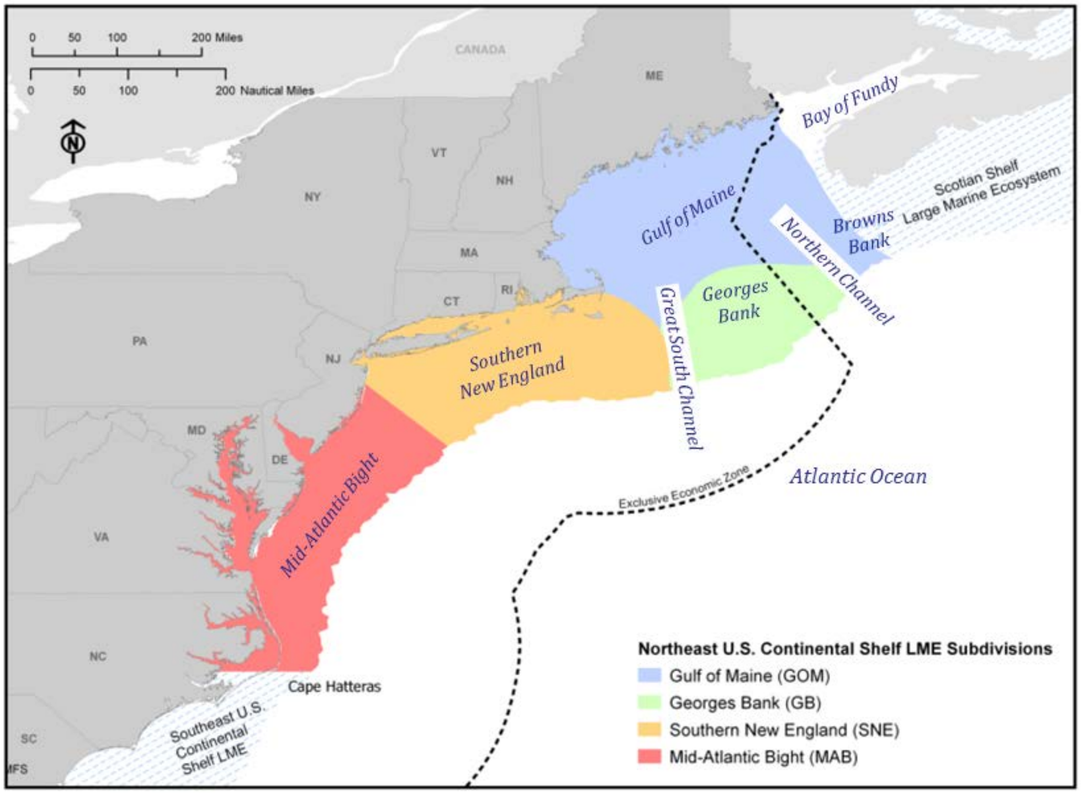
2.1. Dates and Durations of Activities

Fisheries and ecosystem research conducted and funded by NEFSC is summarized in Table 1-2. Dates and duration of individual surveys are inherently uncertain, based on congressional funding levels for the NEFSC, weather conditions, or ship contingencies. While these surveys are planned over the next 5-year period, not every survey may occur each year. The number and extent of surveys depends on available funding, which is subject to change from year to year. However, for the purposes of this LOA application, information on the types of surveys (i.e., description), area of operation, season/frequency, gear used, and level of effort such as number of tows or casts is provided in Table 1-2 for the full suite of activities that may occur during the 5-year period 2021–2026. This precautionary approach allows NEFSC to estimate the potential for interacting with marine mammals during this period and to calculate potential takes as described in Section 6 of this application.

2.2. Region of Activity

The NEFSC would conduct fisheries research activities off of the U.S. Atlantic coast, generally within the Northeast U.S. Continental Shelf Large Marine Ecosystem (NE LME), an area defined as the 200 miles of the shoreline and reaching from the U.S.-Canada border to Cape Hatteras (see Figure 2-1). Occasionally, the COASTSPAN surveys take place in waters off the coast of Florida. The NE LME is divided into four areas: the Gulf of Maine (GOM), Georges Bank (GB), Southern New England (SNE), and the MAB. In addition, a small number of NEFSC survey activities extend east into deeper offshore waters and south into the Southeast U.S. Continental Shelf LME (SE LME) and, rarely, north into the Scotian Shelf LME. However, the great majority of NEFSC research activities occur within the Northeast LME.

Most NEFSC fishery research activities occur over the continental the shelf (<200 m water depth), but pelagic longline and deep-water diversity surveys operate in shelf-break or deeper oceanic waters (> 200 m water depth. Therefore, individual take estimates are calculated for two fishery research areas: (1) the coastal and shelf areas of the U.S. Northeast Continental Shelf LME, and the offshore fishery research area. The 200 m depth contour approximatley separates these two research areas.



Source: NMFS (2016)

FIGURE 2-1. NEFSC RESEARCH AREAS

3. SPECIES AND NUMBERS OF MARINE MAMMALS IN THE ACTION AREA

Over 30 species of cetaceans and four pinniped species inhabit waters of the NE U.S. coast. Seasonally, these marine mammal species are distributed throughout the waters of the continental shelf and shelf break, with some species extending into deeper oceanic waters beyond the U.S. EEZ. The species, stock area, estimated stock abundance, and ESA and MMPA status of marine mammals potentially encountered by NEFSC fisheries research surveys are shown in Table 3-1. The most recent estimated stock abundances were obtained from the 2018 U.S. Atlantic and Gulf of Mexico Stock Assessment Report (SAR) (Hayes, Josephson et al. 2019). Extralimital species such as Bryde's whales (Balaenoptera edeni), beluga whales (Delphinapterus leucas), bowhead whales (Balaena mysticetus), ringed seals (Pusa hispida), and bearded seals (Erignathus barbatus) are not expected to be encountered and are not included.

Marine mammal species composition and abundance vary spatially and temporally across the NE LME subareas where NEFSC research occurs. For example, baleen whales primarily use New England waters, but can be found seasonally in near-shore waters extending to the Cape Hatteras. Many delphinid species such as long-finned pilot whales, short-beaked common dolphins, common bottlenose dolphins, and Atlantic spotted dolphins are common during spring through autumn in waters off the New England coast. Both harbor porpoise and harbor seals are concentrated in the GOM during summer, but their range extends into mid-Atlantic waters in autumn through spring. Gray seals have established breeding colonies in both the Cape Cod region and mid-coast Maine, but they seasonally use haul-out areas as far south as New Jersey.

TABLE 3-1. ABUNDANCE, STATUS AND DENSITY OF NEFSC MARINE MAMMALS

Common Name	Scientific Name	Stock Area	Stock Abundance Estimate[1]	ESA Status[2]	MMPA Status[3]
Cetaceans					
North Atlantic right whale	*Eubalaena glacialis*	Western N. Atlantic	428	E	D, S
Humpback whale	*Megaptera novaeangliae*	GOM	1,396	NL	D, S
Fin whale	*Balaenoptera physalus*	Western N. Atlantic	7,418	E	D, S
Sei whale	*Balaenoptera borealis*	Nova Scotia	6,292	E	D, S
Minke whale	*Balaenoptera acutorostrata*	Canadian E. Coast	24,202	NL	NS
Blue whale	*Balaenoptera musculus*	Western N. Atlantic	unknown	E	D, S
Sperm whale	*Physeter macrocephalus*	North Atlantic	4,349	E	D, S
Dwarf sperm whale	*Kogia sima*	Western N. Atlantic	7,750	NL	NS
Pygmy sperm whale	*Kogia breviceps*	Western N. Atlantic	7,750	NL	NS
Killer Whale	*Orcinus orca*	Western N. Atlantic	unknown	NL	NS
Pygmy killer whale	*Feresa attenuata*	Western N. Atlantic	unknown	NL	NS
Northern bottlenose whale	*Hyperoodon ampullatus*	Western N. Atlantic	unknown	NL	NS
Cuvier's beaked whale	*Ziphius cavirostris*	Western N. Atlantic	5,744	NL	NS
Mesoplodon beaked whales	*Mesoplodon spp.*	Western N. Atlantic	10,107	NL	NS
Melon-headed whale	*Peponocephala electra*	Western N. Atlantic	unknown	NL	NS
Risso's dolphin	*Grampus griseus*	Western N. Atlantic	35,493	NL	NS
Long-finned pilot whale	*Globicephala melas melas*	Western N. Atlantic	39,215	NL	NS
Short-finned pilot whale	*Globicephala macrorhynchus*	Western N. Atlantic	28,924	NL	NS
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western N. Atlantic	93,233	NL	NS
White-beaked dolphin	*Lagenorhynchus albirostris*	Western N. Atlantic	536,016	NL	NS
Short-beaked common dolphin	*Delphinus delphis delphinis*	Western N. Atlantic	172,825	NL	NS
Atlantic spotted dolphin	*Stenella frontalis*	Western N. Atlantic	39,921	NL	NS
Pantropical spotted dolphin	*Stenella attenuata*	Western N. Atlantic	6,593	NL	NS
Striped dolphin	*Stenella coeruleoalba*	Western N. Atlantic	67,036	NL	NS

Common Name	Scientific Name	Stock Area	Stock Abundance Estimate[1]	ESA Status[2]	MMPA Status[3]
Fraser's dolphin	*Lagenodelphis hosei*	Western N. Atlantic	unknown	NL	NS
Rough toothed dolphin	*Steno bredanensis*	Western N. Atlantic	136	NL	NS
Clymene dolphin	*Stenella clymene*	Western N. Atlantic	4,237	NL	NS
Spinner dolphin	*Stenella longirostris*	Western N. Atlantic	4,102	NL	NS
Common bottlenose dolphin (offshore)	*Tursiops truncatus truncatus*	Western N. Atlantic	62,851	NL	NS
Common bottlenose dolphin (coastal)	*Tursiops truncatus truncatus*	Western N. Atlantic	3,751	NL	D, S
Harbor porpoise	*Phocoena phocoena*	GOM/Bay of Fundy	95,543	NL	NS
Pinnipeds					
Harbor seal	*Phoca vitulina concolor*	Western N. Atlantic	75,843	NL	NS
Gray seal	*Halichoerus grypus*	Western N. Atlantic	27,131	NL	NS
Harp seal	*Pagophilus groenlandica*	Western N. Atlantic	unknown	NL	NS
Hooded seal	*Cystophora cristata*	Western N. Atlantic	unknown	NL	NS

[1]Source: N_{best} from Hayes, Josephson et al. (2020) *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019*
[2]NL – Not Listed, E – Endangered
[3]NS – Not Strategic, S – Strategic, D – Depleted

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4. AFFECTED SPECIES STATUS AND DISTRIBUTION

This section provides detailed information on the status, abundance, distribution, and life history of species under NMFS jurisdiction that are likely to be encountered during the research period 2021–2026.

- North Atlantic Right Whale (*Eubalaena glacialis*): Western Atlantic Stock

Abundance, Density, and Stock Status: The North Atlantic right whale is considered one of the most endangered large whales in the world (Pettis, Pace et al. 2020). A Recovery Plan, originally published in 1991 and most recently revised in 2005, is currently in effect for this species (NMFS 2005). The size of this stock is considered to be extremely low relative to OSP in the U.S. Atlantic EEZ. This species is listed as endangered under the ESA and has been declining since 2011 (Pace et al. 2017 as cited in Hayes, Josephson et al. 2020).

The best abundance estimate for the western North Atlantic right whale population from the most recent Stock Assessment Report (SAR) is estimated to be 428 individuals as of 2019 (Hayes, Josephson et al. 2020). This value is based on a published state-space model of sighting data identified using photo-identification techniques (Pace et al. 2017 as cited in Hayes, Josephson et al. 2020). The minimum population estimate is 418 based on 2017 data (Hayes, Josephson et al. 2020). However, this estimate does not account for the Unusual Mortality Event (UME) documented in 2017 as described below, or recent downward trend, which has likely dropped the population estimate below 400 (Roberts, Schick et al. 2020) Based on Figure 109 in (Roberts, Schick et al. 2020), using data from 2010–2018 an average density by season estimate for North Atlantic right whales in the LME <200 m reported as whales per km^2 was 0.003 (April–May), 0.002 (June–August) and 0.002 (September–November). For the purposes of estimating take as described in Section 6, the highest average is used (i.e., 0.003 whales per km^2) (see Table 6-1).

The population appeared to be showing signs of slow recovery, with an estimated growth rate of 2.5 percent for the period 1986–1992 (Knowlton, Kraus et al. 1994). Subsequently, additional analyses showed a decline in survival probability in the 1990s (Caswell, Fujiwara et al. 1999). The decline appeared to be particularly marked in adult females. As reported in Hayes, Josephson et al. (2020), human-caused mortality and serious injury between 2013 and 2017 averaged 6.85 whales per year and is attributed to fishing entanglements and ship strike. Entanglement appears to be increasing by 6.3% per year however, the total level of human-caused mortality is unknown (Hayes, Josephson et al. 2020). Van der Hoop, Vanderlaan et al. (2015; as cited in Hayes, Josephson et al. 2020) concluded that mortalities of large whales (not just North Atlantic right whales) due to ship strikes decreased inside active seasonal management areas in increased outside those areas. However further analysis by Henry, Garron et al. (2020) of reported strikes between 2000 and 2017 did not indicate a trend. Potential Biological Removal[4] (PBR) for the Western Atlantic stock is 0.8 whales per year.

An Unusual Mortality Event (UME) in 2017 was declared after 17 right whales were confirmed dead (12 in Canada; 5 in the U.S.). This UME followed the 2016–2017 calving season with only five documented

[4]Potential biological removal (PBR) is the product of minimum population size, one-half the maximum net productivity rate and a recovery factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to OSP (MMPA Sec. 3. 16 U.S.C. 1362; Wade, P. R. and R. Angliss (1997). Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop. NOAA Technical Memorandum. Seattle, WA**:** 93 pp.

births and coincided with the first calving season since monitoring began in 1990 with no new births documented (2017–2018). In 2018, three stranded right whales were confirmed dead in the U.S. In 2019, ten right whale mortalities were documented; nine occurred in Canadian waters and one in U.S. waters. In four of these cases, cause of death was identified as vessel strike (three) and entanglement (one) (Pettis, Pace et al. 2020). To date, in 2020, one mortality has been documented. The current total confirmed mortalities for the UME are 31 dead stranded whales (21 in Canada; 10 in the U.S.), and the leading category for the cause of death for this UME is "human interaction," specifically from entanglements or vessel strikes[5]. Vessel strikes remain a significant threat to this species.

Based on visual sightings documenting the presence of three or more right whales within a discrete area, voluntary Dynamic Management Area (DMAs) may be established from time to time by NMFS to minimize the risk of vessel-whale interactions. Mariners are encouraged to avoid these areas or reduce speeds to 10 knots or less while transiting through these areas. For example, in 2020 a DMA south of Nantucket from October 5 through 20 because of large aggregations of right whales. Additional information on DMAs is available on the NMFS website: https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales#dynamic-management-areas

Distribution and Habitat: The western North Atlantic right whale population ranges from wintering and calving grounds in the coastal waters of the southeastern U.S. to summer feeding and nursery grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence (Hayes, Josephson et al. 2020). Based on visual and acoustic surveys, there are seven areas where North Atlantic right whales aggregate seasonally: the coastal waters of the southeastern U.S.; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank (GB); Cape Cod Bay (CCB) and Massachusetts Bay; the Bay of Fundy; and the Roseway Basin on the Scotian Shelf (Cole, Hamilton et al. 2013).

Movements within and between habitats are extensive. Critical habitat was initially designated in the North Atlantic Ocean in 1994 (59 FR 28805) and revised in 2008 (73 FR 19000). In 2016, the Northeastern U.S. Foraging Area Critical Habitat was expanded to include nearly all U.S. waters of the Gulf of Maine (81 FR 4837). Surveys flown since 1996 along the northeastern Florida and southeastern Georgia coastline between 31 and 160 km from shore report the majority of right whale sightings occur within 90 km of shore. However, while habitat models may not predict right whales further offshore than about 90 km, however their use of offshore areas still remains unclear Gowan and Ortega-Ortiz 2015 as cited in Hayes, Josephson et al. 2020).

Analysis of the sightings data has shown that the utilization of these areas has a strong seasonal component (Pace and Merrick 2008; as cited in Hayes, Josephson et al. 2020). Visual and acoustic surveys reflected a shift in habitat use patterns beginning in 2010, with fewer whales detected in the Great South Channel and Bay of Fundy (Davis, Baumgartner et al. 2017 and Leiter, Stone et al. 2017; as cited in Hayes, Josephson et al. 2020). Peak abundance of right whales in CCB begins in late winter when the whales follow the seasonal cycle of copepods in the Gulf of Maine. In early spring (May), abundance shifts to Wilkinson Basin and to the Great South Channel (Kenney et al. 1995; as cited in Pershing,

[5] https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2020-north-atlantic-right-whale-unusual-mortality-event

Record et al. (2009). During late June and July, distribution gradually shifts to the northern edge of GB, then, in late summer and fall, the population is centered in waters of the Bay of Fundy and around Roseway Basin (Pershing, Record et al. 2009). While right whales are found consistently in these locations, studies also highlight the high interannual variability in right whale use of some habitats (Ganley, Brault et al. 2019).

Acoustics and Hearing: Parks (2003) developed a model of the frequency range of hearing for North Atlantic right whales using morphometric analyses of inner ears of stranded whales and a previously established model for marine mammal hearing. The predicted total hearing range was 10 Hz to 22 kHz (Parks, Ketten et al. 2007). The 2018 NMFS Acoustic Technical Guidance estimates a generalized hearing range for low-frequency cetaceans of 7 Hz to 35 kHz. North Atlantic right whales are in the low-frequency functional hearing group and while evidence suggests certain species of baleen whales (including North Atlantic right whales) may be more sensitive to very low frequencies, insufficient direct information supports separating these whales into a distinct very low frequency group at this time (Southall, Finneran et al. 2019). North Atlantic right whale vocalizations include moans, groans, belches, and pulses with acoustic energy below 500 Hz and some occasionally reach up to 4 kHz. A typical right whale call is a short “whoop” sound that rises from about 50 Hz to 440 Hz and lasts about 2 seconds (DOSITS 2020).

- Humpback Whale (*Megaptera novaeangliae*): Gulf of Maine Stock
- Abundance, Density, and Stock Status: The best abundance for GOM humpback whales is 1,396 animals based on sightings histories constructed from the 2019 photo-ID recapture database. Based on abundance estimate for the GOM stock from 2000 to 2016, the stock increased 2.8% annually (Robbins and Pace 2018; as cited in Hayes, Josephson et al. 2020). A maximum net productivity rate for the GOM humpback whale of 6.5% calculated by Barlow and Clapham (1997; as cited in Hayes, Josephson et al. 2020), applying an interbirth interval model to photographic mark-recapture data, is reported as a conservative estimate (Hayes, Josephson et al. 2020). The density estimates calculated for humpback whales were 0.0016 for the LME <200 m (Table 6-1). An annual rate of human-caused mortality and serious injury for the period 2013 through 2017, averaged 12.15 animals per year based on incidental fishery interaction records (7.75) and vessel collisions 4.4 (Henry, Garron et al. 2020). PBR for the GOM humpback whale stock is 22.

The global listing status of the humpback whale as endangered was revised on September 8, 2016, when NMFS issued a final rule that revised the listing status of this species. NMFS divided the species into 14 distinct DPSs and reconsidered the global listing. In its place NMFS listed four DPSs as endangered and one DPS as threatened. The remaining nine DPSs including the West Indies DPS of which the GOM stock of humpback whale is included was delisted (81 FR 62259). MMPA stocks do not necessarily equate to DPSs under the ESA. While NMFS is evaluating the stock structure of humpback whales under the MMPA, no changes to current stock structure are proposed at this time. Therefore, while humpback whales in the NE LME are no longer classified under the ESA, the GOM stock remains protected under the MMPA. A Recovery Plan was published in 1991 and is currently in effect (NMFS 1991).

Distribution and Habitat: North Atlantic humpback whales migrate from high-latitude summer feeding grounds to low-latitude winter breeding grounds along the Antillean Island chain. Satellite tags were deployed on humpback whales in the winters and springs of 2008 through 2012 in Silver Bank (Dominican Republic) and in Guadeloupe (French West Indies) breeding areas. On average, whales were monitored for 26 days and demonstrated that some animals remained near their tagging location for multiple days before migrating north while some visited habitats along the northwestern coast of the Dominican Republic, northern Haiti, the Turks and Caicos islands, and off Anguilla. Whales monitored migrating north headed towards feeding grounds in the GOM, Canada, and eastern North Atlantic (Iceland or Norway) (Kennedy, Zerbini et al. 2014). While there is recognition of two breeding areas for North Atlantic humpbacks, our knowledge of breeding season distribution is incomplete (Smith and Pike 2009 and Stevick, Berrow et al. 2016; both as cited in Hayes, Josephson et al. 2020).

An increased number of sightings of humpback whales in the vicinity of the Chesapeake and Delaware Bays occurred in 1992 (Swingle et al. 1993; as cited in Hayes Josephson et al. 2020). Wiley et al. (1995 as cited in Hayes, Josephson et al. 2020) reported 38 humpback whale strandings during 1985–1992 in the U.S. mid-Atlantic and southeastern states, particularly along the Virginia and North Carolina coasts. Between 2013 and 2017, 95 humpback whale strandings recorded in the Marine Mammal Health and Stranding Response database occurred between Maine and Florida. Forty-six sightings of humpbacks in the New York-New Jersey Harbor Estuary were also documented between 2011 and 2016 (Brown, Robins et al. 2017; as cited in Hayes, Josephson et al. 2020). It is unknown whether additional sightings in this area during summer months indicate a change in distribution (Hayes, Josephson et al. 2020).

Feeding is the principal activity of humpback whales in New England waters, and their distribution in this region has been largely correlated to prey species and abundance (Payne, Nicholas et al. 1986, Payne, Wiley et al. 1990). While humpback whales move in response to prey availability, important foraging habitats generally include sandy shoals in the southwestern GOM, offshore waters of Cultivator Shoal, the Northeast Peak of GB, Jeffreys Ledge, and northern GOM (Payne, Nicholas et al. 1986). In these areas, humpback whales feed on Atlantic herring (Clupea harengus), sand lance (Ammodytes spp.), and other small fishes. An increase in sand lance in the southwestern GOM in the mid-1970s and a concurrent decrease in humpback whale abundance in the northern GOM has been associated with commercial depletion of herring and Atlantic mackerel (Scomber scombrus). In 1992–1993, humpback whale abundance in the northern GOM increased dramatically along with a major influx of herring. Few humpback whales were sighted in nearshore Massachusetts waters during this period and were more abundant in the offshore waters of Cultivator Shoal and the Northeast Peak on GB, and on Jeffreys Ledge where herring were typically found.

Acoustics and Hearing: Humpback whales are in the low-frequency functional hearing group, with an estimated auditory bandwidth of 7 Hz to 35 kHz (NMFS 2018b). As with right whales, there is some evidence that humpback whales are sensitive to very low frequencies however, direct information to support separating this species into a distinct very low frequency group is not available (Southall, Finneran et al. 2019). Their vocalizations range from 20 Hz to greater than 24 kHz (Hauer-Jansen 2018).

- Fin Whale (*Balaenoptera physalus*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The fin whale is listed as endangered under the ESA, yet the status of the stock off the U.S. Atlantic coast, relative to OSP is unknown and data are inadequate to determine the population trend for fin whales. A Final Recovery Plan for fin whales was published in 2010 (NMFS 2010). The best abundance estimate for western North Atlantic fin whales is 6,029 (Hayes, Josephson et al. 2020). PBR is unknown for this stock. Minimum annual human-caused mortality and serious injury to fin whales was 2.35 per year, including incidental fishery interaction records (1.55 total[6]); and vessel collisions, 0.8 (all U.S.) (Henry, Garron et al. 2020). The density estimates calculated for fin whales were 0.0036 for the LME <200 m and 0.0007 for the offshore research area >200 m (data reported in OBIS-SEAMAP; Roberts, Best et al. 2016).

Distribution and Habitat: Fin whales are common in waters off the U.S. east coast from Cape Hatteras northward. A recent globally-scaled review of sightings data by Edwards, Hall et al. (2015; as cited in Hayes, Josephson et al. 2020) found evidence to confirm the presence of fin whales in every season throughout much of the U.S. EEZ north of 35º N; however, densities vary seasonally. Fin whales accounted for 46% of the large whales and 24% of all cetaceans sighted during aerial surveys over the continental shelf (CETAP 1982) between Cape Hatteras and Nova Scotia during 1978–82. Fin whales in this region likely have the largest standing stock and the greatest food requirements of any cetacean species (Kenney, Scott et al. 1997).

New England waters represent a major feeding area for fin whales (Kenney, Scott et al. 1997), with key feeding grounds in the western GOM, from Stellwagen Bank to Jeffreys Ledge, and the GSC. Secondary seasonal areas of importance are off eastern Long Island, along the northern edge of GB and in the northern GOM (CETAP 1982, Waring and Finn 1995)There is evidence of site fidelity by females, and possibly, sexual, maturational or reproductive class segregation in the feeding area (Agler, Schooley et al. 1993; as cited in Hayes, Josephson et al. 2020). Clapham and Seipt (1991; as cited in Hayes, Josephson et al. 2020) showed maternally directed site fidelity for fin whales in the Gulf of Maine. Calving, mating, or wintering areas are unknown for most of the population, although Hain, Ratnaswamy et al. (1992) suggested calving takes place during October to January off the U.S. mid-Atlantic region. Fin whales off the U.S. Atlantic coast may migrate into Canadian waters, open-ocean areas, or even subtropical or tropical regions. It is, however, unlikely that fin whales undergo distinct annual migrations (Watkins, Daher et al. 2000; as cited in Hayes, Josephson et al. 2020).

The Department of Fisheries and Oceans, Canada (DFO) generated fin whale estimates from a large-scale aerial survey of Atlantic Canadian shelf and shelf break habitats extending from the northern tip of Labrador to the U.S. border off southern Nova Scotia in August and September of 2016 (Lawson and Gosselin 2018).

- Acoustics and Hearing: Fin whales are in the low-frequency functional hearing group. The best hearing sensitivity in fin whales was estimated by Cranford and Krysl (2015 as cited in NMFS 2018) at 1.2 kHz, with thresholds within 3-dB of best sensitivity from ~1 to 1.5 kHz. As with other low-frequency cetaceans, the estimated hearing range is between 7 Hz to 35 kHz. Fin whales also vocalize at low frequencies of 15–30 Hz (DOSITS 2020). The fin whale's "20 Hz pulse" (or "chirp") is the most commonly observed vocalization produced by fin whales and has been recorded throughout the world's oceans (Weirathmueller, Stafford et al. 2017).
- Sei Whale (*Balaenoptera borealis*): Nova Scotia Stock

Abundance, Density, and Stock Status: Sei whales in the NEFSC survey area are part of the Nova Scotia stock, the range of which includes continental shelf waters of the northeastern U.S. and extends

[6] 0 reported in the U.S., 0.95 unknown but reported in U.S., and 0.6 in Canadian waters.

northeastward to south of Newfoundland despite insufficient information to define stock structure (Donovan 1991 as cited in Hayes, Josephson et al. 2020). Sei whales are listed as endangered under the ESA, despite these unknowns about stock status for assessing population trends. A Recovery Plan for sei whales was published in 2011 (NMFS 2011).

An abundance estimate of 357 for the Nova Scotia stock of sei whales was based on a shipboard and aerial survey June–August 2011 (Palka 2012). A springtime estimate (March through May) of 6,292 sei whales was generated from modeling derived from a visual two-beam abundance survey between 2010 and 2013 (Palka et al. 2017 as cited in Hayes, Josephson et al. 2020). The 2004/2006 estimate should be viewed as very conservative considering the range of sei whales in the entire western North Atlantic, and uncertainties about population structure and whale movements between surveyed and unsurveyed areas (Waring, Josephson et al. 2011). PBR for the Nova Scotia stock of the sei whale is 6.2 (Hayes, Josephson et al. 2020). Henry, Garron et al. (2020) reported incidental fishery interaction records of 0.2 and records of vessel collisions of 0.8 which was considered when calculating PBR. The density estimates calculated for Sei whales were 0.0027 for the LME <200 m and 0.00004 for the offshore research area >200 m.

Distribution and Habitat: Distribution patterns of sei whales in U.S. waters based on habitat suitability analyses suggest they are found where water is cool (<10°C), with high levels of chlorophyll and inorganic carbon, and a relatively shallow mixed layer (<50m) (Chavez-Rosales, Palka et al. 2019). Sei whales have often been found in the deeper waters characteristic of the continental shelf edge region (Hain, Hyman et al. 1985; as cited in Hayes, Josephson et al. 2020). Data indicate that a major portion of the Nova Scotia sei whale stock is centered in northerly waters, perhaps on the Scotian Shelf, during the spring/summer feeding season (Mitchell and Chapman 1977; as cited in Hayes, Josephson et al. 2020). Abundance in U.S. waters is highest in spring, with sightings concentrated along the eastern margin of GB and into the Northeast Channel area, and along the southwestern edge of GB in the area of Hydrographer Canyon (CETAP 1982). NMFS aerial surveys in 1999, 2000 and 2001 found concentrations of sei and right whales along the northern edge of GB in the spring.

While found more frequently offshore, sei whales episodically venture into more shallow areas and inshore waters and although they are known to take piscine (fish) prey, sei whales (like right whales) are largely planktivorous, feeding on euphausiids and copepods. In years of reduced predation on copepods by other predators, and thus greater abundance of this prey source, sei whales are reported in more inshore locations, such as the GSC (in 1987 and 1989) and Stellwagen Bank (in 1986) areas (Payne, Wiley et al. 1990).

Acoustics and Hearing: Sei whales are in the low-frequency hearing group, along with other baleen whales, with an estimated auditory bandwidth of 7 Hz to 35 kHz (NMFS 2018b). Limited reports of sei whale calls indicate that the whales make low and mid-frequency vocalizations including pulse trains (peak energy at 3 kHz), broadband “growl” and “whoosh” sounds (100–600 Hz, 1.5 s in duration), tonal and upsweep calls (200–600 Hz, 1–3 s in duration), and downsweep calls (100–44 Hz, lasting 1.0 s, and 39–21 Hz lasting 1.3 s). Most recently, downsweep calls (82.3 Hz to 34 Hz) were recorded in the North Atlantic (DOSITS 2020).

- Minke Whale (*Balaenoptera acutorostrata*): Canadian East Coast Stock

Abundance, Density, and Stock Status: Minke whales off the eastern coast of the U.S. are considered to be part of the Canadian East Coast stock, which inhabits the area from the eastern half of the Davis Strait

(45º W) to the Gulf of Mexico (Hayes, Josephson et al. 2020). The number of minke whales comprising the Canadian East Coast stock is unknown and data are insufficient to calculate population trends. The best available current abundance estimate for the stock based on data from 2016 is 24,202. This estimate is larger than the previously 2011 estimate because it was derived from a survey area that extended from Newfoundland to Florida (approximately 1,300,000 km^2 larger than in 2011) (Hayes, Josephson et al. 2020). Minke whales are not listed as either threatened or endangered under the ESA. PBR for the Canadian East Coast common minke whale is 189. The average minimum detected human-caused mortality 2013–2017 was 6.8 (Hayes, Josephson et al. 2020). The density estimates determined for minke whales were 0.002 for the LME <200 m and 0.0 for the offshore research area >200 m (data reported in OBIS-SEAMAP; Roberts, Best et al. 2016) (Table 6-1).

Distribution and Habitat: Minke whales are common and widely distributed off the northeast U.S. coast, particularly in the GOM/GB regions (CETAP 1982). The whales are most abundant in New England waters during the spring-to-fall period. A strong seasonal component to minke whale distribution appears to exist in nearshore and offshore waters. They are most abundant, widespread, and common in New England waters in spring and summer (CETAP 1982). This stock is widespread in spring and fall on the continental shelf (Risch, Clark et al. 2013), while September through April is the period of highest acoustic occurrence in deep-ocean waters throughout most of the western North Atlantic (Risch, Gales et al. 2014). Minke whales are largely piscivorous, and consume a variety of forage fishes (e.g., Atlantic herring, mackerel, and sand lance). Their dietary composition on the U.S. OCS was estimated as 95% fish and 5% euphausiids (Kenney, Scott et al. 1997).

Acoustics and Hearing: Minke whales are in the low-frequency functional hearing group. The most sensitive hearing range, defined as the region with thresholds within 40 dB of best sensitivity, was estimated by Tubelli et al. (2012) as cited inNMFS (2018b) to extend from 30 to 100 Hz up to 7.5 to 25 kHz, depending on the specific model used. NMFS (2018b) estimates the general hearing range for low-frequency cetaceans as 7 Hz to 35 kHz. Repetitive, low-frequency (100–500 Hz) pulse trains consisting of either grunt-like pulses or thump-like pulses have been recorded. The grunts produce energy between 80 and 140 Hz and thumps are between 100 and 200 Hz (Risch, Clark et al. 2013).

- Blue Whale (*Balaenoptera musculus*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Blue whales are listed as endangered under the ESA, although the status of this stock relative to the optimum sustainable population (OSP) is unknown and data are insufficient to determine population trends (Hayes, Josephson et al. 2020). A Draft Recovery Plan was published in 2018 (NMFS 2018a). Except for in the Gulf of St. Lawrence area, little is known about the population size of blue whales. The most recent density estimate calculated for blue whales is 0.000009 for the LME <200 m and the offshore research area >200 m (data reported in OBIS-SEAMAP; Roberts, Best et al. 2016) (Table 6-1).

Distribution and Habitat: Blue whale distribution in the western North Atlantic generally extends from the Arctic to at least mid-latitude waters. Most sightings are in the waters off eastern Canada, particularly the Gulf of St. Lawrence (Sears, Wenzel et al. 1987; as cited in Hayes, Josephson et al. 2020). The current Canadian distribution is, in general, spring, summer, and fall in the Gulf of St. Lawrence, especially along the north shore from the St. Lawrence River estuary to the Strait of Belle Isle and off eastern Nova Scotia. As described in Hayes, Josephson et al. (2020) blue whale photographed by a NMFS large whale survey in August 1999 had previously been observed in the Gulf of St. Lawrence in 1985 (R. Sears and P. Clapham, unpublished data cited in (Waring, Fairfield et al. 2007). The blue whale is best considered an occasional visitor in U.S. Atlantic waters, which may represent the current southern limit of its feeding range (CETAP 1982).

Acoustics and Hearing: Blue whales, along with other mysticetes (baleen whales), are in the low-frequency functional hearing group, with an estimated auditory range of 10 Hz to 30 kHz (NMFS 2018b). Blue whale vocalizations have been described as pulses, grunts, groans, and moans, and are typically in the 15–40 Hz range (DOSITS 2020).

- Sperm Whale (*Physeter 4-8ttenuate4-8lus*): North Atlantic Stock

Abundance, Density, and Stock Status: Sperm whales are listed as endangered under the ESA. Data are insufficient to assess population trends, and the current abundance estimate was based on only a fraction of the known stock range (Waring, Fairfield et al. 2007). A Draft Recovery Plan for sperm whales was written and is available for review (NMFS 2006).

Total numbers of sperm whales off the U.S. or Canadian Atlantic coasts are unknown. The best recent abundance estimate for sperm whales is the sum of the estimates from the two 2011 U.S. Atlantic surveys 2,288 (CV=0.28) where the estimate from the northern U.S. Atlantic is 1,593, and from the southern U.S. Atlantic is 695 sperm whales. The minimum population estimate for the western North Atlantic sperm whale is 1,815 (Waring, Josephson et al. 2014). The density estimates calculated for sperm whales were 0.00001 for the LME <200 m and 0.0152 for the offshore research area >200 m.

- Distribution and Habitat: Sperm whales are principally distributed along the continental shelf edge, over the continental slope, and into mid-ocean regions. Sperm whales that occur in the eastern U.S. Atlantic EEZ likely represent only a fraction of the total stock (Hayes, Josephson et al. 2020). In winter, sperm whales concentrate east and northeast of Cape Hatteras, shifting north in the spring (Stanistreet, Nowacek et al. 2018; as cited in Hayes, Josephson et al. 2020). In spring, distribution shifts northward to east of Delaware and Virginia, and is widespread throughout the central MAB and the southern part of GB. Summer distribution includes the area east and north of GB and into the Northeast Channel region, as well as the continental shelf (inshore of the 100 m isobath) south of New England (Hayes, Josephson et al. 2020). In the fall, sperm whale occurrence on the continental shelf south of New England reaches peak levels, and there remains a continental shelf edge occurrence in the MAB (Waring, Fairfield et al. 2007). Similar inshore (< 200 m) observations have been made on the southwestern and eastern Scotian Shelf, particularly in the region of “the Gully” (Whitehead, Brennan et al. 1991).

A 2011 shipboard survey was undertaken in central Virginia and central Florida along the shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. Most sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope (Hayes, Josephson et al. 2020).

Acoustics and Hearing: Sperm whales have an estimated best hearing sensitivity from 0.1 to 30 kHz with frequencies of 2–4 and 10–16 kHz close to maximum energy (Schmidt, Delsmann et al. 2018). Sperm whales, beaked whales (Family Ziphiidae: Berardius spp., Hyperoodon spp., Indopacetus, Mesoplodon spp., Tasmacetus, and Ziphius), and the killer whale (Orcinus orca) are included in the MF cetacean weighting function (NMFS 2018b), there is some suggestion that these species should be considered HF cetaceans (Southall, Finneran et al. 2019). Vocalizations, including echolocation clicks, range from 100 Hz to 30 kHz, with the majority of clicks ranging between 5 and 25 kHz (DOSITS 2020).

- Pygmy Sperm Whales (*Kogia sima*) Western North Atlantic Stocks and Dwarf Sperm Whales (*Kogia breviceps*) Western North Atlantic Stocks
- Abundance, Density, and Stock Status: Pygmy and dwarf sperm whales are difficult to differentiate at sea. While population sizes and trends are unknown because these species are rarely observed, they are believed to range widely over temperate and tropical waters of the Atlantic, Pacific, and Indian Oceans (McAlpine 2018). Neither species is listed as either endangered or threatened under the ESA. Distinct morphological characteristics, as well as data obtained from blood and muscle tissues, enable species determination of stranded animals.

The best estimate for Kogia spp. In the western North Atlantic is 7,750 (Garrison 2020 and Palka 2020; each as cited in Hayes, Josephson et al. 2020). The density estimates calculated for Kogia spp. Were 0 for the LME <200 m and 0.005 for the offshore research area >200 m (data reported in OBIS-SEAMAP; Roberts, Best et al. 2016) (Table 6-1).

Coastwide abundance estimates in 2004 (395), 2011 (3,785) and 2016 (7,750) may appear to indicate an increase in abundance (Garrison 2020 and Palka 2020; each as cited in Hayes, Josephson et al. 2020) however, a generalized linear model did not indicate a statistically significant (p=0.071) trend. The high level of uncertainty in these estimates limits the ability to detect a statistically significant trend. Total annual estimated fishery-related mortality and serious injury to this stock during 2013–2017 was presumed to be zero, as there were no reports of mortalities or serious injuries to dwarf sperm whales or Kogia spp. In the western North Atlantic. PBR for western North Atlantic Kogia spp. Is 46 (Hayes, Josephson et al. 2020).

Distribution and Habitat: Both species occupy temperate to tropical waters (McAlpine 2018). Off the Northeast U.S. they utilize shelf-edge and deeper oceanic regions (Hayes, Josephson et al. 2020). Feeding ecologies of the pygmy and dwarf sperm whales appear to be similar and both species occupy equivalent trophic niches in the region (Staudinger, McAlarney et al. 2013).

- Acoustics and Hearing: Kogia spp. Are in the high-frequency functional hearing group, with an estimated auditory bandwidth of 200 Hz to 180 kHz (Finneran and Jenkins 2012). Vocalization frequencies range from 13 to 200 kHz. Marten (2000) reported that Kogia emitted ultrasonic clicks (most of them inaudible) peaking at 125 kHz.
- Killer Whale (*Ornicus orca*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The Western North Atlantic stock of killer whales is not listed as threatened or endangered under the ESA. Killer whales are considered uncommon or rare in waters of the U.S. Atlantic EEZ (NMFS 2015a). The 12 killer whale sightings constituted 0.1% of the 11,156 cetacean sightings in the 1978–81 CETAP surveys (CETAP 1982). Their distribution extends from the Arctic ice-edge to the West Indies. Although 40 animals were reported from the southern Gulf of Maine in September 1979, and 29 animals were reported in Massachusetts Bay in August 1986, they are normally observed in small groups (Katona, Girton et al. 1988; as cited in (NMFS 2015a). In the U.S. Atlantic

EEZ, while their occurrence is unpredictable, they do occur in fishing areas, perhaps coincident with tuna, in warm seasons (Katona, Girton et al. 1988; as cited in (NMFS 2015a). Results from an extensive analysis of historical whaling records by Reeves and Mitchell (1988; as cited in (NMFS 2015a) suggest the offshore areas need to be considered in present-day distribution, movements, and stock relationships.

The total number of killer whales off the eastern U.S. coast is unknown and data are insufficient to calculate a minimum population estimate or population trend. There were no observed mortalities or serious injury between 2008 and 2012, the total U.S. fishery-related mortality and serious injury for this stock is considered insignificant and approaching zero (NMFS 2015a). Based on data up through 2015, there have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, New England multispecies sink gillnet, mid-Atlantic coastal sink gillnet, and North Atlantic bottom trawl fisheries (NMFS 2015a). PBR cannot be calculated for this species due to insufficient population data.

Distribution and Habitat: Killer whales are found in all oceans and are second only to humans as the most widely spread of all mammals (Parsons, Balcomb et al. 2009). They are most commonly found in coastal and temperate waters of high productivity. Killer whales are very social and the basic social unit is based on matriline relationship and linked by maternal decent. A typical matriline is composed of a female, her sons and daughters, and the offspring of her daughters (Parsons, Balcomb et al. 2009). Females may live to 80–90 years so a female's line may contain four generations. The pod is the next level of organization that is a group of related matrilines that shared a common maternal ancestor. The next level of social structure is the clan, followed by a resident society.

Acoustics and Hearing: Killer whales, like most cetaceans, are highly vocal and use sound for social communication and to find and capture prey. As summarized in DON (2008, and citations therein), the peak to peak source levels of echolocation signals range between 195 and 224 dB re 1 μPa-m. The source level of social vocalizations ranges between 137 to 157 dB re 1 μPa-m. Killer whales are sensitive to a wide range of frequencies between 0.5–105 kHz (Bain, Kriete et al. 1993). Acoustic studies of resident killer whales in British Columbia have found that there are dialects, in their highly stereotyped, repetitive discrete calls, which are group-specific and shared by all group members (Ford 2009). These dialects likely are used to maintain group identity and cohesion, and may serve as indicators of relatedness that help in the avoidance of inbreeding between closely related whales (Ford 2009). The killer whale has the lowest frequency of maximum sensitivity and one of the lowest high frequency hearing limits known among toothed whales. NMFS (2018b) categorizes killer whales as MF cetaceans, but it has been suggested that they be considered HF cetaceans (Southall, Finneran et al. 2019). Earlier killer whale hearing data (Szymanski, Supin et al. 1998) have been augmented by additional data from (Branstetter, St Leger et al. 2017) that indicate relatively good hearing at low frequencies compared with other species in the HF hearing group (Southall, Finneran et al. 2019).

- Pygmy Killer Whale (*Feresa 4-10ttenuate*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Pygmy killer whales are not listed as either endangered or threatened under the ESA. They are assumed to be part of the cetacean fauna of the tropical western North Atlantic. The paucity of sightings of this species may be due to a naturally low number of groups compared to other cetacean species (Hayes, Josephson et al. 2020). Sightings in the more extensively surveyed northern Gulf of Mexico occur in oceanic waters Mullin et al. 1994 and Mullin and Fulling

2004; both as cited in Hayes, Josephson et al. 2020). The western North Atlantic population is provisionally being considered one stock for management purposes.

The numbers of pygmy killer whales off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock (Hayes, Josephson et al. 2020). A group of 6 pygmy killer whales was sighted in waters >1,500 m deep during a 1992 vessel survey of the western North Atlantic off of Cape Hatteras (Hansen, Mullin et al. 1994; as cited in Hayes, Josephson et al. 2020. A single pygmy killer whale was sighted in waters about 4,000 m deep offshore of Long Island in 2013 (NEFSC and SEFSC 2013; each as cited in Hayes, Josephson et al. 2020). Present data are insufficient to calculate density or a minimum population estimate for this stock and there are insufficient data to determine population trends.

During the period 2013 through 2017, three strandings of pygmy killer whales were reported along the Virginia coast. It could not be determined if there was evidence of human interaction for two of the strandings and for the third stranding, no evidence of human interaction was detected (Hayes, Josephson et al. 2020). PBR for the western North Atlantic stock of pygmy killer whales is unknown.

Distribution and Habitat: Pygmy killer whales are distributed in tropical and sub-tropical regions worldwide however sightings as well as recorded strandings of this species in the North Atlantic are extremely rare (Hayes, Josephson et al. 2020). The feeding behavior of pygmy killer whales is not well known. Remains of cephalopods and small fish have been found in stomachs of stranded and incidentally caught individuals. This species can dive at least 1,000 feet in search of food and typically feed in mid- and deep-water environments, as well as near the ocean floor[7].

- Acoustics and Hearing: Pygmy killer whales are classified in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz–160 kHz (Southall, Bowles et al. 2007).
- Northern Bottlenose Whale (*Hyperoodon ampullatus*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Northern bottlenose whales are not listed under the ESA and are considered extremely uncommon or rare in waters of the U.S. Atlantic EEZ. During CETAP surveys 1978–82, there were two sightings of three individuals which constituted less than 0.1% of the 11,156 cetacean sightings in the surveys. Both sightings were in the spring, along the 2,000-m isobath (CETAP 1982). In 1993 two sightings of single animals and in 1996, a single sighting of six animals (including one juvenile), were documented during summer shipboard surveys conducted along the southern edge of Georges Bank (NMFS 2015b).

Two main centers of bottlenose whale distribution in the western north Atlantic include one area called “The Gully” just north of Sable Island, Nova Scotia, and the other in Davis Strait off northern Labrador. Studies at the entrance to the Gully from 1988–1995 identified 237 individuals and estimated the local population size at about 230 animals (95% C.I.). Wimmer and Whitehead (2004 as cited in NMFS 2015b) identified individuals moving between several Scotian Shelf canyons more than 100 km from the Gully. A population estimate of 163 animals (95% confidence interval 119–214), did not include a statistically significant population trend Whitehead and Wimmer (2005 as cited in NMFS 2015b). These individuals are believed to be year-round residents and all age and sex classes are present. Stranding records

[7]NOAA Species Directory 2020 https://www.fisheries.noaa.gov/species/pygmy-sperm-whale

document northern bottlenose whales in the Bay of Fundy and as far south as Rhode Island and three stranded individuals were documented on Sable Island, Nova Scotia, Canada.

The current population estimate off the U.S. Atlantic coast is unknown (Hayes, Josephson et al. 2020) and data are insufficient to define stock(s) inhabiting/visiting U.S. waters. The density estimates calculated for northern bottlenose whales were 0.0 for the LME <200 m and 0.0009 for the offshore research area >200 m (OBIS-SEAMAP data based on Roberts, Best et al. 2016) (Table 6-1). Incidental entanglement in fishing gear and occurs off Labrador, Canada and this species may also be affected by underwater noise. The population consequences of these and other anthropogenic stressors however, are very uncertain (Whitehead and Hooker 2012). PBR for the western North Atlantic northern bottlenose whale is unknown because the minimum population size cannot be determined (NMFS 2015b).

- Distribution and Habitat: Bottlenose whales are typically found in small groups of 1-4 individuals but groups up to 20 have been observed. Northern bottlenose whales are distributed in the North Atlantic from Nova Scotia to about 70º in the Davis Strait to 77º and from England to the west coast of Spitzbergen. It is largely a deep-water species and is very seldom found in waters less than 2,000 m deep (Mead 1989; as cited in (DON 2018). There is no information on the life history of northern bottlenose whales. They are believed to be deep divers feeding primarily on squid, with fish and benthic invertebrates infrequently consumed (Gowans 2009). Northern bottlenose whales have been recorded to dive to 1,400 m (Gowans 2009). The Scotian Shelf population of northern bottlenose whales off eastern Canada has been the subject of long-term photoidentification, behavioral and acoustic studies (Moors-Murphy 2018).

Acoustics and Hearing: There is no information on acoustics for this species. Beaked whales use frequencies of between 300 Hz and 129 kHz for echolocation, and between 2 and 10 kHz, and possibly up to 16 kHz, for social communication (DON 2008). There is no information on the hearing abilities of northern bottlenose whales. They are likely in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall, Bowles et al. 2007). Northern bottlenose whales recorded in the Gully produced sounds consisting predominantly of clicks ranging between 2 and 22 kHz (Hooker and Whitehead 2002).

- Cuvier's Beaked Whale (*Ziphius cavirostris*) and Mesoplodon Beaked Whales (*Mesoplodon spp*.): Western North Atlantic Stocks
- Abundance, Density, and Stock Status: Cuvier's and Mesoplodon spp. Beaked whales (including True's beaked whale, M. mirus; Gervais' beaked whale, M. europaeus; Blainville's beaked whale, M. densirostris; and Sowerby's beaked whale, M. bidens) are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. For this reason, they are grouped into what is called the "undifferentiated complex" of beaked whales and treated together for the purposes of stock assessments. Stock structure is unknown. Off the eastern U.S. and Canadian Atlantic coast the best population estimates for Cuvier's beaked whales are 5,744 (Hayes, Josephson et al. 2020). Neither genus is listed as threatened or endangered under the ESA. The density estimates calculated for Cuvier's beaked whales was 0.0062 for the offshore area >200 m and 0.0046 for the offshore area for Mesoplodon spp. (OBIS-SEAMAP data based on Roberts, Best et al. 2016) (Table 6-1).

Distribution and Habitat: Beaked whales occur principally along the continental shelf edge and in deeper oceanic waters (CETAP 1982, Waring, Fairfield et al. 2007). Most sightings are in late spring and summer, which corresponds to survey effort. Distribution is otherwise derived from stranding reports (Waring, Josephson et al. 2009). During spring and summer, Cuvier's and Mesoplodon spp. Beaked whales occupy shelf-edge and deeper oceanic waters. They are associated with warm waters (20.7° to 24.9° C), Gulf Stream features and warm-core rings, and steep bathymetry (Waring, Hamazaki et al. 2001). Results from a study between 2014 and 2017 of 20 Cuvier's beaked whales satellite-tagged offshore of Cape Hatteras, North Carolina, suggest these animals have very restricted movements and could be a resident population (Foley 2018). Aerial surveys conducted monthly off Cape Hatteras between 2011 and 2015 documented Cuvier's beaked whales every month of the year (McLellan, McAlarney et al. 2018; as cited in Hayes, Josephson et al. 2020) and acoustic recordings confirm consistent year-round presence (Stanistreet, Nowacek et al. 2017; as cited in Hayes, Josephson et al. 2020). A minimum annual rate of human-caused mortality (2013–2017) averaged 0.2 animals per year based on one stranding record that reported plastic ingestion (Hayes, Josephson et al. 2020).

Acoustics and Hearing: Cuvier's and Mesoplodon spp. Beaked whales are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall, Bowles et al. 2007). While empirical hearing threshold data are not available for mysticetes, modeled data indicate hearing sensitivities range from tens of Hz to approximately 20 kHz (Cholewiak, DeAngelis et al. 2017). Vocalizations ranges are similar at 300 Hz to 135 kHz (DON 2008).

- Melon-headed Whale (*Peponocephala electra*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Melon-headed whales are not listed under the ESA. Melon-headed whales are distributed worldwide in tropical and sub-tropical waters (Jefferson, Leatherwood et al. 1994; as cited in Hayes, Josephson et al. 2020). Two sightings of this species have been documented during NMFS vessel surveys in 1992 and 2016 in the U.S. Atlantic. Strandings have been recorded in the U.S. Atlantic with most occurring in Florida and South Carolina, a few in Virginia, and one in New Jersey (Hayes, Josephson et al. 2020).

The population size of melon-headed whales off the U.S. or Canadian Atlantic coast is unknown due to rare sightings (Hayes, Josephson et al. 2020). While a group of melon-headed whales was sighted in waters >2500 m deep during vessel surveys in 1999 (20 whales) and 2002 (80 whales) off of Cape Hatteras, North Carolina, no other sightings during vessel surveys have been confirmed (Hayes, Josephson et al. 2020). Abundances have not been estimated from the 1999 and 2002 vessel surveys in western North Atlantic because the sighting was not made during line-transect sampling effort; therefore, the population size of melon-headed whales is unknown. No melon-headed whales have been observed in any other surveys. Present data are insufficient to calculate a minimum population estimate for this stock and there are insufficient data to determine the population trends or PBR. In the western North Atlantic, annual estimated fishery-related mortality and serious injury during 2013–2017 was presumed to be zero, as there were no reports of mortalities or serious injuries to melon-headed whales. During this same period, three strandings of melon-headed whales were reported off Florida in 2015 (Hayes, Josephson et al. 2020).

Distribution and Habitat: Melon-headed whales generally occur offshore in deep oceanic waters. Nearshore distribution is generally associated with deep water areas near to the coast (Perryman and

Danil 2018). Squid appear to be the preferred prey, along with some fish and shrimp (Perryman and Danil 2018). They are often in large schools (mean school size is about 200), including in mixed schools with Fraser's dolphins (Perryman and Danil 2018). They may also form mixed schools with spinner, bottlenose, and rough-toothed dolphins (Perryman and Danil 2018). Females reach sexual maturity at approximately 11.5 years of age and males at about 15 years (Perryman and Danil 2018).

Acoustics and Hearing: Melon-headed whales are classified in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz–160 kHz (NMFS 2018b). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Risso's Dolphin (*Grampus griseus*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Risso's dolphins are not listed as endangered or threatened under the ESA. Based on data from the 2016 NEFSC and Department of Fisheries and Oceans Canada (DFO) surveys, the best abundance estimate for Risso's dolphins is the sum of the estimates—35,493. This estimate is larger than the previous 2011 number as it is derived from a survey area extending 1,300,000 km^2 between Florida and Newfoundland (Hayes et al. 2020). Abundance estimates of 75,079 and 7,245 Risso's dolphins were generated from vessel surveys conducted in U.S. waters of the western North Atlantic during the summer of 2016 (Garrison 2020; Palka 2020 as cited in Hayes, Josephson et al. 2020). Both surveys occurred June through August with the first survey in waters north of 38ºN latitude along the shelf break and offshore to the outer limit of the U.S. EEZ (NEFSC and SEFSC 2018; as cited in Hayes, Josephson et al. 2020) and the second from Central Florida to approximately 38ºN latitude between the 100-m isobaths and the outer limit of the U.S. EEZ (Hayes, Josephson et al. 2020). PBR for Risso's dolphin is 303. Total annual human-caused mortality 2013–2017 was 54.3 based on fisheries interactions and strandings. The mean combined annual mortality associated with fisheries includes 6.9 from pelagic longline, 5.8 from Northeast sink gillnet, 4.2 from Northeast bottom trawl and 37 from the mid-Atlantic bottom trawl (Hayes, Josephson et al. 2020 and citations therein). The density estimates calculated for Risso's dolphin were 0.0020 for the LME <200 m and 0.0128 for the offshore research area >200 m (OBIS-SEAMAP based on data from Roberts, Best et al. 2016).

Distribution and Habitat: Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to GB during the spring, summer, and autumn. In winter, the range begins at the MAB and extends farther offshore into oceanic waters. In general, the population occupies the mid-Atlantic continental shelf edge year round, and is rarely seen in the GOM (Payne, Selzer et al. 1984; as cited in Hayes, Josephson et al. 2020). During 1990, 1991, and 1993, spring/summer surveys conducted in continental shelf edge and deeper oceanic waters had sightings of Risso's dolphins associated with strong bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Waring, Fairfield et al. 1992; as cited in Hayes, Josephson et al. 2020). Sightings during 2016 surveys were concentrated along the shelf break (NEFSC and SEFSC 2018; as cited in Hayes, Josephson et al. 2020).

Acoustics and Hearing: Risso's dolphins are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). Vocalizations range from 400 Hz to 65 Hz (DON 2008). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Long-finned Pilot Whale (*Globicephala melas*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Two species of pilot whale (Globicephala spp.) occur in the western Atlantic, long-finned and short-finned pilot whales and differentiating between these species can be challenging (Hayes, Josephson et al. 2020). In U.S. Atlantic waters, pilot whales are distributed primarily along the continental shelf edge off the northeastern U.S. coast in winter and early spring (Hamazaki 2002). In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters and remain in these areas through late autumn (CETAP 1982; Payne and Heinemann 1993; as cited in Hayes, Josephson et al. 2020). The best available estimate for long-finned pilot whales in the western North Atlantic is 39,215 (Garrison 2020 and Palka 2020; each as cited in Hayes, Josephson et al. 2020) and is based on summer surveys from 2016 including waters from central Virginia to Labrador. The 2016 estimate is larger than those from 2011 due to a larger survey area extending from Newfoundland to Florida, about 1,300,000 km^2 larger than the 2011 survey area. Species density is 0.00220 for the LME <200 m and the offshore research area >200 m (Table 6-1). PBR for the western North Atlantic long-finned pilot whale is 306 (Hayes, Josephson et al. 2020).

Distribution and Habitat: Pilot whales (Globicephala spp.) occur throughout the NEFSC survey area from Canada to Cape Hatteras. Long-finned pilot whales concentrate along the Northeast U.S. shelf edge between the 100 m and 1000 m isobaths during mid-winter and early spring (Abend and Smith 1999; as cited in Hayes, Josephson et al. 2020). In late spring, pilot whales move from the mid-Atlantic region onto GB and the Scotian Shelf, and into the GOM, where they remain through late autumn (Waring, Josephson et al. 2011). Pilot whales generally occur in areas of high relief or submerged banks and are also associated with the Gulf Stream wall and thermal fronts along the continental shelf edge (Hamazaki 2002). Pilot whales feed primarily on squid but also consume fish (Spitz, Cherel et al. 2011).

Acoustics and Hearing: Globicephala spp. Are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). Their vocalizations range from 2 to 60 kHz (DON 2008). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Short-finned Pilot Whale (*Globicephala macrorhynchus*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Short-finned pilot whales occur worldwide in tropical to warm temperate waters and may seasonally extend into shelf-edge waters north of Cape Hatteras. Most pilot whale sightings south of Cape Hatteras are expected to be short-finned pilot whales (i.e., south of approximately 42°N) (Garrison and Rosel 2017; as cited in Hayes, Josephson et al. 2020).

Shipboard surveys in 2016 covering waters from central Florida to the lower Bay of Fundy provide the best available estimate for short-finned pilot whales in the western North Atlantic is 28,924 (Palka 2012) (Garrison 2016, Garrison and Rosel 2017 and Garrison and Palka 2018; all as cited in Hayes, Josephson et al. 2020). These sightings of pilot whales were strongly concentrated along the continental shelf break; however, pilot whales were also observed over the continental slope in waters associated with the Gulf Stream (Hayes, Josephson et al. 2020). For the period 2013–2017, there were a total of 160 incidental mortalities of short-finned pilot whales in the commercial pelagic longline fishery in the U.S. EEZ in the Atlantic Ocean. There was also one self-reported incidental mortality in the hook and line fishery during this same period. Fourteen short-finned pilot whales and on unspecified pilot whale stranded between Massachusetts and Florida between 2013 and 2017. Species density is 0.00220 for the LME <200 m and the offshore research area >200 m (Table 6-1). PBR for the western North Atlantic short-finned pilot whale is 236 (Hayes, Josephson et al. 2020).

Distribution and Habitat: Short-finned pilot whales occur worldwide in tropical to warm temperate waters and may seasonally extend into shelf-edge waters north of Cape Hatteras (Leatherwood and Reeves 1983). In 2014 and 2015, Thorne, Foley et al. (2017; as cited in Hayes, Josephson et al. 2020) tracked 33 short-finned pilot whales off Cape Hatteras using satellite-linked telemetry tags and documented that whales were concentrated along the continental shelf break from Cape Hatteras north to Hudson Canyon, but whale distribution also included shelf break waters south of Cape Lookout, shelf break waters off Nantucket Shoals, and deeper offshore waters of the Gulf Stream east and north of Cape Hatteras. The 2014 and 2015 data reinforce that important foraging habitat for short-finned pilot whales is found along the continental shelf break is an in the western North Atlantic.

Acoustics and Hearing: Short-finned pilot whale whistles and clicks have a dominant frequency range of 2 to14 kHz and a source level of 180 dB re 1 µPa-m for whistles (DON 2008). Globicephala spp. Are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Atlantic White-sided Dolphin (*Lagenorhynchus acutus*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The dolphin genus Lagenorhynchus is currently proposed to be revised (Vollmer, Ash et al. 2019; as cited in Hayes, Josephson et al. 2020), however such changes are not yet officially accepted. Atlantic white-sided dolphins are not listed as threatened or endangered under the ESA. The best available abundance estimate for white-sided dolphins in the western North Atlantic stock is 93,233 based on June–September 2016 surveys conducted from Labrador to the U.S. east coast, covering nearly the entire western North Atlantic stock (i.e., Gulf of Maine and Gulf of St. Lawrence populations and part of the Labrador population). As these survey areas did not overlap, the estimates were added together to produce a species abundance estimate for the stock area. In addition, the 2016 survey area was much larger than in 2011 and extended from Newfoundland to Florida which, along with the fact that the more recent surveys were corrected to availability bias, resulted in larger population estimates than 2011. The density estimates calculated for Atlantic white-sided dolphins were 0.0453 for the LME <200 m and 0.0 for the offshore research area >200 m (Table 6-1).

PBR for the western North Atlantic stock of white-sided dolphins is 544. During the period 2013–2017, there were a total of 26 incidental mortalities due to commercial fisheries in the Atlantic (2.8 in the Northeast sink gillnet, 21 in the Northeast bottom trawl and 1.9 in the Mid-Atlantic bottom trawl). Mass strandings up to 100 or more animals are common for this species. The causes for these strandings are unknown. During 2013–2017, there were a total of 60 strandings reported along the U.S. Atlantic coast and 63 in Canada (Hayes, Josephson et al. 2020).

Distribution and Habitat: Atlantic white-sided dolphins occur in temperate and sub-polar regions of the North Atlantic, primarily in continental shelf waters to the 100 m depth contour. The species ranges from central West Greenland to North Carolina (about 35˚ N) and perhaps as far east as 43˚ W (Hamazaki 2002). Distribution of sightings, strandings, and incidental takes suggest the possible existence of three stocks: GOM, Gulf of St. Lawrence, and Labrador Sea stocks (Palka, Read et al. 1997; as cited in Hayes, Josephson et al. 2020). Evidence for a separation between the well-documented unit in the southern GOM and a Gulf of St. Lawrence population comes from a lack of summer sightings along the Atlantic side of Nova Scotia. White-sided dolphins were seen frequently in the GOM and at the mouth of the Gulf of St. Lawrence, but few were recorded between these two regions. Since 2007, however, this gap has been less obvious and could be related to an increasing number of animals being distributed more northwards due to climatic/ecosystem changes that are occurring in the Gulf of Maine (Hayes, Josephson et al. 2020 and citations therein). The GOM stock of white-sided dolphins is most common in continental shelf waters from Hudson Canyon (approximately 39˚ N) north through GB, and in the GOM to the lower Bay of Fundy.

Sightings data indicate seasonal shifts in distribution (Northridge, Tasker et al. 1997; as cited in Hayes, Josephson et al. 2020). During January to May, low numbers of white-sided dolphins are found from GB to Jeffreys Ledge (off New Hampshire), and even lower numbers are found south of GB, as documented by a few strandings on beaches of Virginia and North Carolina. From June through September, large numbers of white-sided dolphins are found from GB to the lower Bay of Fundy, including waters of the western Gulf of Maine and east and southeast of Cape Cod (Hamazaki 2002).

Sightings south of GB, particularly around Hudson Canyon, have been made at all times of the year but at low densities. The Virginia and North Carolina observations appear to represent the southern extent of the species range during winter months (Hayes, Josephson et al. 2020). White-sided dolphins are opportunistic feeders and their diet is based on available prey (Craddock, Polloni et al. 2009; as cited in Hayes, Josephson et al. 2020). White-sided dolphin habitat preference along the Mid-Atlantic Ridge, based on a summer 2004 vessel survey from the Reykjanes Ridge to north of the Azores, was associated with cold (5–16°C) and less saline (34.6–35.8‰) water masses north of the Charlie-Gibb Fracture Zone (Waring, Nottestad et al. 2008; as cited in Hayes, Josephson et al. 2020). Water depth ranged between 1200 m and 2400 m.

- Acoustics and Hearing: Atlantic white-sided dolphins are in the mid-frequency functional hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall, Bowles et al. 2007). Their vocalizations range from 6 to 15 kHz (DON 2008). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.
- White-beaked Dolphin (*Lagenorhynchus albirostris*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The dolphin genus Lagenorhynchus is currently proposed to be revised (Vollmer, Ash et al. 2019; as cited in Hayes, Josephson et al. 2020), however such changes are not yet officially accepted. White-beaked dolphins are not listed as threatened or endangered under the ESA. Data are insufficient to determine population trends and the total number of white-beaked dolphins in U.S. and Canadian waters is unknown (Hayes, Josephson et al. 2020). The best abundance estimate for the western North Atlantic white-beaked dolphin is 536,016, and it is derived from 2016 Canadian Northwest Atlantic International Sightings Survey (NAISS) aerial survey data. The density estimates calculated for white-beaked dolphins were 0.00003 for the LME <200 m and 0.0 for the offshore research area >200 m (Table 6-1). PBR for the western North Atlantic white-beaked dolphin is 4,153. There are no documented reports of fishery-related mortality or serious injury to this stock in the U.S. EEZ. For the period 2013–2017, a total of 5 white-beaked dolphins were reported stranded in Massachusetts (4) and

North Carolina (1) while two animals stranded in Nova Scotia and a total of 85 stranded off the coast of Newfoundland (Hayes, Josephson et al. 2020).

- Distribution and Habitat: White-beaked dolphins are the more northerly of the two species of Lagenorhynchus in the northwest Atlantic. They occur in waters from SNE north to western and southern Greenland and Davis Straits (Leatherwood, Caldwell et al. 1976; as cited in Hayes, Josephson et al. 2020), and in the Barents Sea and south to at least Portugal (Reeves, Smeek et al. 1999; as cited in Hayes, Josephson et al. 2020). In waters off the northeastern U.S. coast, white-beaked dolphin sightings have been concentrated in the WGOM and around Cape Cod. The limited distribution of this species in U.S. waters has been attributed to opportunistic feeding (CETAP 1982). White-beaked dolphins were only observed over the central part of the Reykjanes Ridge, during a summer 2004 vessel survey from the Reykjanes Ridge to north of the Azores (Waring, Nottestad et al. 2008; as cited in Hayes, Josephson et al. 2020).

Acoustics and Hearing: White-beaked dolphins are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). Their vocalizations range from 6.5 to 15 kHz (DON 2008). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Short-beaked Common Dolphin (*Delphinus delphis*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Although the common dolphin may be one of the most widely distributed cetacean species, total numbers off the U.S. and Canadian Atlantic coasts is unknown, as is stock status within these waters. The current best abundance estimate for common dolphins off the U.S. Atlantic coast is 172,825 which is the total of Canadian and U.S. surveys conducted in 2016. The 2016 estimate is larger than those from 2011 because the 2016 estimate is derived from a survey area extending from Newfoundland to Florida, which is about 1,300,000 km^2 larger than the 2011 survey area (Hayes et al. 2019). A trend analysis has not been conducted for this stock. PBR for the western North Atlantic stock of common dolphin (short-beaked) is 1,452. Average annual estimated fishery-related mortality or serious injury during 2013–2017 was 419 common dolphins from estimated annual bycatch in observed fisheries plus 0.2 from research takes, for a total of 419.2 (Hayes, Josephson et al. 2019). The density estimates calculated for short-beaked common dolphins were 0.0891 for the LME <200 m and 0.0 for the offshore research area >200 m (OBIS-SEAMAP based on data from Roberts, Best et al. 2016) (Table 6-1).

Distribution and Habitat: Common dolphins in the North Atlantic are found along the shoreline of Massachusetts in mass-stranding events (Bogomolni, Pugliares et al. 2010 and Sharp, Knoll et al. 2014; both as cited in Hayes, Josephson et al. 2020). At-sea sightings have been concentrated over the continental shelf between the 100-m and 2000-m isobaths and over prominent underwater topography and east to the mid-Atlantic Ridge (29˚W) (Hayes, Josephson et al. 2020 and citations therein). Though less common south of Cape Hatteras, schools have been reported as far south as the Georgia/South Carolina border (32º N) (Jefferson, Fertl et al. 2009; as cited in Hayes, Josephson et al. 2020). They have seasonal movements where they are found from Cape Hatteras northeast to Georges Bank (35˚ to 42˚N) during mid-January to May (Payne, Selzer et al. 1984; as cited in Hayes, Josephson et al. 2020). Common dolphins move onto GB, Gulf of Maine, and the Scotian Shelf from midsummer to autumn. Selzer and Payne (1988; as cited in as cited in Hayes, Josephson et al. 2020) reported very large aggregations (greater than 3,000 animals) on Georges Bank in autumn. Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs during

summer and autumn when water temperatures exceed 11ºC (Sergeant, Mansfield et al. 1970 and Gowans and Whitehead 1995; both as cited in Hayes, Josephson et al. 2020). Common dolphins are opportunistic feeders and their diet is based on available prey. Common dolphins associated with warmer (>14°C) and more-saline (34.8–36.7‰) waters along the Mid-Atlantic Ridge during a summer 2004 vessel survey from the Reykjanes Ridge to north of the Azores (Waring, Nottestad et al. 2008; as cited in Hayes, Josephson et al. 2020). During some observations, the animals were associated with striped dolphins and Cory's shearwaters (Calonectris diomedea).

Acoustics and Hearing: Common dolphins are in the mid-frequency functional hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). Their vocalizations range widely from 200 Hz to 150 kHz (DON 2008). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Atlantic Spotted Dolphin (*Stenella frontalis*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Atlantic spotted dolphins are not listed as threatened or endangered under the ESA. The Atlantic spotted dolphin occurs in two forms which may be distinct sub-species: the large, heavily spotted form which inhabits the continental shelf and is usually found inside or near the 200-m isobath; and the smaller, less spotted island and offshore form which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico. This species may also co-occur with pantropical spotted dolphins (Hayes, Josephson et al. 2020). Prior to 1998, species of spotted dolphins were not differentiated during surveys, resulting in insufficient data to determine the population trends. Stock status in the U.S. Atlantic EEZ relative to OSP is unknown. A decline in population size for this species between 2004 and 2016 is indicated based on available abundance estimates (Hayes, Josephson et al. 2020).

The best estimate of abundance for the western North Atlantic stock of Atlantic spotted dolphins is 39,921 Garrison 2020; Palka 2020 as cited in Hayes, Josephson et al. 2020). The density estimates calculated for Atlantic spotted dolphins were 0.0013 for the LME <200 m and 0.0241 for the offshore research area >200 m (Table 6-1). PBR for the combined offshore and coastal forms of Atlantic spotted dolphins is 320. Total annual estimated fishery-related mortality and serious injury to this stock was presumed to be zero for the period 2013–2017. During this period, there were a total of 21 reported strandings between North Carolina and Florida (Hayes, Josephson et al. 2020).

Distribution and Habitat: Atlantic spotted dolphins are distributed in tropical and warm temperate waters of the western North Atlantic. They range from SNE, south through the Gulf of Mexico and the Caribbean to Venezuela (Leatherwood, Caldwell et al. 1976; as cited in Hayes, Josephson et al. 2020). They regularly occur in the inshore waters south of Chesapeake Bay and near the continental shelf edge and continental slope waters north of this region (Payne et al. 1984 and Mullin and Fulling 2003; both as cited in Hayes, Josephson et al. 2020). Atlantic spotted dolphins north of Cape Hatteras also associate with the north wall of the Gulf Stream (Waring, Fairfield et al. 1992; as cited in Hayes, Josephson et al. 2020).

Acoustics and Hearing: Atlantic spotted dolphins are in the mid-frequency functional hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). Vocalizations similarly range from 100 Hz to 130 kHz (DON 2008). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Pantropical Spotted Dolphin (*Stenella attenuate*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin 2009). Where they co-occur, the offshore ecotype of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea. The western North Atlantic pantropical spotted dolphin population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s).

Sightings have been concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic. Due to the paucity of sightings, there are insufficient data to determine whether the western North Atlantic stock comprises multiple demographically independent populations (Hayes, Josephson et al. 2020).

The best abundance estimate available for western North Atlantic pantropical spotted dolphins is 6,593 based on surveys between Florida and Bay of Fundy (Hayes, Josephson et al. 2020 and citations therein). Three coastwide abundance estimates are available from the summers of 2004, 2011, and 2016 for this species (4,439 in 2004; 3,333 in 2011; and 6,593 in 2016) (Garrison and Palka 2018; as cited in Hayes, Josephson et al. 2020). However, a generalized linear model indicated no statistically significant linear trend in these abundance estimates (Hayes, Josephson et al. 2020). The density estimates calculated for white-beaked dolphins were 0.0 for the LME <200 m and 0.0015 for the offshore research area >200 m (OBIS-SEAMAP data based on Roberts, Best et al. 2016) (Table 6-1). PBR for pantropical spotted dolphins is 44. Total annual estimated fishery-related mortality and serious injury to this stock during 2013–2017 was presumed zero. A total of five pantropical dolphins stranded between 2013 and 2017 in Florida (four in 2015 and one in 2016) (Hayes, Josephson et al. 2020).

Distribution and Habitat: Distribution of spotted dolphins is worldwide in tropical and some sub-tropical waters between 30–40° N latitude to 20–40° S latitude. Offshore spotted dolphin habitat is characterized by well-stratified water, warm (>25° C) surface temperatures, low salinity, and a sharp, but shallow, thermocline at approximately 50 m. Spotted dolphins primarily eat small epipelagic fish, squid, crustaceans, and flying fish in some areas. Pantropical spotted dolphins often occur in large multi-species schools, particularly with spinner dolphins. School size ranges from a few hundred to several thousand, with mean school size of 120 in the ETP (Perrin 2009).

Acoustics and Hearing: Spotted dolphins are classified in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz–160 kHz (NMFS 2018b). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Striped Dolphin (*Stenella coeruleoalba*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Striped dolphins are found in the western North Atlantic from Nova Scotia south to at least Jamaica and the Gulf of Mexico and appear to prefer continental slope waters offshore to the Gulf Stream (Hayes, Josephson et al. 2020 and citations therein). There is very little information concerning striped dolphin stock structure in the western North Atlantic (Archer and Perrin 1997; as cited in Hayes, Josephson et al. 2020). The best abundance estimate for striped dolphins is 67,036 and is the sum of the 2016 U.S. Atlantic surveys (Hayes, Josephson et al. 2020). The density estimates calculated for striped dolphins were 0.0 for the LME <200 m and 0.0614 for the offshore research area >200 m (OBIS-SEAMAP based on Roberts, Best et al. 2016) (Table 6-1). PBR for the western North Atlantic striped dolphin is 529. A total of 39 incidental mortalities were reported in the U.S. (22) and Canadian (17) Atlantic for the period 2013–2017. During this same period, there were 22 reported strandings in U.S. waters, with most (12) occurring in North Carolina (Hayes, Josephson et al. 2020).

Distribution and Habitat: Off the U.S. east coast, they distribute along the continental shelf edge from Cape Hatteras to the southern margin of GB, and also occur offshore over the continental slope and continental rise in the mid-Atlantic region (CETAP 1982, Mullin and Fulling 2003; as cited in Hayes, Josephson et al. 2020). Continental shelf edge sightings were generally centered along the 1,000 m depth contour in all seasons (CETAP 1982). The first stranding record of this species in Newfoundland and Labrador was documented in 2017 (Ledwell, Huntington et al. 2018; as cited in Hayes, Josephson et al. 2020).

- Acoustics and Hearing: Striped dolphins are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b) (NMFS 2018b). Their vocalizations range from 6 to > 24 kHz (DON 2008). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.
- Fraser’s Dolphin (*Lagenodelphis hosei*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Fraser’s dolphins are distributed worldwide in tropical waters (Louella and Dolar 2009) and are assumed to be part of the cetacean fauna of the tropical western North Atlantic. There has only been one animal sighted in the western North Atlantic and therefore, this species is considered very rare. The numbers of Fraser’s dolphins and seasonal abundance for this species off the U.S. or Canadian Atlantic coast are unknown. In 1999, a group of an estimated 250 Fraser’s dolphins was sighted in waters 3,300 m deep in the western North Atlantic off Cape Hatteras during a vessel survey. No Fraser’s dolphins have been observed in any other surveys. Therefore, present data are insufficient to calculate a minimum population estimate for this stock and PBR is unknown. Total annual fishery-related mortality and serious injury for the period 2013–2017 is presumed zero and there were no reported strandings for this period (Hayes, Josephson et al. 2020).

Distribution and Habitat: Fraser’s dolphins are a tropical species generally found between 30°N and 30°S (Louella and Dolar 2009). They are typically oceanic and commonly occur in water depths of 1,500–2,500 m. They prey primarily on mesopelagic fish, cephalopods, and crustaceans and, in the ETP, are thought to feed at 250 to 500 m depth. Fraser’s dolphins often occur in tightly grouped, fast moving schools of 100–1,000 individuals. They commonly occur in large mixed-species schools with melon-headed whales in the Eastern Tropical pacific. They are deep divers and capable of diving to >600 m (Louella and Dolar 2009).

Acoustics and Hearing: Fraser's dolphins are classified in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz–160 kHz (NMFS 2018b). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Rough-toothed Dolphin (*Steno bredanensis*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Roughed-toothed dolphins are not listed under the ESA. For management purposes, rough-toothed dolphins observed off the eastern U.S. coast are provisionally considered a separate stock from dolphins recorded in the northern Gulf of Mexico, although there is currently no information to differentiate these stocks. Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation. The best abundance estimate available for the western North Atlantic rough-toothed dolphin is 136 based on an average from summer 2011 and summer 2016 shipboard surveys covering waters from central Florida to the lower Bay of Fundy (Hayes, Josephson et al. 2019). The 2011 and 2016 NEFSC surveys covered waters deeper than 100-m while the SEFSC covered waters greater than 50-m depth, all within the U.S. EEZ. Sightings of rough-toothed dolphins were rare (four in 2011 and zero in 2016) in waters between central Virginia and the lower Bay of Fundy and therefore no abundance estimate was made for this region. Sightings were also rare between central Virginia and central Florida (Hayes, Josephson et al. 2019). The abundance estimate of 271 was generated from one summer shipboard survey in 2011 (Garrison 2016; as cited in Hayes, Josephson et al. 2019). PBR for the western North Atlantic stock of rough-toothed dolphins is 0.7. Total annual estimated fishery-related mortality and serious injury to this stock between 2012 and 2016 was zero. While several mass strandings of rough-toothed dolphins along the U.S. east coast have occurred in the past, there were no strandings reported for the period 2012 to 2016 between Maine and Florida (Hayes, Josephson et al. 2019). The density estimates calculated for rough-toothed dolphins were 0.0005 for the LME <200 m and 0.0010 for the offshore research area >200 m (OBIS-SEAMAP based on data from Roberts, Best et al. 2016) (Table 6-1).

Distribution and Habitat: Most shipboard sightings from the U.S. East Coast have occurred in oceanic waters at depths greater than 1,000 m (Hayes, Josephson et al. 2019). Five rehabilitated and tagged rough-toothed dolphins in the western North Atlantic moved through a large range of water depths averaging greater than 100 m, though each of the five tagged dolphins transited through very shallow waters at some point, with most of the collective movements recorded over a gently sloping sea floor. These five rough-toothed dolphins moved through waters ranging from 17° to 31°C, with temperatures averaging 21° to 30°C. Recorded dives were rarely deeper than 50 m (Hayes, Josephson et al. 2019). They feed on a variety of fish and cephalopods but their general ecology is poorly studied. They may stay submerged for up to 15 minutes and are known to dive as deep as 150 m (Jefferson 2002; as cited in Hayes, Josephson et al. 2020).

Acoustics and Hearing: As summarized in DON (2008), the rough-toothed dolphin produces a variety of sounds, including broadband echolocation clicks and whistles. Echolocation clicks typically have a frequency range of 0.1 to 200 kHz, with a dominant frequency of 25 kHz. Whistles have a wide frequency range of 0.3 to greater than 24 kHz but dominate in the 2 to 14 kHz range. They are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b).

While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Clymene Dolphin (*Stenella clymene*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The numbers of Clymene dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this species since it was rarely seen in any surveys. The best abundance estimate available for this species in the western North Atlantic is 4,237 (Garrison 2020 and Palka 2020; each as cited in Hayes, Josephson et al. 2020) and is based on summer 2016 surveys from central Florida to the lower Bay of Fundy. This new estimate is the first since the 1998 survey. PBR for the western North Atlantic stock of clymene dolphins is 21. Total annual fishery-related mortality and serious injury to this stock for 2013–2017 was presumed to be zero and only one stranding was documented in New Jersey in 2013 (Hayes, Josephson et al. 2020).

Distribution and Habitat: Clymene dolphins are found only in the Atlantic Ocean in tropical to warm-temperate waters; the exact range is not well understood (Jefferson 2009). Most sightings have been in deep, offshore waters, but may be seen near shore when deep water approaches the coast. It likely feeds on mesopelagic fishes and squid. They are known to associate with spinner dolphins. Schools of this species are often moderately large but most consist of less than a few hundred animals(Jefferson 2009).

Acoustics and Hearing: There has been little work done on the acoustic behavior of these animals but they appear to be quite vocal with whistles in the frequency range of 6–19 kHz (Jefferson 2009). It is assumed that they are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Spinner Dolphin (*Stenella longirostris*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The best abundance estimate available for spinner dolphins in the western North Atlantic is 4,102 (Garrison 2020 and Palka 2020; each as cited in Hayes, Josephson et al. 2020) based on 2016 surveys between central Florida and the lower Bay of Fundy. Previously, the number of spinner dolphins off the U.S. Atlantic coast has not been estimated because there have only been three sightings during recent NMFS surveys. Sightings have occurred almost exclusively in deeper (>2,000 m) oceanic waters (CETAP 1982, Waring, Fairfield et al. 1992; as cited in Hayes, Josephson et al. 2020) off the northeast U.S. coast. One sighting during summer 2011 in oceanic waters off North Carolina and two additional sightings during summer 2016 in oceanic waters off Virginia have been documented (Hayes, Josephson et al. 2020). There are insufficient data to determine the population trends for this species. PBR for the western North Atlantic spinner dolphin is 20. For the period 2013–2017, there were presumed to be zero fishery-related mortalities. There were two documented strandings in Florida, one each year in 2016 and 2017 (Hayes, Josephson et al. 2020).

Distribution and Habitat: Spinner dolphins occur in all tropical and most sub-tropical waters between 30–40°N and 20–40°S latitude, generally in areas with a shallow mixed layer, shallow and steep thermocline, and little variation in surface temperatures (Perrin 2009). Its distribution in the Atlantic is very poorly known. In the western North Atlantic, these dolphins occur in deep water along most of the U.S. coast south to the West Indies and Venezuela, including the Gulf of Mexico. Mixed schools with other species, particularly pantropical spotted dolphins, are common (Perrin 2009).

Acoustics and Hearing: Spinner dolphins are in the mid-frequency functional hearing group (NMFS 2018b), with an estimated auditory bandwidth of 150 Hz to 160 kHz. While Southall, Finneran et al. (2019) have suggested placing this species in the high frequency hearing group, NMFS has not yet adopted this recommendation.

- Common Bottlenose Dolphin (*Tursiops truncatus*): Various Stocks

There are two morphologically and genetically distinct common bottlenose dolphin morphotypes described as the coastal and offshore forms. Both inhabit waters in the western North Atlantic Ocean along the U.S. Atlantic coast. The two morphotypes are genetically distinct based upon both mitochondrial and nuclear markers. For this LOA, information reported in Hayes, Josephson et al. 2020 for the offshore morphotype and the coastal morphotype represent the main stocks that could be impacted by the majority of NEFSC research. Based on the proposed research listed in Table 1-2, the COASTSPAN project may occasionally occur as far south as northern Florida. The majority of NEFSC research occurs in the northern portion of the LME which may involve the offshore, Northern Migratory Coastal, Southern Migratory Coastal stocks of bottlenose dolphins while the coastal that occur south of Cape Hatteras may include South Carolina/Georgia Coastal and Northern Florida Coastal stocks. While all five of these stocks are discussed here, the South Carolina/Georgia Coastal and Northern Florida stocks are not likely to interact with nearshore COASTSPAN surveys and therefore, takes are not requested for those stocks (see additional information in Section 6.4).

Abundance, Density, and Stock Status

<u>Offshore Stocks</u> – In the western North Atlantic, the best available estimate for the offshore stock of common bottlenose dolphins is 62,851 (Garrison 2020 and Palka 2020; each as cited in Hayes, Josephson et al. 2020) and is based on 2016 summer surveys covering waters from central Florida to the lower Bay of Fundy. Three coastwide abundance estimates for offshore common bottlenose dolphins from the summers of 2004, 2011, and 2016 are available (54,739, 77,539 and 62,851, respectively) (Garrison 2020 and Palka 2020; each as cited in Hayes, Josephson et al. 2020). A statistically significant trend in these estimates is not indicated based on linear modeling (Hayes, Josephson et al. 2020). PBR for the western North Atlantic offshore common bottlenose dolphin is 519. The offshore stock density estimate taken from OBIS-SEAMAP based on Roberts, Best et al. (2016) is 0.1615 animals per km^2 (Table 6-1). This density is used to calculate disturbance takes in Section 6.

A total of 28 fishery-related incidental mortalities were reported for 2013–2017, including 7 in Northeast sink gillnet, 10.4 in Northeast bottom trawl, and 10.9 in the Northeast Mid-Atlantic bottom trawl (zero were reported for pelagic longline) (Hayes, Josephson et al. 2020). A UME due to Morbillivirus occurred between 2013 and 2015, when a total of 1,872 stranded common bottlenose dolphins were recovered in an area stretching from New York to Brevard County, Florida (Morris, Zelner et al. 2015; as cited in Hayes, Josephson et al. 2020).

<u>Coastal and Estuarine Stocks</u> – The coastal morphotype of this species includes multiple stocks along the U.S. East Coast. The Northern Migratory and Southern Migratory Coastal stocks are thought to make broad-scale seasonal migrations along the Western North Atlantic coast. The best available abundance estimate for the Northern Migratory Coastal stock is complicated by the overlap with other stocks. Summer aerial surveys by the SEFSC in 2010, 2011 and 2016 estimated abundance of 14,314, 15,360 and 6,639 dolphins, respectively. The 2016 estimate is currently used as the best estimate of population size for this stock due to a UME that occurred 2013–2015. During the 2013–2015 event, a total of 1,872 dolphins stranded in an area which stretched from New York to Brevard County, Florida. This number potentially included other stock such as the Southern Migratory Coastal stock described below. PBR for the Northern Migratory Coastal stock is 48 (Hayes, Josephson et al. 2018),

The best abundance estimate for the Southern Migratory stock is 3,751 (Garrison, Barry et al. 2017 as cited in Hayes, Josephson et al. 2018). This estimate was based on aerial surveys during the summer of 2016 of coastal and shelf waters from Florida to New Jersey. The 2013–2015 UME described above likely included dolphins from this stock however the specific number is unknown. PBR for the Southern Migratory Coastal stock is 23 (Hayes, Josephson et al. 2018).

The density estimate combined for the Southern and Northern Migratory stocks taken from OBIS-SEAMAP based on Roberts, Best et al. (2016) is 0.1359 animals/ km^2 (Table 6-1). This density is used to calculate disturbance takes in Section 6.

Based on summer aerial surveys in 2016 along the coastal and shelf waters from Florida to New Jersey, the best abundance estimate for the South Carolina/Georgia Coastal stock is 6,027 (Hayes, Josephson et al. 2018). Approximately 305 dolphins from this stock were identified in the UME that involved 1,872 dolphins during the period 2013–2015. PBR for this stock is 46 (Hayes, Josephson et al. 2018).

The Northern Florida Coastal Migratory stock of common bottlenose dolphins overlaps spatially and temporally with the Southern Migratory Coastal stock as well as the Offshore stock (Garrison et al. 2017 as cited in Hayes, Josephson et al. 2018). The best available abundance estimate based on 2016 summer aerial surveys is 877. One mortality from this stock was documented in 2014 in a lazy line trawl during fishery research conducted by the SWFSC. Two additional mortalities occurred in 2013 due to entanglement with a braided rope of unknown origin and a conductor wire. PBR for the Northern Florida Coastal Migratory stock is 6 (Hayes, Josephson et al. 2018).

In 2006, NMFS implemented the Bottlenose Dolphin Take Reduction Plan (BDTRP) to reduce the serious injury and mortality of Western North Atlantic coastal bottlenose dolphins incidental to 13 U.S. commercial fisheries in Category I and II. Due to the smaller gear size, reduced set time and specific survey methods used by NEFSC versus commercial fishing practices, the NEFSC surveys do not meet the requirements necessary to implement BDTRP regulations. The only survey that occurs south of Cape Hatteras, NC where the Northern Florida and South Carolina/Georgia Coastal stocks occur is COASTSPAN (see Table 1-2) however, these surveys are all conducted at nearshore shallow water locations or in estuaries, and are stationary sets, not tracklines. COASTSPAN uses small size gillnets and longline gear that is short in length and not likely to reach areas where Northern Florida and South Carolina/Georgia coastal bottlenose dolphin stocks occur. COASTSPAN does not regularly use watercraft of any kind and is more of a shore deployment. For this reason, M/SI takes are not requested for the Northern Florida or South Carolina/Georgia Coastal stocks (see Section 6.6.1).

There are 10 estuarine stocks of common bottlenose dolphins identified for North Carolina, South Carolina, Georgia, and Florida waters (Waring, Josephson et al. 2014). Due to the limited NEFSC survey efforts in South Carolina, Georgia, and Florida estuarine waters (see Section 1.4.18) and the lack of significant historical takes during these surveys, in this application NEFSC is not requesting takes from any common dolphin estuarine stocks. The 2015 notice of proposed rulemaking (80 FR 39587) stated that "in the future, if there is a bottlenose dolphin take from one of the estuarine stocks (to be determined by genetic sampling), the NEFSC will consult with OPR and the Atlantic Bottlenose Dolphin Take Reduction Team under the Adaptive Management provisions of the final rule to discuss appropriate modifications to COASTSPAN survey protocols." However, no takes of common bottlenose. dolphins have occurred in NEFSC COASTSPAN surveys since 2008, when the COASTSPAN gillnet survey caught and killed one common bottlenose dolphin while a cooperating institution was conducting the survey in South Carolina. Level of effort for COASTSPAN surveys projected for this application is expected to be equal to or less that during the previous 5-year period[8].

Distribution and Habitat: North of Cape Hatteras, there is separation of the two morphotypes across bathymetry during summer months (Hayes, Josephson et al. 2020 and citations therein). Aerial surveys flown during 1979–1981 indicated a concentration of common bottlenose dolphins in waters < 25 m deep corresponding to the coastal morphotype, and an area of high abundance along the shelf break corresponding to the offshore stock (CETAP 1982), while those in waters > 25 m depth were from the offshore morphotype (Garrison, Rosel et al. 2003; as cited in Hayes, Josephson et al. 2020). South of Cape Hatteras however, the ranges of the coastal and offshore morphotypes overlap to some degree. During warmer months, the Northern Migratory Coastal stock occurs in coastal waters from the shoreline to approximately the 20-m isobath between Assateague, Virginia to Long Island, New York. During cold months (January and February), the Northern Migratory Coastal stock occurs primarily between Cape Lookout, North Carolina to the North Carolina/Virginia border. The distribution of the Southern Migratory Coastal stock is not well understood but satellite tag telemetry data indicate this stock occurs seasonally along the coast between Norther Carolina and northern Florida, where it may overlap with the South Carolina/Georgia stock. The South Carolina/Georgia Coastal Stock inhabit coastal waters from the shoreline to approximately the 200-m isobath from the Little River Inlet, South Carolina (33.8°N), south to the Georgia/Florida border (30.7°N). The northern and southern boundaries for the Northern Florida Coastal stock are poorly understood but are thought to inhabit coastal waters from the shoreline to approximately the 200-m depth between coastal Florida near 29.4°N to the Florida/Georgia border (Hayes, Josephson et al. 2018). There are six Biologically Important Areas (BIAs) that have been established by NMFS for bottlenose dolphins that occur between North Carolina and Jacksonville, Florida. BIAs are reproductive areas, feeding areas, migratory corridors, and areas in which small and resident populations are concentrated.

Acoustics and Hearing: Coastal and offshore stocks of bottlenose dolphins are in the mid-frequency functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (NMFS 2018b). Bottlenose dolphin vocalization frequencies range from 3.4 to 130 kHz (DON 2008).

- Harbor Porpoise (*Phocoena phocoena*): Gulf of Maine/Bay of Fundy Stock

Abundance, Density, and Stock Status: The stock of harbor porpoise found in U.S. and Canadian Atlantic waters occurs in the GOM/Bay of Fundy stock (Hayes, Josephson et al. 2020 and citations therein). This stock is currently not listed under the ESA. Population trends for this species are unknown. The best abundance estimate (95,543) of the Gulf of Maine/Bay of Fundy harbor porpoise stock is the sum of the 2016 NEFSC and Department of Fisheries and Oceans Canada (DFO) surveys which have been were added together because survey areas did not overlap (Hayes, Josephson et al. 2020). The density estimates

[8]Personal communication, NEFSC, Apex Predators Program December 2, 2020.

calculated for harbor porpoise were 0.0403 for the LME <200 m and 0.0 for the offshore research area >200 m (Table 6-1). PBR for the Gulf of Maine/Bay of Fundy harbor porpoise is 851. For the period 2013–2017, there were a total of 217 fishery-related mortalities (193 in Northeast sink gillnet, 21 in Mid-Atlantic gillnet, and 3.2 in Northeast bottom trawl). During this same period, there were a total of 297 strandings in the U.S. and 86 strandings in Canada along the Atlantic coast (Hayes, Josephson et al. 2020).

- Distribution and Habitat: The Gulf of Maine/Bay of Fundy harbor porpoise population primarily occupies cooler (< 17° C) and relatively shallow (< 200 m) coastal waters off the Northeast U.S. and adjacent waters in the Bay of Fundy and southwest Nova Scotia, Canada (Hayes, Josephson et al. 2020 and citations therein). These animals have been seen in non-summer months from the coastline to deep waters (>1800 m; Westgate, Read et al. 1998; as cited in Hayes, Josephson et al. 2020), although the majority are found over the continental shelf. Passive acoustic monitoring detected harbor porpoises regularly during the period January-May offshore of Maryland (Wingfield, O’Brien et al. 2017; as cited in Hayes, Josephson et al. 2020). From July to September, the species concentrates in the northern GOM and southern Bay of Fundy region, with highest densities in waters between 10° and 15.5° C (Hayes, Josephson et al. 2020 and citations therein). During fall (October-December) and spring (April-June), harbor porpoise are widely dispersed from New Jersey to Maine, with lower densities farther north and south. A component of the population occupies shelf waters between Massachusetts and North Carolina during fall. During winter (January to March), intermediate densities of harbor porpoise can be found in waters off New Jersey to North Carolina, and lower densities are found in waters off New York to New Brunswick, Canada. Habitat use is believed to be associated with prey, particularly Atlantic herring (Hayes, Josephson et al. 2020 and citations therein).

Acoustics and Hearing: Harbor porpoise are in the high-frequency functional hearing group, whose estimated auditory bandwidth is 200 Hz to 180 kHz (NMFS 2018b). Their vocalizations range from 110 to 150 kHz (DON 2008).

- Harbor Seal (*Phoca vitulina concolor*): Western North Atlantic Stock

Abundance, Density, and Stock Status: Harbor seals are not considered threatened or endangered under the ESA. Harbor seals are found year round in the coastal waters off eastern Canada and Maine and occur seasonally (September through May) in areas from southern New England to Virginia (Hayes, Josephson et al. 2020 and citations therein). The stock structure of the western North Atlantic population of harbor seals is unknown, although those found along the eastern U.S. and Canadian coasts are thought to represent one population (Temte, Bigg et al. 1991 and Andersen and Olsen 2010; each as cited in Hayes, Josephson et al. 2020). The best abundance estimate of harbor seals is 75,834 based on a 2012 survey (Waring, DiGiovanni et al. 2015). For calculating acoustic disturbance takes of harbor seals (see Section 6), a density estimate of 0.2844 animals/km^2 is used (81 FR 53061). This density was calculated as the ratio of the abundance reported in the 2013 SAR (70,142) (Waring, Josephson et al. 2014) over the area of fishery research that overlapped with the survey area (246,662 km^2). Physical disturbance takes of harbor seals within Penobscot Bay are based on historical takes and observations within the bay by researchers as documented in (NEFSC 2018b, NEFSC 2019, NEFSC 2020) (see Section 6.4).

PBR for the western North Atlantic stock of harbor seals is 2,006. From 2013–2017, the total human caused mortality and serious injury to harbor seals is estimated to be 350 per year (338 from fisheries and 12 from non-fishery-related interaction stranding mortalities) (Hayes, Josephson et al. 2020).

- Distribution and Habitat: Harbor seals use a variety of terrestrial and aquatic habitats in U.S. waters. Their activities are influenced by regional topography, life history requirements, environmental parameters, anthropogenic activities, prey distribution, and, possibly, inter-specific competition with gray seals. Based on tagging studies, adult harbor seals can make long-distance migrations through the mid-Atlantic and Gulf of Maine (Waring, Gilbert et al. 2006 and Jones, Rees et al. 2018; each as cited in Hayes, Josephson et al. 2020). Previously, it was believed that the majority of seals moving into southern New England and mid-Atlantic waters were subadults and juveniles (Whitman and Payne 1990 and Katona, Rough et al. 1993; both as cited in Hayes, Josephson et al. 2020). The more recent studies demonstrate that various age classes utilize habitat along the eastern seaboard throughout the year.

Rocky areas (i.e., small islands, isolated rocks, tidal ledges) are the predominant haul-out substrate in coastal waters from the Maine–Canadian border south to Plymouth, Massachusetts. Rocky substrates are also used during pupping, breeding and molting seasons when harbor seals are concentrated in Maine coastal waters (Gilbert, Waring et al. 2005). Harbor seal diet off the Northeast U.S. coast reflects seasonal spatial distributions of prey delineated in NEFSC research trawl surveys (Payne and Selzer 1989). For example, sandlance (Ammodytes spp.) are abundant on Stellwagen Bank, which is adjacent to a major harbor seal haul-out location on the outer portion of Cape Cod, and, silver hake (Merluccius bilinearis) is widely distributed in the Gulf of Maine.

Acoustics and Hearing: Harbor seals are assigned to functional hearing groups based on the medium (air or water) through which they are detecting the sounds, for an estimated auditory bandwidth of 50 Hz to 86 kHz (NMFS 2018). Vocalizations range from 25 Hz to 4 kHz (DON 2008).

- Gray Seal (*Halichoerus grypus*): Western North Atlantic Stock
- Abundance, Density, and Stock Status: Gray seals are not listed as threatened or endangered under the ESA. The Atlantic gray seal population estimate is separate from the population in Canada and reflects the size of the breeding population in each respective country. The lack of information on the rate of exchange between animals in the U.S. and Canada, which influences seasonal changes in abundance throughout the range of this transboundary stock as well as life history, affects the ability to estimate population sizes. The total Canadian gray seal population in 2016 was estimated to be 424,300 (DFO 2017; as cited in Hayes, Josephson et al. 2020). Additional data on movements of animals between Canada and the U.S. is necessary to separate out intrinsic rates of increase from the overall annual growth rate (Hayes, Josephson et al. 2020). Based on Canadian population models, the number of pups born at U.S. breeding colonies can be used to approximate the total size (pups and adults) and is estimated as 27,131 (Hayes, Josephson et al. 2020). A density estimate for gray seals in NEFSC research areas is not available. However, since the population of gray seals is about 1/3 of the population of harbor seals, a gray seal density that is 1/3 of the harbor seal density, or 0.0930 animals per km^2 is used to calculate acoustic takes. Physical disturbance takes of gray seals within Penobscot Bay are based on

historical takes and observations within the bay by researchers as documented in (NEFSC 2018b, NEFSC 2019, NEFSC 2020) (see Section 6.4).

PBR for the western North Atlantic stock of gray seals in U.S. waters is 1,389 animals. The average annual estimated human-caused mortality and serious injury to gray seals in the U.S. and Canada was 5,410 per year for the period 2013–2017 (946 U.S./4,464 Canada). This average is based on: 940 from U.S. observed fisheries; 5.6 from non-fishery human interaction stranding and shooting mortalities in the U.S.; 0.8 from U.S. research mortalities; 672 Canadian commercial harvest; 55 from the DFO scientific collections; and 3,737 removals of nuisance animals in Canada (DFO 2017, Mike Hammill pers. comm; as cited in Hayes, Josephson et al. 2020).

Distribution and Habitat: Historically, gray seals were distributed along the northeastern U.S. coast but bounties and lack of protection reduced numbers dramatically in the 20th century. Recolonization and recovery of gray seals in the U.S. is related to re-establishment of pupping sites driven by population growth and immigration from Canadian colonies 1988–2019 (Wood, Murray et al. 2020). The highest growth rate (26%) occurred at Monomoy Island while slight decrease (−0.2%) on Green Island suggests that this site may have already been at carrying capacity in 1994 when pupping was first documented). Pupping sites were documented at Muskeget Island, Monomoy Island, Seal Island, and Green Island (Wood et al. 2020). Data analyzed between 1993 and 2000 demonstrate that cod comprised, on average, <5% of a gray seal's diet (Trzcinski, Mohn et al. 2006). Diet studies based primarily on scat samples indicate that grey seals feed on sand eels and gadoids, although there were regional and seasonal differences (McConnell, Fedak et al. 1999).

Acoustics and Hearing: Gray seals, as with all pinnipeds, are assigned to functional hearing groups based on the medium (air or water) through which they are detecting the sounds, for an estimated auditory bandwidth of 50 Hz to 86 kHz (NMFS 2018). Vocalizations range from 100 Hz to 3 kHz (DON 2008).

- Harp Seal (*Pagophilus groenlandica*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The world’s harp seal population is divided into three separate stocks, each identified with a specific breeding site (Bonner 1990 and Lavigne and Kovacs 1988; as cited in Hayes, Josephson et al. 2018). The largest stock is located off eastern Canada and is divided into two breeding herds which breed on the pack ice. The Front herd breeds off the coast of Newfoundland and Labrador, and the Gulf herd breeds near the Magdalen Islands in the middle of the Gulf of St. Lawrence (Sergeant 1965 and Lavigne and Kovacs 1988; as cited in Hayes, Josephson et al. 2018). The second stock breeds on the West Ice off eastern Greenland (Lavigne and Kovacs 1988; as cited in Hayes, Josephson et al. 2018). The third stock breeds on the ice in the White Sea off the coast of Russia. The Front/Gulf stock is equivalent to western north Atlantic stock. The status of the western north Atlantic harp seal stock in the U.S. Atlantic is unknown, but the stock’s abundance appears to have stabilized (McAlpine and Walker 1990, as cited in Hayes, Josephson et al. 2018). The species is not listed as threatened or endangered under the ESA (Hayes, Josephson et al. 2018).

The population size for western North Atlantic harp seals in 2012 was 7.1 million animals (95% CI 5.9–8.3 million; Hammill, Stenson et al. 2014; as cited in Hayes, Josephson et al. 2018), based on a population model that was applied to 1952–2012 population data (Waring, Josephson et al. 2014). Data are insufficient to calculate the minimum population estimate and density estimates for U.S. waters. Recent increases in strandings may not indicate population size (Hayes, Josephson et al. 2018).

Distribution and Habitat: Harp seals occur throughout much of the North Atlantic and Arctic Oceans (Ronald and Healey 1981 and Lavigne and Kovacs 1988; as cited in Hayes, Josephson et al. 2018) and are highly migratory (Sergeant 1965 and Stenson and Sjare 1997; as cited in Hayes, Josephson et al. 2018). Breeding occurs at different times for each stock between mid-February and April. Adults then assemble north of their whelping patches to undergo the annual molt. The migration then continues north to Arctic summer feeding grounds. In late September, after a summer of feeding, nearly all adults and some of the immature animals of the western north Atlantic stock migrate southward along the Labrador coast, usually reaching the entrance to the Gulf of St. Lawrence by early winter. There they split into two groups, one moving into the Gulf and the other remaining off the coast of Newfoundland. The southern limit of the harp seal's habitat extends into the U.S. Atlantic waters during winter and spring.

Since the 1990s, numbers of sightings and strandings have been increasing off the east coast of the U.S. from Maine to New Jersey (Katona, Rough et al. 1993, Stevick and Fernald 1998. McAlpine 1999 and Lacoste and Stenson 2000; all as cited in Hayes, Josephson et al. 2018). These extralimital appearances usually occur in January–May (Rubinstein 1994; Harris, Lelli et al. 2002; as cited in Hayes, Josephson et al. 2018), when the western North Atlantic stock of harp seals is at its most southern point of migration. Therefore, they are expected to be extremely rare in areas of NEFSC research and takes are not requested for this species. Concomitantly, a southward shift in winter distribution off Newfoundland was observed during the mid-1990s, which was attributed to abnormal environmental conditions (Lacoste and Stenson 2000; as cited in Hayes, Josephson et al. 2018). Most of the information on their distribution in Northeast U.S. waters is limited to fishery bycatch and stranding records (Waring, Josephson et al. 2009). In coastal regions, individual harp seals have been observed on coastal beaches, frozen ponds, up coastal rivers or on ice floes. Overall, little is known regarding the ecology of harp seals in U.S. waters.

Acoustics and Hearing: Harp seal, as with other pinnipeds, are assigned to functional hearing groups based on the medium (air or water) through which they are detecting the sounds, for an estimated auditory bandwidth of 50 Hz to 86 kHz (NMFS 2018b). The frequencies of underwater vocalizations range from 66 to 120 kHz (DON 2008).

- Hooded Seal (*Cystophora cristata*): Western North Atlantic Stock

Abundance, Density, and Stock Status: The western North Atlantic stock of hooded seals appears to be increasing in abundance, although stock status in U.S. Atlantic waters is unknown. The number of hooded seals in the western North Atlantic is relatively well known and is derived from pup production estimates produced from whelping pack surveys. The best abundance estimate for western North Atlantic hooded seals is 593,500. The minimum population estimate 543,549. The species is not listed as threatened or endangered under the ESA (Hayes, Josephson et al. 2019).

Distribution and Habitat: The hooded seal occurs throughout much of the North Atlantic and Arctic Oceans (King 1983; as cited in Hayes, Josephson et al. 2019) preferring deeper water and occurring farther offshore than harp seals (Sergeant 1976, Campbell 1987, Lavigne and Kovacs 1988, and Stenson, Meyers et al. 1996; all as cited in Hayes, Josephson et al. 2019). The western North Atlantic stock of hooded seals whelps off the coast of eastern Canada and is divided into three whelping areas. The Front herd (largest) breeds off the coast of Newfoundland and Labrador, Gulf herd breeds in the Gulf of St. Lawrence, and the third area is in the Davis Strait. Hooded seals are highly migratory and may wander as far south as Puerto Rico (Mignucci-Giannoni and Odell 2001; as cited in Hayes, Josephson et al. 2019), with increased occurrences from Maine to Florida. These appearances usually occur between January and May in New England waters, and in summer and autumn off the southeast U.S. coast and in the Caribbean (McAlpine et al. 1999, Harris et al. 2001, and Mignucci-Giannoni and Odell 2001; all as cited in Hayes, Josephson et al. 2019). Hooded seals are expected to be very rare in waters surveyed by NEFSC and takes for this species are not being requested. Three of four hooded seals stranded, satellite tagged, and released in the U.S. in 2004 migrated to the eastern edge of the Scotian Shelf and 2 of the 4 seals moved to the southeast tip of Greenland (Waring, Josephson et al. 2009; WHALENET at http://whale.wheelock.edu). Although it is not known which stock these seals come from, it is known that during spring, the northwest Atlantic stock of hooded seals are at their southernmost point of migration in the Gulf of St. Lawrence.

Acoustics and Hearing: Like other pinnipeds, hooded seals are assigned to functional hearing groups based on the medium (air or water) through which they are detecting the sounds, for an estimated auditory bandwidth of 50 Hz to 86 kHz (NMFS 2018b). Vocalizations range from <4 to 120 kHz (DON 2008).

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5. TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

The MMPA (16 USC 1372 Section 102 (a) prohibits takes of marine mammals by any person or vessel, within certain exceptions, in waters or on lands under U.S. jurisdiction. Certain exceptions under Section 101(a)(5) include the authorization of take incidental to activities other than commercial fishing (see Section 1.2). This section describes the types of incidental take requested by the NEFSC associated with fisheries and ecosystem research.

The NEFSC is petitioning NMFS for regulations pursuant to Section 101(a) (5) (A) of the MMPA, 16 USC Section 1371.101 (a) (5), and 50 CFR Section 216, Subpart I, effective approximately October 2020 through October 2025 to allow the potential incidental taking of small numbers of marine mammals incidental to the research activities. Since issuance of the LOAs on October 30, 2015, the NEFSC has implemented specific mitigation and monitoring measures to ensure the least practicable impact on marine mammal species and their habitats, many of which will continue to be implemented (see Sections 11 and 13). However, to be precautionary the NEFSC is requesting incidental takes based on a quantitative analysis described in more detail in Section 6. The types of incidental taking requested in this application include:

- Level A harassment (i.e., non-serious injury). Level A take associated with auditory injury or permanent threshold shift is not possible from acoustic gear used for research (see Section 6.2) and therefore is not part of this request;
- Level B harassment (i.e., behavioral disturbance or temporary [hearing] threshold shift); and
- Mortality or serious injury (M/SI). NMFS interprets the regulatory definition of serious injury (i.e., any injury that will likely result in mortality) as any injury that is “more likely than not” to result in mortality, or any injury that presents a greater than 50 percent chance of death to a marine mammal. A serious injury must contribute to the death or likely death of the animal to be classified as such.

Of the 59 surveys/projects, 42 involve gear and equipment with the potential to take marine mammals. Gear types include towed trawl nets fished at various levels in the water column, dredges, gillnets, traps, longline and other hook and line gear. Surveys using any type of seine net (e.g., gillnets), trawl net, or hook and line (e.g., longlines) have the potential for marine mammal interaction (e.g., entanglement, hooking) resulting in mortality or serious injury. In addition, the NEFSC conducts hydrographic, oceanographic, and meteorological sampling concurrent with many of these surveys which requires the use of active acoustic devices (e.g., side-scan sonar, echosounders). These active sonars result in elevated sound levels in the water column, resulting in the potential to behaviorally disturb marine mammals resulting in Level B harassment. Section 6.2 describes these sources of potential M/SI, and Section 6.6.1 estimates potential M/SI takes during NEFSC using these gears.

Level B harassment may occur during the use of certain underwater equipment that emits underwater noise such as narrow and multi beam echosounders (see Section 6.3). No hearing loss or physiological damage (permanent threshold shift, Southall, Finneran et al. 2019) is expected to occur to marine mammals by the acoustic gear or vessel movements during NEFSC surveys. As described in Section 6.4 Level B harassment may also occur due to the physical presence of researchers during studies in the Penobscot River estuary in Maine and at several locations along the Maine coast.

The MMPA and its implementing regulations have not provided a clear operational definition of "take by harassment" especially for minor, temporary behavioral disturbance. As a result, there has been much debate concerning how substantial and prolonged a change in behavior must be before it constitutes a "take by harassment". There is general recognition that minor and brief changes in behavior generally do not have biologically significant consequences for marine mammals and do not "rise to the level of taking" (NRC 2005). Criteria and procedures for assessing the impact of behavioral disturbance on marine mammals are still being refined (Southall, Bowles et al. 2007, Ellison, Southall et al. 2012, Southall, Finneran et al. 2019). To be precautionary, the NEFSC is requesting takes for potential behavioral disturbance as described in detail in Section 6.

6. TAKE ESTIMATES FOR MARINE MAMMALS

Authorization for incidental takes is requested for activities described in Section 2. In order to determine the potential for interaction during NEFSC research activities, a variety of factors are considered including estimated marine mammal densities in each research area, a summary of historical interactions between marine mammals and NEFSC research, historical marine mammal interactions between commercial fisheries that may use the same gear, and other biological factors such as feeding behavior or propensity to travel in groups. This section also includes a description of the area of potential disturbance due to noise sources used during research, and a discussion of the potential for behavioral responses or serious injury or mortality due to research activities. Marine mammals with no records of historical interaction with NEFSC research gear and no documented mortality or serious injury in relevant commercial fisheries are not considered in this section or in the NEFSC request for takes.

6.1. Marine Mammal Densities

As described in Section 3 marine mammal stock abundances were determined from the most recent SAR (Hayes, Josephson et al. 2019). Cetacean densities shown in Table 6-1 were obtained using the mapping tool for cetacean density for the U.S. Atlantic and Gulf of Mexico referred to as OBIS-SEAMAP (Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations) (Roberts, Best et al. 2016). The database provides monthly mean abundances across the East Coast (EC) for 12 species covered by this petition: Atlantic spotted dolphin; Atlantic white-sided dolphin; bottlenose dolphin; fin whale; harbor porpoise; humpback whale; minke whale; North Atlantic right whale; Risso’s dolphin; sei whale; short-beaked common dolphin (all stocks combined); and sperm whale. For these species, the densities shown in Table 6-1 were derived by averaging the monthly densities into a seasonal average density for spring (April-May), summer (June-August), and fall (September–November). As shown in Table 1-2, The majority of NEFSC surveys occur during the April to November time frame; only two studies with the potential for takes of marine mammals can occur into December (Monkfish RSA and Monkfish tagging studies using gillnets). Therefore, the highest of the spring, summer or fall average densities are shown in Table 6-1 and were used to calculate potential takes. Only two monkfish Research Set Aside projects may occur in the month of December. Given the density estimates used for take estimates are the highest of the seasons during which most surveys occur potential takes that may occur in December are accounted for by this approach.

North of Cape Hatteras, active acoustic gear used by other NEFSC surveys has the potential take the offshore and migratory coastal stocks of bottlenose dolphins. Only COASTSPAN surveys occur south of Cape Hatteras into South Carolina, Georgia and Florida waters, and these surveys do not use acoustics. As described in Section 4.27 a combined density estimate for coastal stocks is 0.1359 and an offshore stock density is 0.1615 (Roberts, Best et al. (2016). These densities are used to calculate potential acoustical takes of bottlenose dolphins in the LME and offshore regions and are likely conservative.

For the remaining 17 species, the database only provides an annual EC average density which were used for this application. Appendix A summarizes seasonal and annual densities, and estimated abundances for cetaceans. The density reported for harbor seals in the 2016 Final Rule (81 FR 53061) is the best available information to represent a density for harbor and gray seals combined considering this species is known to co-occur in the NEFSC research area.

To determine if the marine mammal aerial density derived from Roberts, Best et al. (2016) applies to the LME (defined as the area shoreward of the 200 m depth contour) or offshore region (the area offshore of the 200 m depth contour), the animal's life history and depth preferences were considered. Maps provided by Roberts, Best et al. (2016) were consulted to see where the typical highest densities were located (LME or offshore). For marine mammals that clearly use one of the regions, the density from OBIS-SEAMAP was entered for that region and the density for other region was entered as 0. For animals that use either region, the average density from OBIS-SEAMAP was used for the predominant region and the density for the non-predominant region was chosen by looking at the database maps and qualitatively choosing an appropriate density from the map pixels. For example, Risso's dolphins are primarily an offshore species, but low numbers move into the GOM and GB during the spring and summer months. So, for this animal, both LME and offshore densities are provided in Table 6-1.

To account for the effects of marine mammal diving behavior on potential exposure to underwater sound sources, volumetric densities for marine mammal species were determined (see Table 6-1). Exposures of marine mammals to sounds that might exceed the Level B harassment threshold of 160 dB rms consider volumetric densities and the area of water that may be ensonified by equipment used by NEFSC. As described in the 2015 proposed rule (80 FR 39542), marine mammals were categorized into two generalized depth strata: surface-associated (0-200 m) or deep-diving (0 to >200 m). These depth strata are based on reasonable assumptions of behavior (Reynolds III and Rommell 1999). Animals in the shallow diving strata were assumed to spend a majority of their lives (>75%) at depths of 200 m or shallower. For shallow diving species, the volumetric density is the area density divided by 0.2 km (i.e., 200 m). The animal's volumetric density and exposure to sound is limited by this depth boundary. Species in the deeper diving strata were assumed to regularly dive deeper than 200 m and spend significant time at depth. For deeper diving species, the volumetric density is calculated as the area density divided by a nominal value of 0.5 km (i.e., 500 m), consistent with the approach used in the 2016 Final Rule (81 FR 53061). Where applicable, both LME and offshore volumetric densities are provided. As described in Section 6.5, level of effort and acoustic gear types used by NEFSC differ in these areas and takes are calculated for each area (LME and offshore).

TABLE 6-1. MARINE MAMMAL DENSITIES WITHIN THE NEFSC RESEARCH AREAS

Common Name	Dive Profile/Vertical Habitat		LME Area Density (per km²)[1,2]	LME Volumetric Density (per km³)[3]	Offshore Density (per km²)[2,4]	Offshore Volumetric Density (per km³)[5]
	0–200 m	>200 m				
Cetaceans						
North Atlantic right whale[6]	X		0.0030	0.0150	0	0
Humpback whale	X		0.0016	0.00800	0	0
Fin whale	X		0.0048	0.02400	0.00005	0.00025
Sei whale	X		0.0008	0.00400	0	0
Minke whale	X		0.002	0.01000	0	0
Blue whale	X		0.000009	0.00005	0.000009	0.00005
Sperm whale		X	0	0	0.0056	0.01120
Dwarf sperm whale		X	0	0	0.005	0.01000
Pygmy sperm whale		X	0	0	0.005	0.01000
Killer Whale	X		0.000009	0.00005	0.000009	0.00005
Pygmy killer whale	X		0.000009	0.00005	0.000009	0.00005
Northern bottlenose whale		X	0	0	0.00009	0.00018
Cuvier’s beaked whale		X	0	0	0.0062	0.01240
Mesoplodon beaked whales		X	0	0	0.0046	0.00920
Melon-headed whale	X		0	0	0.0010	0.00500
Risso’s dolphin	X		0.0020	0.01000	0.0128	0.06400
Long-finned pilot whale		X	0.0220	0.11000	0.0220	0.04400
Short-finned pilot whale		X	0.0220	0.11000	0.0220	0.04400
Atlantic white-sided dolphin	X		0.0453	0.22650	0	0
White-beaked dolphin	X		0.00003	0.00015	0	0
Short-beaked common dolphin	X		0.0891	0.44550	0	0
Atlantic spotted dolphin	X		0.0013	0.00650	0.0241	0.12050
Pantropical spotted dolphin	X		0	0	0.0015	0.00750
Striped dolphin	X		0	0	0.0614	0.30700

Common Name	Dive Profile/Vertical Habitat		LME Area Density (per km^2)[1,2]	LME Volumetric Density (per km^3)[3]	Offshore Density (per km^2)[2,4]	Offshore Volumetric Density (per km^3)[5]
	0–200 m	>200 m				
Fraser's dolphin	X		0	0	0.0004	0.00200
Rough toothed dolphin	X		0.0005	0.00250	0.0010	0.00500
Clymene dolphin	X		0.0032	0.01600	0	0
Spinner dolphin	X		0	0	0.0002	0.00100
Common bottlenose dolphin offshore stock	X		0	0	0.1615	0.3230
Common bottlenose dolphin coastal stocks	X		0.1359	0.6795	0	0
Harbor porpoise	X		0.0403	0.20150	0	0
Pinnipeds						
Harbor Seal	X		0.2844	1.4220	0	0
Gray Seal	X		0.0939	0.4695	0	0

[1]LME is the area in shore of the 200 m depth contour
[2]Source: Unless otherwise stated Roberts, Best et al. (2016)
[3]LME volumetric density is the LME area density divided by 0.2 km
[4]Offshore is the area offshore of the 200 m depth contour.
[5]Offshore volumetric density is the offshore area density divided by 0.2 km or 0.5 km for shallow or deep diving species or 0.5 km for deep diving species.
[6]Density from Roberts, Schick et al. (2020).

6.2. Sources of Potential Mortality and Serious Injury Due to Research

During 2016–2017 and 2018 research surveys, the NEFSC reported no Level A interactions with marine mammals (NEFSC 2018b, NEFSC 2019). On September 24, 2019, a lethal take of a short-beaked common dolphin (Delphinus delphis) occurred during a Cooperative Research NTAP cruise sponsored by the NEFSC (NEFSC 2020). The gear was a 4 seam 3 bridle Bigelow net with a spread restrictor cable. This is the only marine mammal M/SI take during the 2016–2017, 2018 and 2019 survey seasons.

The 2016 Final Rule (81 FR 53061) described historical NEFSC interactions from 2004–2015. Over that time period, eight marine mammals were killed in interactions with trawl gear (short-beaked common dolphin, gray seal), six were killed due to capture in gillnets (Common bottlenose, Northern South Carolina estuarine stock, gray seal, harbor porpoise and bottlenose dolphin), and one suffered mortality in a fyke net (harbor seal). Also, over that time period, two minke whales were caught in trawl gear and released alive.

In addition to those species with a history of interactions with NEFSC research gear over the 12-year period (2004–2015), it is appropriate to include estimates for future incidental takes of a number of species that have not been taken historically but inhabit the same areas and show similar types of behaviors and vulnerabilities to such gear as the species previously taken. The potential for take of these other “analogous” species would be low and would occur rarely, if at all, based on lack of takes over the past 17 years. However, to be precautionary MS/I takes are requested for nine cetacean species and three pinniped species due to potential interaction with trawl, gillnet, longline and fyke net gears (see Section 6.6.1).

All other gears used in NEFSC fisheries research (e.g., a variety of plankton nets, CPR, CTDs, ROVs, and video cameras) are not expected to negatively interact with marine mammals. Specifically, CTDs, plankton nets (Bongo, Pairovet, and Manta nets), CPR gear, and vertically deployed or towed imaging systems are considered to be no-impact gear types.

6.3. Sources of Acoustic Disturbance Due to Research

The potential sources of disturbance to marine mammals during NEFSC research activities are associated with the physical presence of human activities (i.e., vessels) and noise (i.e., underwater equipment such as echosounders). The proposed action does not include intentional approaches to marine mammals on sea or land. Any disturbance due to physical presence of humans or vessels would be incidental to research activities.

Disturbance of an animal due to the physical presence of vessels or noise from underwater equipment does not automatically imply that harassment has occurred. The MMPA and its implementing regulations do not have a clear operational definition of “take by harassment”. There is recognition that minor and brief changes in behavior generally do not have biologically significant consequences for marine mammals and do not “rise to the level of taking” (NRC 2005). Also, Southall, Bowles et al. (2007) emphasized the need to distinguish minor, short-term changes in behavior with no lasting biological consequences from biologically significant effects on critical life functions such as growth, survival, and reproduction. The biological relevance of a behavioral response to noise exposure depends, at least in part, on how long the response persists. Southall, Bowles et al. (2007) noted that “a reaction lasting less than 24 hours is not regarded as particularly severe unless it could directly affect survival or reproduction."

The 2015 proposed rule (80 FR 39542) describes two categories of active sound sources that may be used during NEFSC research. Different operating characteristics of sound sources result in differing potential for acoustic impacts on marine mammals. Category 1 active acoustic sound sources with high frequencies (higher than 180kHz) are outside the known functional hearing range of marine mammals. For this reason, Category 1 sources are not likely to cause behavioral disturbance and are not considered further in this application.

The NEFSC also uses a variety of single, dual and multi beam echosounder to determine the trawl net orientation, and current profilers (e.g., Acoustic Doppler Current Profiler [ADCP] that are considered Category 2 sources. Output frequencies under Category 2 are generally within marine mammal hearing ranges (i.e., 10 to 180 kHz). While many of the Category 2 sound sources may be audible to marine mammals, many tend to be highly directional and/or have short ping durations which may reduce the likelihood that marine mammals receive the signal. Some of these sources may also be operated in different output modes (i.e., distributed across multiple beams versus a single beam), which may further reduce perception by animals in the water (80 FR 39542). NEFSC vessels may be equipped with multiple devices that emit sound underwater and some equipment may use a range of frequencies.

Table 6-2 provides operating characteristics of NEFSC active acoustic sources which are described in more detail in the following subsections. From the eight Category 2 sources identified in Table 6-2, the NEFSC identified six of the eight as having the largest potential impact zones during operations based on their relatively lower output frequency, higher output power, and operational pattern of use: EK60, ME70, DSM 300, ADCP Ocean Surveyor, Simrad EQ50, and Netmind (80 FR 39542). Further examination of these six sources considers operational patterns of use relative to each other, and which sources would have the largest potential impact zone when used simultaneously. NEFSC determined that the EK60, ME 70, and DSM 300 sources comprise the total effective exposures relative to line-kilometers surveyed (see Section 6.5). As described in Section 6.6.2, acoustic disturbance takes are calculated for these three dominant sources. Of these dominant acoustic sources, only the EK 60 can use a frequency within the hearing range of baleen whales (18k Hz). Therefore, for NAWR and all other baleen whales, Level B harassment is only expected for exposure to the EK60. The other two dominant sources are outside of their hearing range.

TABLE 6-2. OPERATING CHARACTERISTICS OF NEFSC ACTIVE ACOUSTIC SOUND SOURCES

Active Acoustic System	Operating Frequencies	Maximum Source Level (dB)	Single Ping Duration (ms) and Repetition Rate (Hz)	Orientation/ Directionality	Nominal Beam Width
Simrad EK500 and EK60 Narrow Beam Scientific Echosounders[1]	18, *38*, *70*, *120*, *200*, 333 kHz[2]	224	Variable; most common settings are 1 ms and 0.5 Hz	Downward looking	11°@18k Hz 7°@38 kHz
Simrad ME70 Multibeam Echosounder[1]	70–120 kHz	205	0.06–5 ms; 1–4 Hz	Primarily Downward looking	140°
Raymarine SS260 transducer for DSM 300[1]	50, 200 kHz	217	Unknown	Downward looking	19°@50 kHz 6°@200 kHz
Simrad SX90 narrow beam sonar.	20–30 kHz	219	Variable	Omnidirectional	4–5° (variable for tilt angles from 0–45° from horizontal)
Teledyne RD Instruments ADCP Ocean Surveyor	75 kHz	224	0.2 Hz	Downward looking	30°
Simrad ITI Catch Monitoring System	27–33 kHz	214	0.05–0.5 Hz	Downward looking	40°
Simrad EQ50	50, 200 kHz	210	Variable	Downward looking	16°@50 kHz 7°@200 kHz
NetMind	30, 200 kHz	190	Unknown	Downward looking	50°

[1]Predomiant omianat noise source used in take calculations (81 FR 53061)
[2]Primary frequencies italicized.

6.3.1. *Multi-frequency Narrow Beam Echosounder*

The NEFSC deploys multi-frequency sensors to acoustically map resources including fish abundance and biomass, plankton, schooling behavior and migration patterns, and avoidance reactions to survey vessels among other purposes. Simultaneous use of echosounder frequencies can be used to map larger fish and even be used for species identification. The NEFSC operates Simrad EK500 and EK60 systems, which transmit and receive at six frequencies ranging from 18–333 kHz. These were determined to be one of three dominant noise sources for which takes are calculated.

As described in the 2015 proposed rule (80 FR 39542), underwater sounds from an echosounder are brief (<1 second), intermittent, broadband, and consist of a high peak pressure with rapid rise time and rapid decay (ANSI 1986; NNIOSH 1998; as cited in 80 FR 39542). As described by Au et al. 1988; Dolphin et al. 1995; Supin and Popov 1995; and Mooney, Nachtigall et al. 2009 (all as cited in 80 FR 39542), marine mammals have fine auditory temporal resolution and can detect signals separately. For this reason, marine mammals are not likely to perceive underwater sound from the echosounder as continuous. Therefore, given that this sound would be perceived as intermittent, not continuous, the threshold of 160 dB is more appropriate to use than the 120 dB threshold for estimating takes associated with acoustic harassment incidental to such sources (80 FR39542).

Lurton and DeRuiter (2011) modeled the potential impacts (PTS and behavioral reaction) of conventional echosounders on marine mammals. They estimated PTS onset at typical distances of 10 to 100 meters for the kinds of acoustic sources used in fisheries surveys considered here. They also emphasized that these effects would very likely only occur in the cone ensonified below the ship and that behavioral responses to the vessel at these extremely close ranges would very likely influence the probability of animals being exposed to these levels.

Animals are likely to avoid a moving vessel, either because of its physical presence or because of behavioral harassment resulting from exposure to sound from active acoustic sources. It is unlikely that animals would remain in the presence of a harassing stimulus absent some overriding contextual factor. Because of this likely avoidance behavior, as well as the source characteristics (i.e., intermittent pulsing and narrow cones of ensonification), the risk of animals experiencing repetitive exposures at the close range or of the duration necessary to cause PTS is negligible. Therefore, the NEFSC does not anticipate causing any Level A harassment by acoustic sources of marine mammals and this LOA application includes no quantitative estimates for Level A harassment from these sources.

6.3.2. Multibeam Echosounder and Sonar

Multi-beam echosounders operate in a similar fashion to equipment described above but multiple acoustic beams allow coverage of a greater area compared to single beam sonar. These systems are typically used for mapping the seafloor or conducting bathymetry surveys but also may be used to map fish schools and biomass. The Simrad ME70 is used by NEFSC and emits frequencies ranging from 70 to 120 kHz.

6.3.3. Single-Frequency Omnidirectional Sonar

Single-frequency omni-directional sonar is used to prevent interference by vessels and operate between frequencies of 20 to 30 kHz. Systems such as the SX90 used by NEFSC can provide omnidirectional imaging around the source with three different vertical beam widths available (single or dual vertical view and 4–5° variable for tilt angles from 0 to 45° from horizontal).

6.3.4. Acoustic Doppler Current Profiler (ADCP)

ADCPs are used to measure water current velocities simultaneously at a range of depths and operate by transmitting a series of “pings” which bounce off particles in the water column towards the device. Depending on their distance from the device, particles will emit different frequencies which then results in a profile of the current speed at different depths. ADCPs operate between frequencies ranging from 75 to 300 kHz.

6.3.5. Net Monitoring Systems

The NEFSC uses a range of net sensors to monitor the position of gear as well as the position and concentrations of fish relative to gear. To monitor the trawl net opening, NEFSC uses NetMind System which measures door spread and monitors the door height off of the bottom and operates at 30 and 200 kHz. The Simrad ITI Catch Monitoring System is also used to monitor the exact position of trawl gear. These systems were determined to not be predominant noise sources and were not considered in take calculations.

6.4. Sources of Physical Disturbance to Pinnipeds due to Research

As described in the 2016 PEA, there are research activities during which the physical presence of researchers may result in Level B incidental harassment of pinnipeds on haulouts. These surveys monitor fish communities in the Penobscot River Estuary and require researchers in small skiffs to pass ledges where seals are typically hauled out. Gear used in these surveys include a Mamou shrimp trawl (12 days per year) and fyke nets (up to 100 days per year). Haulouts where surveys occur include mostly harbor seals, but smaller numbers of gray seals may be present (NMFS 2016). Researchers avoid close passes of the haulouts and do not set research gear near these areas. Behavioral disturbance may include head lifts, shifts in body position towards the water, or seals entering the water. The periodic, short-term incidental harassment would have temporary effects on seals and would not be expected to alter their continued use of the tidal ledges.

Annual reports for incidental take compiled by NEFSC summarize observations of seals hauled out on three ledges potentially impacted by surveys in Penobscot Bay and in adjacent waters (NEFSC 2018b, NEFSC 2018a, NEFSC 2019). The observations were made during Penobscot Bay hydroacoustic transects using 10x50 magnification binoculars at a distance of from 300–500 m of the ledges. Table 6-3 summarizes the results of the haulout surveys for 2017–2019.

TABLE 6-3. SEALS OBSERVED IN PENOBSCOT BAY DURING HYDROACOUSTIC SURVEYS

	2017		2018		2019	
Species	**Count on Haulout**	**Count in Water**	**Count on Haulout**	**Count in Water**	**Count on Haulout**	**Count in Water**
Harbor seals	242	65	401	52	330	50
Gray seals	2	17	11	2	33	29

Source: (NEFSC 2018b, NEFSC 2018a, NEFSC 2019)

In addition to observations made during the hydroacoustic study described above, the Penobscot Bay Trawl Survey, the only trawl survey conducted in the bay over the period 2017–2019, made visual observations of marine mammals reacting to the presence of the trawling vessel (NEFSC 2018b). Marine mammal observations during the 2017 Trawl Survey reported: 17 harbor seals and 3 gray seals during the deployment, fishing, and retrieval of gear. All observation were of animals swimming. The survey was not conducted in 2018 or 2019. Should the Penobscot Bay surveys be reinstated during the 2021–2026 period, takes are estimated based on expected level of effort and observations of hauled out seals from 2017 to 2019 (see Section 6.6.3).

6.5. Line Kilometers to be Surveyed and Effective Exposure Areas

Table 6-4 summarizes the potential maximum line kilometers expected to be surveyed each year over the period 2021–2026, and the three dominant noise source types (EK60, ME70, and DSM300) used by

NEFSC in the LME and offshore regions. The line kilometers shown in Table 6-4 are likely an overestimate. There are several factors that influence the level of research effort from year-to-year including but not limited to funding, changes in priorities, or staff availability. To be precautionary this application uses a maximum expected level of effort for assessing potential impacts on marine mammals. Therefore, for the future research period 2021–2026, the take calculations use these same conservative numbers to estimate the potential interactions with marine mammals during research. The majority of surveys shown in Table 1-2 are conducted in the LME: only the Deep Sea Coral Survey and Deepwater Biodiversity Survey are conducted in the offshore region. This level of effort is reflected in the line kilometers shown for each region. The line kilometers for each region are used to estimate acoustic exposures.

TABLE 6-4. MAXIMUM LINE KILOMETERS (KM) TO BE SURVEYED AND DOMINANT ACOUSTIC SOURCES

Source	<200m depth line kms/source	Full depth (>200m) Summed line kms/source
LME Region		
Compilation of Sources & Line kms for all studies conducted in the LME		
EK60	16,058.8	52,756
ME70	36,697.2	
DSM300	14,000	14,000
Offshore Region		
Compilation of Sources & Line kms for all studies conducted in the offshore region		
EK60	19,86.4	7,136
ME70	5,149.6	0

Based on the operating parameters for each of the dominant source types shown in Table 6-4, the volume of water ensonified at or above the 160 dB rms threshold was estimated. In all cases where multiple sources are operated simultaneously, the one with the largest estimated acoustic footprint was considered to be the effective source shown in Table 6-4. This was calculated for each depth stratum (0–200 m and > 200m), where appropriate (i.e. in the LME region, where depth is generally less than 200 m, only the exposure area for the 0–200 m depth strata was calculated). In some cases, different sources were determined to be predominant in each depth stratum for all line km when multiple sources were in operation; this was accounted for in estimating overall exposures for species that utilize both depth strata (deep divers). Table 6-5 shows the effective exposure areas for the three predominant sources (EK50, ME70, DSM300) across two depth strata. The areas of exposure were estimated using a commercial software package (MATLAB) and key source-specific parameters such as frequency, beamwidth, source level, tilt angle, and horizontal and vertical resolution, and environmental characteristics such as depth for attenuation coefficient, temperature, salinity, pH, and latitude. Additional details on how predominant sources and volume of water ensonified were calculated can be found in the 2015 proposed rule (80 FR 39542).

TABLE 6-5. EFFECTIVE EXPOSURE AREAS FOR DOMINANT ACOUSTIC SOURCES OVER TWO DEPTH STRATA

Active Acoustic System	Effective exposure area: sea surface to 200 m depth (km^2)	Effective exposure area: sea surface to depth at which 160-dB threshold is reached (km^2)
EK60	0.0142	0.1411
ME70	0.0201	0.0201
DSM300	0.0004	0.0004

6.6. Take Requests

Take of marine mammals incidental to the NEFSC's research activities could occur as a result of: (1) injury or mortality due to gear interactions; (2) behavioral disturbance resulting from the use of active acoustic sources (Level B harassment only); or (3) behavioral disturbance of pinnipeds hauled out on the shoreline resulting from close proximity of research vessels (Level B harassment only).

6.6.1. Potential Mortality or Serious Injury

To estimate the number of potential takes that could occur by M/SI and Level A through gear interaction, consideration of past interactions between gear (i.e., trawl, gillnet, and fyke gear) used by NEFSC and specific marine mammal species provides important context. Additionally, other species that may be vulnerable to NEFSC gear types are evaluated for potential take in future research 2021–2026. Section 6.2 describes the historical interactions of NEFSC research gear and marine mammals over the period 2004–2019. Species killed during the period 2004–2015 due to NEFSC research included short-beaked common dolphin, gray seal, common bottlenose dolphin, harbor porpoise and harbor seal. Two minke whales were incidentally caught and released alive. In 2008, the COASTSPAN gillnet survey caught and killed one common bottlenose dolphin while a cooperating institution was conducting the survey in South Carolina. This was the only occurrence of incidental take during a COASTPAN survey. Although no genetic information is available from this dolphin, based on the location of the event, NMFS retrospectively assigned this mortality to the Northern South Carolina Estuarine System stock in 2015 from the previous classification as the western North Atlantic stock (Waring, Josephson et al. 2014).

The 2016 final rule (81 FR 53061) determined M/SI takes by considering the 11-year annual average (2004–2015) of captures of six species and the projected five-year totals for trawl, gillnet, and fyke net gear. In order to produce precautionary estimates, the annual average for the 11-year period (2004–2015) was calculated and rounded up to the nearest whole number. Effort over the period 2021 to 2026 is expected to be no more than, and in all likelihood will be less than, effort from 2004–2015. Only one interaction occurred over the 2017–2019 period. A lethal take of a common dolphin during a Cooperative Research NTAP cruise sponsored by the Center in late September 2019. The gear was a 4 seam 3 bridle Bigelow net with a spread restrictor cable. This is the only marine mammal take on record during 2017, 2018 and 2019. Therefore, it is very precautionary to use the annual averages from the 2016 final rule to estimate M/SI takes over the period 2021–2026. Table 6-6 summarizes the M/SI takes requested due to gear interactions during NEFSC research in the LME region. M/SI takes are not requested for the offshore region because the gear used in the offshore Deepwater Biodiversity Survey (towed cameras, eDNA system) and Deep-sea Coral Survey (ROVs, towed cameras, CTD samplers) would not be expected to injure or kill marine mammals. The Deepwater Biodiversity Survey previously used a 4-seam, 3-bridle net bottom trawl. For future research, an acoustic, optic, oceanographic, and biological sampling system integrates wideband echosounders, stereo and holographic cameras, environmental and light sensors, and eDNA instruments towed at the depths of the meso and bathypelagic communities to get an in-depth view of organisms. The surveys involve towing a platform approx. 20 feet behind the vessel. The platform carries a variety of instruments and sensors to collect data and send real-time information back to the surface for researchers to view and monitor (https://www2.whoi.edu/staff/pwiebe/projects/deep-see/).

With regard to bottlenose dolphins, M/SI takes of offshore and Northern and Southern migratory stocks only are requested. COASTSPAN is the only research conducted by NEFSC that may occur south of Cape Hatteras where coastal and estuarine bottlenose dolphin stocks are found. As described in Section 4.27, M/SI takes of Northern Florida and South Carolina/Georgia coastal bottlenose dolphin stocks are not being requested because COASTSPAN surveys are not likely to reach areas where these stocks are found. Takes for North Carolina, South Carolina, Georgia and Florida estuarine stocks also are not being requested. As described in Section 4.27, NEFSC cooperative research efforts in coastal and estuarine waters south of Cape Hatteras are limited and M/SI takes of common bottles nose dolphins in these cooperative COASTSPAN surveys are exceedingly rare (most recently occurring when one estuarine bottlenose dolphin was taken in 2008). In addition, mitigation measures to specifically reduce interactions with dolphins during COASTSPAN surveys are described in Section 11.

In addition to considering species for which NEFSC has a history of interactions, some species may occur within the research area that are considered “analogous” to those that have been taken by NEFSC simply due to the fact that they may inhabit similar areas or because they have been taken during commercial fisheries that use similar gear. For example, harbor seals are likely to have the same vulnerability to be taken in gillnets as gray seals (one per year). Therefore, NEFSC requests one harbor seal take and one gray seal take each from trawl, gillnet and fyke net (used only in Penobscot Bay) gear per year (total of 15 for each species over the authorization period).

The potential for take of Atlantic white-sided dolphins in gillnets is expected to be similar to harbor porpoise (one per year) but is reduced to only one Atlantic white sided dolphin over the entire five-year authorization period. NEFSC surveys such as NEFOP observer training, monkfish RSA, and tagging projects for spiny dogfish and monkfish use gill nets and may overlap with Atlantic white-side dolphins in shelf waters of the GB and lower Bay of Fundy. However, there are no records of interactions with Atlantic white-sided dolphins from NEFSC gillnet surveys and NEFSC sets are greatly limited in effort when compared to commercial fisheries. As shown in Table 6-6, one M/SI take of a white-sided dolphin due to an interaction with an NEFSC gillnet is added to be precautionary.

Finally, there are some species that may have a history of being taken in commercial fisheries but for which there is extremely low likelihood of take during NEFSC due to the gear used and the limited extent, spatially and temporally, of NEFSC research with areas in habituated by such species. For example, while there are no recorded interactions with longline gear used by NEFSC, commercial longline gear has taken whales. Several species shown to interact with commercial longline fisheries but for which the NEFSC is not requesting take include long-finned and short-finned pilot whales. While it is possible these species could become entangled in longline gear, NEFSC uses a shorter mainline length and lower number of hooks relative to that of commercial fisheries. Overall, NEFSC research effort is minimal compared to commercial longline fisheries, and M/SI takes of pilot whales are not anticipated.

In summary, based on the information described here species for which there is a potential for M/SI take are listed in Table 6-6. As there is no specific information to indicate whether any given future interaction might result in M/SI versus Level A harassment, it is conservatively assumed that all future interactions would result in mortality.

TABLE 6-6. MORTALITY AND SERIOUS INJURY (M/SI) TAKE ESTIMATES FOR THE LME, 2021–2026

Common Name	Trawl 5-Year Estimated Total	Gillnet 5-Year Estimated Total	Longline 5-Year Estimated Total	Fyke Net 5-Year Estimated Total	5-Year Total M/SI Take Requested All gears
Cetaceans					
Minke whale	5	0	0	0	**5**
Risso's dolphin	2	0	1	0	**3**
Atlantic white-sided dolphin	2	1	0	0	**3**
White beaked common dolphin	2	0	0	0	**2**
Short-beaked common dolphin	5	1	1	0	**7**
Atlantic spotted dolphin	2	0	0	0	**2**
Common bottlenose dolphin North and South Migratory stocks and Offshore stock[1]	6	15	3	0	**24**
Harbor porpoise	2	5	0	0	**7**
Pinnipeds[2]					
Harbor Seals	5	5	0	5	**15**
Gray Seals	5	5	0	5	**15**

[1]Estimate 8 takes total from each stock over the 5-year period. M/SI takes are not requested for the N FL and SC/GA coastal stocks and numerous estuary stocks, see Section 6.6.1 for discussion..
[2]Assumes 1 harbor seal and/or one gray seal could be taken per year.
Source: 81 FR 53061

6.6.2. Potential Disturbance from Underwater Noise

Potential disturbance to marine mammals during NEFSC research may result from underwater noise that exceeds the Level B threshold of 160 dB rms. Based on the operating parameters for each sound source shown in Table 6-2, an estimated volume of water ensonified at or above the 160 dB rms threshold was determined (Table 6-5). In all cases where multiple sources are operated simultaneously, the one with the largest estimated acoustic footprint was considered to be the "dominant" noise source. For each depth stratum (0–200 m and >200 m), an estimate of the volume of water ensonified was calculated using a simple model of sound propagation loss, which accounts for the loss of sound energy over increasing range. Following the approach described in detail in the in the 2015 Proposed Rule (80 FR 39542), a spherical spreading model, where propagation loss = 20 * log [range] results in a 6-dB reduction in sound level for each doubling of distance from the source (i.e., 60 dB of attenuation over 1,000 m). This accounts for the frequency-dependent absorption coefficient (a at 15°C and 33 parts per thousand [ppt]) and beam pattern of sound sources used in NEFSC research which are generally highly directional. For systems that operate over a range of frequencies, the lowest frequency was used. Because the equipment used and the type of research has not changed, this approach using updated marine mammal density numbers where available, remains valid for this petition.

After determining the effective sound exposure area for transmissions considered in two dimensions, the next step was to determine the effective three dimensional volume of water ensonified at or above 160 dB rms for the sum of each survey in each region. For each of the three predominant sound sources, the volume of ensonified water is estimated as the athwartship (defined as the position across a vessel from side to side at right angles to the keel) cross-sectional area (in km^2) of sound at or above 160 dB rms multiplied by the expected annual distance traveled (in line km) by the ship (see Table 6-5).

If different sources operate simultaneously, the predominant noise source at each depth strata was used (see Table 6-5). This provided an estimate of exposure that is depth-specific based on two factors: whether the species is shallow-diving or deep-diving, and also which noise source predominates at a specific depth. For deep-diving species that may encounter sound from different sources when diving from the surface to depths greater than 200 m, this is accounted for by using the specific ensonified area based on which equipment predominates at each depth strata (i.e., 0–200 m and >200 m; see Tables 6-4 and 6-5). Again, this approach remains valid because the equipment and type of research has not changed.

Level B harassment due to acoustic sources is estimated by multiplying the volume of water ensonified at 160 dB rms, or higher, for the predominate sound source over the total line kilometers for which the sources is used by the volumetric density of animals in the given region (LME or offshore). The humpback whale and exposure to sound from the EK 60 can be used to demonstrate the calculation:

1) EK60 ensonified volume; 0–200 m: 0.0142 km^2 (from Table 6-4) * 16058.8 km (from Table 6-3) = 228.03 km^3

2) Estimated exposures to sound ≥ 160 dB rms; humpback whale; EK60, LME region: (0.008 humpback whales /km^3 * 228.03 km^3 = 1.8 estimated humpback exposures to SPLs ≥ 160 dB rms resulting from use of the EK60 in the 0–200 m depth stratum.

Similar calculations were conducted for the ME 70 and DSM300 for each animal in the LME region, with the exception of baleen whales, as these sound sources are outside of their hearing range. As shown in Table 6-7, the estimated exposures for each source for each animal were added and the total number of exposures were rounded up to the nearest integer. The annual estimated takes were then multiplied by 5 to represent the 5-year period of the LOA (far right column of Table 6-7). For baleen whales, only acoustic takes for the EK 60 are counted, because the other sources are outside of the hearing range for baleen whales.

In the offshore region, the EK 60 and ME70 are dominant in the 0–200 m stratum and only the EK 60 is dominant in the full stratum (see Table 6-4). Therefore, estimated exposures were calculated for the EK60 and ME70 for up to the 200 m depth stratum offshore and for the EK 60 only for the offshore full depth stratum. Using the offshore volumetric densities shown in Table 6-1, the volumes ensonified in Table 6-5, and the line kilometers to be surveyed in Table 6-4, exposures within this region were calculated and are shown in Table 6-8.

TABLE 6-7. MARINE MAMMAL LEVEL B ACOUSTIC TAKES REQUESTED IN THE LME REGION

Common Name	Volu-metric density (#/km^3)	Vertical Habitat (shallow vs. deep divers)		Estimated Acoustic Takes in 0–200 m depth stratum				Total Takes per species per year in LME	Total takes requested over the 5-year period
		0–200 m	>200 m	EK60	ME70	DSM300	Total		
Cetaceans									
North Atlantic right whale	0.015	X		3.4	0	0	3.4	4	**20**
Humpback whale	0.008	X		1.8	0	0	1.8	2	**10**
Fin whale	0.024	X		5.5	0	0	5.5	6	**30**
Sei whale	0.004	X		0.9	0	0	0.9	1	**5**
Minke whale	0.010	X		2.3	0	0	2.3	3	**15**
Blue whale	0.00005	X		0.01	0	0	0.01	1	**5**
Killer Whale	0.00005	X		0.01	0.033	0.009	0.053	1	**5**
Pygmy killer whale	0.00005	X		0.01	0.033	0.009	0.053	1	**5**
Risso's dolphin	0.010	X		2.3	7.4	2.0	11.7	12	**60**
Long-finned pilot whale	0.110	X	X	25.1	81.1	22.2	128.4	129	**645**
Short-finned pilot whale	0.110	X	X	25.1	81.1	22.2	128.4	129	**645**
Atlantic white-sided dolphin	0.227	X		51.6	167.1	45.7	264.4	265	**1,325**
White-beaked dolphin	0.00015	X		0.034	0.111	0.030	0.175	1	**5**
Short-beaked common dolphin	0.446	X		101.6	328.6	89.8	520	520	**2,600**
Atlantic spotted dolphin	0.007	X		1.5	4.8	1.3	7.6	8	**40**
Rough toothed dolphin	0.003	X		0.6	1.8	0.5	2.9	**3**	**15**
Clymene dolphin	0.016	X		3.6	11.8	3.2	18.7	**19**	**95**
Common bottlenose dolphin[1]	0.679	X		154.9	501.2	137	793.1	**794**	**3,970**
Harbor Porpoise	0.2015	X		45.9	148.6	40.6	235.2	**236**	**1,180**
Pinnipeds									
Harbor Seal	1.422	X		324.3	1048.9	286.7	1659.8	**1660**	**8,300**
Gray Seal	0.469	X		107.1	346.3	94.7	548.02	**549**	**2,745**

[1]Northern and Southern coastal migratory stocks combined

TABLE 6-8. MARINE MAMMAL LEVEL B ACOUSTIC TAKES REQUESTED IN THE OFFSHORE REGION

Common Name	Volu-metric density (#/km³)	Vertical Habitat (shallow vs. deep divers)		Estimated Acoustic Takes in 0–200m depth stratum[1]			Estimated Acoustic Takes >200m depth stratum[2]	Total Takes per species Offshore	Total Takes Requested over the 5-year period
		0–200 m	>200 m	EK60	ME70	Total	EK60		
Fin whale	0.00025	X		0	0.026	0.026	0	1	**5**
Blue whale	0.00005	X		0	0.005	0.005	0	1	**5**
Sperm whale	0.0112		X	0.3	1.2	1.5	2.8	5	**25**
Dwarf sperm whale	0.01		X	0.3	1.0	1.3	2.5	4	**20**
Pygmy sperm whale	0.01		X	0.3	1.0	1.3	2.5	4	**20**
Killer Whale	0.00005	X		0.001	0.005	0.006	0	1	**5**
Pygmy killer whale	0.00005	X		0.001	0.005	0.006	0	1	**5**
Northern bottlenose whale	0.00018		X	0.01	0.02	0.02	0.05	1	**5**
Cuvier's beaked whale	0.0124		X	0.3	1.3	1.6	3.1	5	**25**
Mesoplodon beaked whales	0.0092		X	0.3	1.0	1.2	2.3	4	**20**
Melon-headed whale	0.005	X		0.1	0.5	0.7	0	1	**5**
Risso's dolphin	0.064	X		1.8	6.6	8.4	0	9	**45**
Long-finned pilot whale	0.044		X	1.2	4.6	5.8	11.1	17	**85**
Short-finned pilot whale	0.044		X	1.2	4.6	5.8	11.1	17	**85**
Atlantic spotted dolphin	0.1205	X		3.4	12.5	15.9	0	16	**80**
Pantropical spotted dolphin	0.0075	X		0.2	0.8	1.0	0	1	**5**
Striped dolphin	0.307	X		8.7	31.8	40.4	0	41	**205**
Fraser's dolphin	0.002	X		0.1	0.2	0.3	0	1	**5**
Rough toothed dolphin	0.005	X		0.14	0.52	0.66	0	1	**5**
Spinner dolphin	0.001	X		0.0	0.1	0.1	0	1	**5**
Common bottlenose dolphin[3]	0.3230	X		9.1	33.4	42.5	0	43	**215**

[1]DSM300 not used in offshore surveys.
[2]Only EK60 used for the >200 m depth stratum.
[3]Offshore stock.

6.6.3. Potential Physical Disturbance

As described in Section 6.4, only one research project would involve the physical presence of researchers that may result in Level B incidental harassment of pinnipeds on haulouts (i.e., in Penobscot Bay). Seals observed on haulouts and in adjacent waters are discussed in Section 6.4 and shown in Table 6-3. The 2016 final rule (81 FR 53061) estimated that all hauled out seals could be disturbed by passing research skiffs. This was a conservative assumption given that only 20 seals were observed in the water during the actual 2017 Penobscot Bay surveys (NEFSC 2018b) and researchers have estimated that only about 10 percent of hauled out seals had been visibly disturbed in the past (NMFS 2016). Thus, for this application it is assumed that 10% of the animals hauled out could be flushed into the water and taken. Since an animal can only be taken once per day, the harassment takes are estimated based on the number of days per year the activity might take place, times the number of seals potentially affected (10% of the number hauled). Table 6-9 provides the estimated annual and 5-year takes of harbor and gray seals due to behavioral harassment during surveys in the lower estuary of the Penobscot River.

TABLE 6-9. LEVEL B HARASSMENT TAKE OF PINNIPEDS DURING PENOBSCOT RIVER SURVEYS

Common Name	Estimated Number of Seals Hauled Out[1]	Estimated Number of Seals Potentially Disturbed per Day[2]	Estimated Annual Instances of Harassment			5-Year Total Harassment Takes Requested All gears
			Fyke Net 100 DAS	Mamou Shrimp Trawl 12 DAS	Total	
Harbor seals	400	40	4,000	480	4,480	**22,400**
Gray seals	30	3	300	36	336	**1,680**

[1]Largest numbers taken from Table 6-3 to be conservative.
[2]Assumes 10% of animals hauled out could be disturbed per day of surveys.

6.6.4. Total Takes Requested over the 5-Year Period 2021–2026

Table 6-10 summarizes the total M/SI, Level B LME and Level B offshore requested for the 5-year period from 2021–2026. For context, Tables 6-11 and 6-12 compare takes authorized in the 2016 final rule (81 FR 53061) to actual takes over the period 2016–2019, as well as to future takes estimated for the 2021–2026 research period. The differences in take estimates shown by the comparison in Table 6-12 is primarily due to differences in density estimates as shown in Appendix A. For certain species, there are notable differences in current density estimates when compared to the information available in 2016 when the final rule was published. For example, the volumetric density calculated for white-beaked dolphin in the 2016 rule (81 FR 53061) was much higher (0.0405) compared to the current volumetric density calculated for this new application (0.00015). These differences are reflected in new take estimates presented here.

TABLE 6-10. TOTAL M/SI AND LEVEL B TAKES REQUESTED OVER THE FIVE YEAR PERIOD 2021–2026

Common Name	5-Year Total M/SI Take Requested	5-Year Total Level B Take Request		
		Level B LME	Level B Offshore	Total
Cetaceans				
North Atlantic right whale	**0**	20	0	**20**
Humpback whale	**0**	10	0	**10**
Fin whale	**0**	30	5	**35**
Sei whale	**0**	5	0	**5**
Minke whale	**5**	15	0	**15**
Blue whale	**0**	5	5	**10**
Sperm whale	**0**	0	25	**25**
Dwarf sperm whale	**0**	0	20	**20**
Pygmy sperm whale	**0**	0	20	**20**
Killer Whale	**0**	5	5	**10**
Pygmy killer whale	**0**	5	5	**10**
Northern bottlenose whale	**0**	0	5	**5**
Cuvier's beaked whale	**0**	0	25	**25**
Mesoplodon beaked whales	**0**	0	20	**20**
Melon-headed whale	**0**	0	5	**5**
Risso's dolphin	**3**	60	45	**105**
Long-finned pilot whale	**0**	645	85	**730**
Short-finned pilot whale	**0**	645	85	**730**
Atlantic white-sided dolphin	**3**	1,325	0	**1,325**
White-beaked common dolphin	**2**	5	0	**5**
Short-beaked common dolphin	**7**	2,600	0	**2,600**
Atlantic spotted dolphin	**2**	40	80	**120**
Pantropical spotted dolphin	**0**	0	5	**5**
Striped dolphin	**0**	0	205	**205**
Fraser's dolphin	**0**	0	5	**5**
Rough toothed dolphin	**0**	15	5	**20**
Clymene dolphin	**0**	95	0	**95**
Spinner dolphin	**0**	0	5	**5**
Common bottlenose dolphin[1]	**24**[2]	3,970	215	**4,185**
Harbor Porpoise	**7**	1,180	0	**1,180**

Common Name	5-Year Total M/SI Take Requested	5-Year Total Level B Take Request		
		Level B LME	Level B Offshore	Total
Pinnipeds				
Harbor seals[3]	**15**	8,300 22,400	0	**30,700**
Gray seals[3]	**15**	2,745 1,680	0	**4,425**

[1]For Level B LME takes the combined density of Northern and Southern migratory stocks was used; for offshore takes the density of the offshore stock was used.
[2]Eight takes each from the offshore, N. and S. migratory stocks, over the 5-year period.
[3]For Level B takes, the first number is disturbance due to acoustic sources, the second is physical disturbance due to surveys in Penobscot Bay

TABLE 6-11. NEFSC M/SI TAKES THE PERIOD 2016–2019 COMPARED TO 2016 AUTHORIZED AND FUTURE M/SI TAKES REQUESTED FOR THE PERIOD 2021–2026

Common Name	Total NEFSC MS/I Takes Per Reporting Period[1]			2016–2020 Total NEFSC Authorized MS/I Takes[2]	2021–2026 Total NEFSC Requested MS/I Takes[3]
	2016-2017	2018	2019		
Minke whale	0	0	0	5	5
Risso’s dolphin	0	0	0	3	3
Atlantic white-sided dolphin	0	0	0	3	3
White-beaked common dolphin	0	0	0	2	2
Short-beaked common dolphin	0	0	1	7	7
Atlantic spotted dolphin	0	0	0	2	2
Common bottlenose dolphin	0	0	0	24	34
Harbor Porpoise	0	0	0	7	7
Pinnipeds					
Harbor seals	0	0	0	15	15
Gray seals	0	0	0	n/a	15

[1]Sources: (NEFSC 2018b, NEFSC 2019, NEFSC 2020)
[2]81 FR 53061
[3]Table 6-5

TABLE 6-12. NEFSC LEVEL B ACOUSTIC TAKES FOR THE PERIOD 2016–2019 COMPARED TO 2016 AUTHORIZED[1] AND NEFSC REQUESTED LEVEL B ACOUSTIC TAKES FOR FUTURE RESEARCH 2021–2026 (LME AND OFFSHORE COMBINED)

Common Name	Total NEFSC Level B Takes Per Reporting Period[2]			2016–2020 Total NEFSC Authorized Acoustic Takes[1]	2021–2026 Total NEFSC Requested Acoustic Takes[3]
	2016-2017	2018	2019		
Cetaceans					
North Atlantic right whale	0	0	0	0	20
Humpback whale	0	0	0	0	10
Fin whale	0	0	0	0	35
Sei whale	0	0	0	0	5
Minke whale	0	0	0	0	15
Blue whale	0	0	0	0	10
Sperm whale	1	1	1	75	25
Dwarf sperm whale	0	0	0	10	20
Pygmy sperm whale	0	0	0	10	20
Killer Whale	0	0	0	0	10
Pygmy killer whale	0	0	0	0	10
Northern bottlenose whale	0	0	0	10	5
Cuvier’s beaked whale	8	7	10	165	25
Mesoplodon beaked whales	8	7	11	165	20
Melon-headed whale	0	0	0	0	5
Risso’s dolphin	19	17	21	395	105
Long-finned pilot whale	124	100	160	1,175	730
Short-finned pilot whale	124	100	160	1,175	730
Atlantic white-sided dolphin	87	70	113	720	1,325
White-beaked common dolphin	29	23	37	240	5
Short-beaked common dolphin	779	633	1,002	6,965	2,600
Atlantic spotted dolphin	3	3	3	80	120
Pantropical spotted dolphin	0	0	0	0	5
Striped dolphin	41	41	41	1,180	205
Fraser’s dolphin	0	0	0	0	5
Rough toothed dolphin	0	0	0	5	20
Clymene dolphin	0	0	0	0	95
Spinner dolphin	0	0	0	0	5

Common Name	Total NEFSC Level B Takes Per Reporting Period[2]			2016–2020 Total NEFSC Authorized Acoustic Takes[1]	2021–2026 Total NEFSC Requested Acoustic Takes[3]
	2016-2017	2018	2019		
Common bottlenose dolphin[4]	396	321	482	3,425	4,185
Harbor Porpoise	69	55	89	565	1,180
Pinnipeds					
Harbor seals	1,013	817	1,313	8,390	8,300
Gray seals	101	0	0	0	1,680

[1]2016 Final Rule for NEFSC Research for the Period 2016–2020 (81FR53061)
[2]Sources: (NEFSC 2018b, NEFSC 2019, NEFSC 2020). Acoustic takes are calculated based on survey length and do not represent actual observed animals.
[3]Table 6-9 of this application.
[4]Coastal and offshore stocks combined.

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7. ANTICIPATED IMPACT OF THE ACTIVITY ON SPECIES AND STOCKS

Although NEFSC surveys have the potential to adversely impact the health and condition of an individual marine mammal, adverse effects on annual rates of recruitment or survival of the affected marine mammal species or stocks are not anticipated. To illustrate this, the PBR can be compared to anticipated removals due to fishery research. In using PBR to evaluate the impact of NEFSC fisheries research activities on affected marine mammal stocks, two assumptions are made:

- All animals in the combined category for Level A injury, serious injury, and mortality will be seriously injured or killed (worst case assumption).
- The requested take will equal the actual take of marine mammals in fisheries research activities.

7.1. Physical Interactions with Gear

As described in Section 6.2, on September 24, 2019, a lethal take of a common dolphin occurred during a Cooperative Research NTAP cruise sponsored by the NEFSC. This is the only marine mammal M/SI take during the 2017, 2018 and 2019 survey seasons. Prior to that, over that time period 2004–2015, 10 marine mammals were killed in interactions with trawl gear, six were killed due to capture in gillnets, and two suffered mortality in fyke nets. Also, over that time period, two minke whales were caught in trawl gear and released alive.

Due to the low level of historical takes, as well as the low level of predicted future takes associated with the use of trawl, gillnet, longline and fyke net gears these surveys are expected to: (1) have a negligible impact on most of the affected species or stocks of marine mammals (based on the likelihood that the activities will not affect annual rates of recruitment or survival); and (2) not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses. The basis for this determination is that the requested M/SI take is less than 1% of residual PBR for most stocks (see Table 7-1). Residual PBR incorporates residual anthropogenic mortality from other sources (85 FR 27028). If anthropogenic mortality from other sources does not exceed PBR, then then residual PBR is positive, the incremental increase from the proposed action is considered, and if less than 10% is considered insignificant. Therefore, the requested take is considered negligible for all stocks with the exception of the Northern Florida coastal stock of common bottlenose dolphins and the Southern migratory stock of common bottlenose dolphins (if the high end of “other mortality” is considered).

TABLE 7-1. M/SI TAKE REQUESTS COMPARED TO RELATIVE PBR

Species	NEFSC Annual Take Level A, M/SI Request (2021–2026)	PBR (Annual Potential Biological Removal)[1]	Other Mortality[1]	Residual PBR[2]	% of Residual PBR Requested Annually
Cetaceans					
Minke whale	1	189	8.2	181	0.55
Risso's dolphin	0.6	303	54.3	248.7	0.24
Atlantic white-sided dolphin	0.6	544	26	518	0.12
White-beaked common dolphin	0.4	4,153	0	4,153	0.01
Short-beaked common dolphin	1.4	1,452	419	1,033	0.14
Atlantic spotted dolphin	0.4	320	0	320	0.13
Common bottlenose dolphin (offshore stock)	1.6	519	28	491	0.33
Common bottlenose dolphin (N. migratory stock)	1.6	48	6.1 to 13.2	41.9 to 34.8	3.82 to 4.59
Common bottlenose dolphin (S. migratory stock)	1.6	23	0 to 14.3	23 to 8.7	6.96 to 18.39
Harbor porpoise	1.4	851	217	634	0.22
Pinnipeds					
Harbor seal	5	2,006	350	1,656	0.32
Gray seal	5	1,389	940[3]	449	1.11

[1]PBR and total annual M/SI from Table 1 of Hayes, Josephson et al. (2020).
[2]PBR minus other anthropogenic mortality.
[3]Does not include Canadian commercial harvest or removal of nuisance animals from Canadian waters

7.2. Disturbance and Behavioral Responses Due to Acoustic Equipment

Several mechanisms exist by which research activities could potentially disturb marine mammals and alter behavior, including the physical presence of human activities (i.e., vessels or field crews on land), fishing gear, underwater sound from engines, hydraulic gear, or acoustic devices used for navigation and research. Marine mammals rely on sound to obtain detailed information about their surroundings, communicate, navigate, reproduce, socialize and avoid predators. Thus, the surrounding soundscape is a key component of marine mammal habitat and can be considered their acoustic habitat (Clark, Suydam et al. 2009). Underwater sound comes from numerous natural sources (biological and physical processes) and anthropogenic sources. Biological sounds include marine life (marine mammals, fish, snapping shrimp). Physical sounds include wind and wave activity, rain, cracking sea ice, undersea earthquakes and volcano eruptions. Anthropogenic sound includes shipping and other vessel traffic, military activity, marine construction, oil and gas exploration and more. Some of these natural and anthropogenic sounds are present more or less everywhere in the ocean all of the time. Therefore, background sound in the ocean is commonly referred to as "ambient noise" (DOSITS 2020). Sound levels at a given frequency and location can vary by 10–20 dB from day to day (Richardson, Greene Jr. et al. 1995). The result is that, depending on the source type and its intensity, sound from a specified activity may be a negligible addition to the local soundscape or could form a distinctive signal that may affect marine mammals.

The impacts of anthropogenic noise on marine mammals have been summarized in numerous articles and reports including Richardson, Greene Jr. et al. (1995), NRC (2005), Southall, Bowles et al. (2007), and Southall, Finneran et al. (2019). Marine mammals use hearing and sound transmission to perform vital life functions. The distance to which anthropogenic sounds are audible depends on the level of ambient noise, anthropogenic sound source levels, frequency, ambient noise levels, the propagation characteristics of the environment, and sensitivity of the marine mammal (Richardson, Greene Jr. et al. 1995). Marine mammals exposed to high intensity sound repeatedly or for prolonged periods could experience hearing a threshold shift, resulting in the loss of hearing sensitivity at certain frequency ranges (Kastak, Schusterman et al. 1999, Schlundt, Finneran et al. 2000, Finneran, Schlundt et al. 2002, Finneran, Carder et al. 2005). Threshold shifts can be categorized as a permanent threshold shift (PTS) where loss of hearing sensitivity is unrecoverable, or a temporary threshold shift (TTS) in which case an animal may recover hearing sensitivity over time Southall, Bowles et al. (2007).

In 2019, Southall, Finneran et al. (2019) published an update to the 2007 Marine Mammal Noise Exposure Criteria, proposing eight discrete hearing groups including: 1) low frequency cetaceans; 2) high frequency cetaceans; 3) very high frequency cetaceans; 4) sirenians; 5) phocid carnivores in water; 6) phocid carnivores in air; 7) other marine carnivores in water; and 8) other marine carnivores in air (Southall, Finneran et al. 2019). The 2019 publication confirms the weighting functions and thresholds used by NMFS and cited in the 2018 revised NMFS Technical Guidance (NMFS 2018b). The NMFS Technical Guidance continues to be used for defining regulatory thresholds for calculating incidental takes of marine mammals under the MMPA and have been used in this MMPA LOA application.

The Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2018b) uses marine mammal hearing groups defined by Southall, Bowles et al. (2007) with some modifications. These groups and their generalized hearing ranges are shown in Table 7-2. As shown in the table, marine mammals found in the NEFSC research areas fall into the following categories: baleen whales are low-frequency cetaceans; killer whales are mid frequency cetaceans; porpoises are high frequency cetaceans; and harbor seals are in the phocid category. NMFS (2018b) considered acoustic thresholds by hearing group to acknowledge that not all marine mammals have identical hearing ability or identical susceptibility to noise or noise-induced PTS. (NMFS 2018b) also used the hearing groups to establish marine mammal auditory weighting functions (Table 7-3).

Although the 2018 guidance identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive), given the highly directional, e.g., narrow beam widths of acoustic equipment, NMFS does not anticipate animals would be exposed to noise levels resulting in injury. Potential effects of underwater noise on marine mammals have been evaluated for NEFSC research alternatives and are presented in the 2016 PEA and supplemented in this chapter as needed. As described in Section 6, only the EK60 is within the hearing range for baleen whales.

TABLE 7-2. GENERALIZED HEARING RANGES FOR MARINE MAMMAL HEARING GROUPS IN WATER

Hearing Group	Hearing Range
Low-frequency cetaceans (e.g. baleen whales)	7 Hz to 35kHz
Mid-frequency cetaceans (e.g. beaked and killer whales)	150 Hz to 160 kHz
High-frequency cetaceans (e.g. porpoises)	275 Hz to 160 kHz
Phocids (e.g. harbor seals)	50 Hz to 86 kHz
Otariids and other non-phocid marine carnivores	60 Hz to 39 kHz

Source: (NMFS 2018b)

TABLE 7-3. SUMMARY OF WEIGHTING AND EXPOSURE FUNCTION PARAMETERS

Hearing Group	*a*	*b*	f_1 (kHz)	f_2 (kHz)	*K* (dB)
Low-frequency cetaceans	1.0	2	0.20	19	0.13
Mid-frequency cetaceans	1.6	2	8.8	110	1.20
High-frequency cetaceans	1.8	2	12	140	1.36
Phocids in water	1.0	2	1.9	30	0.75
Otariids in water	2.0	2	0.94	25	0.64

Source: (NMFS 2018b)

Animals exposed to natural or anthropogenic sound may experience physical and behavioral effects, ranging in magnitude from none to severe Southall, Bowles et al. (2007). Watkins (1986; as reported in NRC (2003) suggests that contextual factors influence whether or not a marine mammal becomes habituated to a particular disturbance or stimuli. For example, animals may tolerate a stimulus they might otherwise avoid if the benefits in terms of feeding, mating, migrating to traditional habitat, or other factors outweigh the negative aspects of the stimulus.

- The actual radius of a behavioral effect is smaller than the radius of noise detectability (Richardson, Greene Jr. et al. 1995, Southall, Bowles et al. 2007). As an example, during spring migration, bowheads were shown to continue through an area where the only available lead was within 200 m of a projector playing sounds associated with a drilling platform that produced received levels of 131 dB re 1 µPa (Richardson et al. 1991 as reported in NRC 2003). NMFS currently uses a behavioral threshold of 160 dB rms for intermittent noise sources which encompasses non-pulse echosounders such as the EK60/80 used in fisheries surveys. The interim behavioral effect threshold as applied by NMFS do not account for differences between species in hearing ranges and sensitivity to noise at different frequencies and are based on broadband unweighted sound levels.

These thresholds are conservative considering that many natural and anthropogenic noise sources can cause noise levels above these thresholds but not necessarily result in adverse behavioral effects to marine mammals. TTS is by definition recoverable rather than permanent and is treated as ‘‘Level B harassment’’ under the MMPA

In summary, the available information on hearing and potential auditory effects in marine mammals would suggest that the high frequency cetacean species would be the most likely to have temporary (not permanent) hearing losses from a vessel operating high frequency sonar sources, but individuals would have to either be very close to and remain very close to vessels operating these sources for multiple exposures at relatively high levels. Given the moving nature of vessels in fisheries research surveys, the likelihood that animals may avoid the vessel to some extent based on either its physical presence or active acoustic sources, and the intermittent nature of many of these sources, the potential for TTS is probably low for high frequency cetaceans and very low to zero for other species.

Behavioral responses of marine mammals are extremely variable depending on a host of exposure factors, including exposure level, behavioral context and other factors. The most common type of behavioral response seen across studies is behavioral avoidance of areas around sound sources. These are typically the types of responses seen in species that do clearly respond, such as harbor porpoises, around temporary/mobile higher frequency sound sources in both the field (Johnston 2002) and in the laboratory settings (Kastelein, Rippe et al. 2000, Kastelein, van Schie et al. 2005, Kastelein, Verboom, Jennings and de Haan 2008, Kastelein, Verboom, Jennings, de Haan et al. 2008). However, what appears to be more sustained avoidance of areas where high frequency sound sources have been deployed for long durations has also been documented in some odontocete cetaceans, particularly those like porpoises and beaked whales that seem to be particularly behaviorally sensitive (Southall, Bowles et al. 2007, Carretta, Barlow et al. 2008). While low frequency cetaceans and pinnipeds have been observed to respond behaviorally to low- and mid-frequency sounds, there is little evidence of behavioral responses in these species to high frequency sound exposure (Kastelein, van Schie et al. 2005)

7.3. Disturbance and Behavioral Changes Due to Close Approach

Harbor and gray seals may be hauled out on ledges in Penobscot Bay and at may be disturbed by research activities occurring in the bay. NEFSC expects some of these animals will exhibit a behavioral response to the visual stimuli (e.g., including flushing, vocalizing and head alerts), and as a result estimates of Level B harassment have been calculated and are discussed in Sections 6.4 and 6.6.3, and estimated takes are shown in Table 6-8. These events are expected to be infrequent and cause only a very temporary disturbance (lasting for minutes). The Penobscot Estuarine Fish Community and Ecosystem Survey uses shrimp trawls and occurs over 12 days per year split between spring, summer and fall seasons. The Marine Estuaries Diadromous Survey uses fyke nets and takes place over 100 days from April to November. Pupping occurs in Maine in May–June for harbor seals, and December–January for gray seals. Neither survey would result in impacts on the gray seal pupping season because they do not overlap with pupping. These surveys may disturb harbor seals during the months of May and June if the survey periods during spring overlapped spatially with seasonal pupping of harbor seals. However, harbor seal females stay with pups during the pupping season for 3 weeks and never leave the rookery, after which pups are left to fend for themselves. While the probability of a survey having a minor adverse effect on individual seals does exist during spring and summer through physical disturbance (in-water acoustic disturbance is unlikely as seals remain hauled out during pupping period), it is unlikely that a female would abandon her pup during this period and population level effects would be considered negligible. This is supported by relevant studies of pinniped populations that experience more regular vessel disturbance indicate that population level impacts are unlikely to occur.

7.4. Active Acoustic Sources Used by the NEFSC

High frequency transient sound sources operated by the NEFSC are used for environmental and remote-object sensing in the marine environment. They include various echosounders (e.g., multibeam systems), scientific sonar systems, positional sonars (e.g., net sounders for determining trawl position), and environmental sensors (e.g., current profilers). The specific acoustic sources used in NEFSC active acoustic surveys, are described in Section 6.3 and shown in Table 6-2. The types of active sources employed in fisheries acoustic research and monitoring fall under one of two based on operating frequency (e.g., within or outside the known audible range of marine species) and other output characteristics (e.g., signal duration, directivity).

7.4.1. Category 1 Active Acoustic Sources

Some active fisheries acoustic sources (e.g., short range echosounders, acoustic Doppler current profilers) have very high output frequencies (>180 kHz) and generally short duration signals and highly directional beam patterns. Based on the frequency band of transmissions relative to the functional hearing capabilities of marine species, they are not expected to have any negative effect on marine life. While recent literature suggests there is potential for “sub-harmonic” sounds to be generated from commercially available 200 kHz echosounders, the underwater sounds were reported well below harmful levels (Deng, Southall et al. 2014). As described in the 2019 Final Rule for SEFSC research, “behavioral response to a stimulus does not necessarily indicate that Level B harassment, as defined by the MMPA, has occurred. Source levels of the secondary peaks considered in these studies—those within the hearing range of some marine mammals—mean that these subharmonics would either be below the threshold for Level B harassment or would attenuate to such a level within a few meters” (85 FR 27028). They are thus not considered explicitly in the qualitative assessment below (or in the quantitative analysis conducted in Section 6.3). Additionally, passive listening sensors which exist on many oceanographic research vessels have no potential impact on marine life because they are remotely and passively detecting sound rather than producing it.

Category 1 active sources are not expected to have adverse effects on marine mammals. The relative output frequency of these sources is greater than180 kHz and is above the known hearing capabilities of marine mammal species. NOAA does not regulate or require take assessments for acoustic sources with source frequencies at or above 180 kHz because they are above the functional hearing range of any known marine animal (including high frequency odontocete cetaceans, such as harbor porpoises).

7.4.2. Category 2 Active Acoustic Sources

Category 2 acoustic sources are present on most NEFSC fishery research vessels and include a variety of single, dual, and multi-beam echosounders (many with a variety of modes), sources used to determine the orientation of trawl nets, and several current profilers with slightly lower output frequencies than Category 1 sources. Category 2 active acoustic sources have moderate to very high output frequencies (10 to 180 kHz), generally short ping durations, and are typically focused (highly directional) to serve their intended purpose of mapping specific objects, depths, or environmental features.

Category 2 active acoustic sources are likely to be audible to some marine mammal species. Most of these sources are unlikely to be audible to whales and most pinnipeds, whereas they may be detected by odontocete cetaceans (and particularly high frequency specialists such as harbor porpoise). There is relatively little direct information about behavioral responses of marine mammals, including the odontocete cetaceans, but the responses that have been measured in a variety of species to audible sounds (Nowacek, Thorne et al. 2007, Southall, Bowles et al. 2007) suggest that the most likely behavioral responses (if any) would be short-term avoidance behavior of the active acoustic sources.

The potential for direct physical injury from these types of active sources is low, but there is a low probability of temporary changes in hearing (masking and even temporary threshold shift) from some of the more intense sources in this category. Measurements by Finneran and Schlundt (2010) of TTS in mid-frequency cetaceans from high frequency sound stimuli indicate a higher probability of TTS in marine mammals for sounds within their region of best sensitivity; the TTS onset values estimated by Southall, Bowles et al. (2007) were calculated with values available at that time and were from lower frequency sources. Thus, there is a potential for TTS from some of the Category 2 active sources, particularly for mid- and high-frequency cetaceans. However, even given the more recent data, animals would have to be either very close (few hundreds of meters) and remain near sources for many repeated pings to receive overall exposures sufficient to cause TTS onset (Lucke, Siebert et al. 2009, Finneran and Schlundt 2010). If behavioral responses typically include the temporary avoidance that might be expected (see above), the potential for auditory effects resulting in physiological damage (injury) is considered extremely low so as to be negligible in relation to realistic operations of these devices.

7.5. Collision and Strike

Ship strikes and collisions with cetaceans can cause major wounds, which may lead to the death of the animal. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel’s propeller. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus 2001, Laist, Knowlton et al. 2001).

Jensen and Silber (2003) summarized large whale ship strikes worldwide from 1975 to 2003 and found that most collisions occurred in the open ocean involving large vessels. Commercial fishing vessels were responsible for four of 134 records (3%), and one collision each (0.75%) was reported for a research boat, pilot boat, whale catcher boat, and dredge boat.

The probability of vessel and marine mammal interactions occurring during Center operations is negligible due to the vessel's slow operational speed, which is typically 4 kts or less. Outside of operations, each vessel's cruising speed would be approximately 10 kts, which is generally below the speed at which studies have noted reported increases of marine mammal injury or death (Laist, Knowlton et al. 2001). The relatively low speed of gliders or other autonomous surface vehicles (typically 1–3 kts with a maximum speed of 8 kts) reduce the risk of collision with marine mammals such that this potential effect is considered negligible. Monitoring and marine mammal watches in the vicinity of operations as described in Section 11 further reduce the risk of interactions.

7.6. Impacts of NEFSC Fisheries Research Activities on Marine Mammal Species and Stocks

The requested annual Level A M/SI takes associated with entanglement or hooking in NEFSC fisheries research surveys over the period 2021–2026 do not exceed any stock's PBR. For all species except two stocks of bottlenose dolphins, M/SI takes would be less than 10% of residual PBR (see Table 7-1), which can be considered negligible as described in Section 7.1. M/SI takes above the 10% significance threshold do not necessarily indicate that effects would be more than negligible (85 FR 27028). Where M/SI takes are above 10% of residual PBR, mitigation measures and the incidence of historical takes are considered in determining if impacts would be negligible. As shown Table 6-11, no Level A interactions with common bottlenose dolphins from any stock were reported over the period 2016–2019. General mitigation measures to reduce marine mammal takes as described in Section 11 will continue to keep takes of these dolphins at zero to minimal.

NEFSC fisheries research activities have the potential to cause Level B harassment and serious injury or mortality of marine mammals in the study area. However, because of the low level of historical interactions relative to the abundance of affected populations, as well as the low level of predicted future takes associated with NEFSC surveys, the activities would not affect annual rates of recruitment or survival or the health and condition of the species or stock of the requested species.

Based on this information the NEFSC believes that its activities: (1) will have a negligible impact on the affected species or stocks of marine mammals (based on the likelihood that the activities will not affect annual rates of recruitment or survival); and (2) will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

8. ANTICIPATED IMPACTS ON SUBSISTENCE USES

The proposed activity will take place in the Northeast LME and adjacent offshore region and would not affect Arctic marine mammals that are harvested for subsistence use. Therefore, there are no relevant subsistence uses of marine mammals implicated by this action as identified in MMPA Section 101(a)(5)(A)(i).

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9. ANTICIPATED IMPACTS ON HABITAT

The impact of NEFSC surveys on the availability of prey for marine mammals can be determined by considering biomass removals of high-quality prey species such as herring, mackerel, squid and shrimp. (Table 9-1).

TABLE 9-1. PREY BIOMASS REMOVED DURING NEFSC RESEARCH SURVEYS.

Prey Species	Estimated Stock Biomass (tons)	2020 Allowable Biological Catch (ABC) (tons)	Research Catch 2017 (tons)	Commercial Catch 2017 (tons)
Atlantic herring	571,000[1]	17,781[2]	8	54,000
Atlantic mackerel	unknown	32,170[3]	8	11,700
Longfin Squid	unknown	25,794[2]	4	9,000
Northern shortfin squid	unknown[4]	26,000[4,5]	0.6	25,000
Northern shrimp	3,525[6]	NA	0.5	32.6

[1]65th Northeast Regional Stock Assessment Workshop (65th SAW) Assessment Summary Report.
[2]2019–2021 Atlantic Herring Overfishing Limit (OFL) and ABC Recommendations Herring Plan Development Team Report
[3]http://www.mafmc.org/newsfeed/2019/noaa-fisheries-proposes-atlantic-mackerel-squid-and-butterfish-quotas-for-the-2020-fishing-year
[4]Macho and Humberstone (2019)
[5]2020 ABC as suggested by Macho and Humberstone (2019).
[6]Hunter, Whitmore et al. (2018)Assessment Report for Gulf of Maine Northern Shrimp – 2018.

Table 9-1 shows that biomass of prey species removed during NEFSC surveys is very small relative to their overall biomass in the area and is a very small percentage of the ABC. In addition to the small amount of biomass removed, the size classes of fish targeted in research surveys are juvenile individuals, some of which are only centimeters long; these small size classes are not known to be prey of marine mammals. For these reasons it is determined that removal of prey biomass during NEFSC surveys will not change food availability and will have no effect on overall prey sources for marine mammals.

The overall effects of NEFSC research activities on fish populations are minor since they are of negligible magnitude and intensity, short-term in duration, of localized geographic extent, and are unlikely to result in measurable population change.

Bottom trawl and dredging gear used by NESFC could physically impact seafloor habitat and the epifauna and infauna associated with the seafloor. Bottom contact fishing gear used in NEFSC fishery research activities and funded fishery research activities include otter trawls, sea scallop dredges, and hydraulic surfclam dredges. Other fishing gear that contacts the seafloor, such as pots and traps, can cause physical damage but the impacts are localized and minimal as this type of gear is fixed in position. The ropeless lobster traps planned for ongoing use would have minimal effect of seafloor habitat. The recovery time for damage to infauna and epifauna varies based on the type of fishing gear used, the type of seafloor surface (i.e., mud, sand, gravel, mixed substrate), and the level of repeated disturbances. In general, biological damage from a single disturbance is 1–18 months, and up to 3 years from repeated disturbances (Stevenson, Chiarella et al. 2004). Because research surveys are conducted in the same areas but not in the exact same locations they are expected to cause single rather than repeated disturbances in any one area. Therefore, any physical damage caused by NEFSC surveys and funded fishery research activities would be expected to recover within 1–18 months. Given the small magnitude of area affected by research and the short-term nature of physical damage effects, these impacts to habitat are considered minor or negligible.

10. ANTICIPATED EFFECTS OF HABITAT IMPACTS ON MARINE MAMMALS

The potential effects of NEFSC fishery research activities on marine habitat include:

- Biological damage to infauna and epifauna
- Removal of organisms which produce structure, and
- Alteration of the turbidity and geochemistry of the water column.

As described in Section 9, fishing gear that contacts the seafloor can alter or physically damage seafloor habitat with varying recovery times. However, the area affected by research each year is a very small fraction of the total area involved in survey efforts. Given the small magnitude of area affected by research and the short-term nature of physical damage effects, these impacts are considered minor or negligible.

Infauna are animals that live in the seafloor or within structures that are on the seafloor. Infauna usually constructs tubes or burrows and are commonly found in deeper and subtidal waters. Clams, tubeworms, and burrowing crabs are infaunal animals. Epifauna live on the surface of the seafloor or on structures on the seafloor such as rocks, pilings, or vegetation. Epifauna may attach themselves to such surfaces or range freely over them, as by crawling or swimming. Mussels, crabs, starfish, and flounder are epifaunal animals. Fishing gear that contact the seafloor can disturb infauna and epifauna by crushing them, burying them or exposing them to predators. The level of biological damage to infauna and epifauna can vary from very minimal to more severe particularly with repeated disturbance in the same areas (Stevenson, Chiarella et al. 2004).

The recovery time for damage to infauna and epifauna varies based on the type of fishing gear used, the type of seafloor surface (i.e., mud, sand, gravel, mixed substrate), and the level of repeated disturbances. In general, biological damage from a single disturbance is 1–18 months, and up to 3 years from repeated disturbances (Stevenson, Chiarella et al. 2004). Because research surveys are conducted in the same areas but not in the exact same locations they are expected to cause single rather than repeated disturbances in any one area. Therefore, any physical damage caused by NEFSC surveys and funded fishery research activities would be expected to recover within 1–18 months. Given the small magnitude of area affected by research and the short-term nature of physical damage effects, these impacts are considered minor or negligible.

Organisms such as cold water corals create structure on the seafloor that not only contain a high diversity of corals but also provide an important habitat for other infauna (Stevenson, Chiarella et al. 2004). Cold water corals are generally slow growing, fragile and long lived that makes them particularly vulnerable to damage. Fishing gear that contacts coral can break or disrupt corals reducing structural complexity and reducing species diversity of the corals and other animals that utilize this habitat (Freiwald, Fossa et al. 2004). The extent of overlap between cold water corals and NEFSC survey vessels is expected to be limited given the small number and small areal extent of NEFSC surveys and funded fishery research using bottom trawl and dredging equipment. In addition, only two surveys occur outside of the LME, the Deepwater Biodiversity Survey and the Deep-sea Corals Survey. Neither of these surveys use bottom contacting gear. Although fisheries research effects on corals may be long-term, the magnitude of this potential effect is negligible.

Fishing gear that contacts the seafloor can increase the turbidity of the water by suspending fine sediments and benthic algae. Suspension of fine sediments and turnover of sediment can also alter the geochemistry of the seafloor and the water column, but impacts of alteration of turbidity and geochemistry in the water column are not very well understood (Stevenson, Chiarella et al. 2004). These types of effects from fisheries research activities would be periodic, temporary, and localized and are considered negligible.

As stated in Section 9, the proposed activities are not anticipated to result in impacts to marine mammal habitats or to the food resources on which they depend. Therefore, long-term adverse impacts to marine mammals resulting from loss of or modification to marine mammal habitats as a result of the proposed activities are not expected.

11. MITIGATION MEASURES

In order to issue an incidental take authorization under Section 101(a)(5)(A or D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, ‘‘and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking’’ for certain subsistence uses. The following suite of mitigation measures will be employed by the NEFSC during fisheries research. The procedures described are based on best practices and protocols used during previous research surveys. Additional mitigation measures may be considered and developed further and may be implemented by the NEFSC during the five year life of the permit. Mitigation measures for NEFSC surveys proposed over the period 2020–2025 are shown in Table 11-1.

TABLE 11-1. PROPOSED MITIGATION AND MONITORING MEASURES

Survey Type	Proposed Action
General Measures Applicable to All Surveys	• Coordination and Communication: In advance of each survey, coordination with the NOAA OMAO or other relevant parties to ensure clear understanding of the mitigation measures and the manner of their implementation. Conduct briefings at the outset of each survey and as necessary with the ship’s crew. Chief scientist (CS) to coordinate with Officers on Deck (OOD) or equivalent to ensure procedures are understood. • Protected Species Training: Conduct a formalized protected species training program for all crew members that are part of NEFSC-affiliated research and cooperative research. Training will include topics such as monitoring and sighting protocols, species identification, decision-making factors avoiding take, procedures for handling and documenting protected species interactions, and reporting requirements. • Vessel speed: if vessel crew or dedicated marine mammal observers sight marine mammals that may intersect the vessel, they will immediately communicate with the bridge for appropriate course alteration or speed reduction as possible. • Handling Procedures: Implement NEFSC established protocols to reduce interaction with marine mammals following a step-wise order; 1) ensure health and safety of crew; depending on how and where an animal is hooked or entangled, take action to prevent further injury to the animal; 3) take action to increase the animal’s chance of survival; and 4) record detailed information on the interaction, actions taken and observations of the animal throughout the incident.
Surveys Using Trawl Gear	• Upon arrival, conduct trawl operations upon arrival on station to the extent practicable. • For all beam, mid-water, and bottom trawl, initiate visual observation for protected species no less than 15 minutes prior to deployment or retrieval of gear. Scan the surrounding waters with the naked eye and rangefinding binoculars. Continue visual monitoring while gear is deployed. • During nighttime operations, observe with the naked eye and any available vessel lighting. • If protected species are sighted within 15 minutes before setting gear, the OOD may determine whether to implement the “move-on” rule and transit to a different section of the sampling area. Trawl gear will not be deployed if protected species are sighted near the ship unless there is no risk of interaction as determined by the OOD or CS.

<table>
<tr><th>Survey Type</th><th>Proposed Action</th></tr>
<tr><td></td><td>
If, after moving on, protected species are still visible from the vessel and appear at risk, the OOD may decide to move again or skip the station.
If gear deployment or retrieval is suspended due to protected species presence, resume only after there are no sightings for 15 minutes within 1nm of sampling location.
If deploying bongo plankton or other small net prior to trawl gear, continue visual observations until trawl gear is ready to be deployed.
Conduct standard tow durations of no more than 30 minutes at target depth for distances less than 3 nm. The exceptions to the 30-minute tow duration are the Atlantic Herring Acoustic Pelagic Trawl Survey and the Deepwater Biodiversity Survey where total time in the water (deployment, fishing, and haul-back) is 40 to 60 minutes and 180 minutes, respectively.
Clean gear prior to deployment. Empty gear as quickly as possible to ensure no marine mammals are entangled.
</td></tr>
<tr><td>Surveys Using Dredge Gear</td><td>
For all scallop and hydraulic clam dredges, the OOD, CS or other members) and crew standing watch on the bridge will scan for marine mammals using binoculars during all daytime operations.
Initiate protected species watches upon arrival on station. Scan the surrounding waters with the naked eye and range finding binoculars.
If protected species are sighted around the vessel before setting the gear, the OOD may decide to implement the “move-on” rule and transit to a different section of the sampling area. Dredge gear will not be deployed if marine mammals are sighted near the ship unless there is no risk of interaction as determined by the OOD or CS.
After moving on, if protected species are still visible from the vessel and appear at risk, the OOD may decide to move again or skip the station. The OOD and CS may discuss strategies for avoid takes of these species.
If dredging is delayed because of marine mammal presence, operations only resume when the animals have no longer been sighted or are no longer at risk.
Conduct dredge operations upon arrival on station to the extent practicable.
Continue visual monitoring while gear is deployed. If protected species are sighted before gear retrieval, the CS, watch leader, or OOD will determine the best action to minimize interactions with animals.
During nighttime operations, observe with the naked eye and any available vessel lighting.
Conduct standard tow durations of no more than 15 minutes at target depth for distances less than 1 nm for scallop dredging and 10 minutes for clam dredging.
Clean gear prior to deployment. Empty gear as quickly as possible to ensure no protected species are entangled.
</td></tr>
<tr><td>Longline Surveys</td><td>
Deploy longline gear as soon as practicable upon arrival on station.
Initiate visual observation for protected species no less than 15 minutes prior to deployment and retrieval of gear. Scan surrounding waters with the naked eye and binoculars (or monocular). Conduct visual observations during nighttime surveys using the naked eye and available vessel lighting.
If protected species are sighted within 15 minutes before setting gear, implement the move-on rule if species appears at risk of interaction with gear. If, after moving on, protected species are still visible from the vessel, NEFSC will use professional judgment about whether to move again or skip the station.
</td></tr>
</table>

Survey Type	Proposed Action
Longline Surveys, cont'd.	• For Apex Predators Bottom Longline Coastal Shark Survey, if one or more marine mammals are observed within 1nm of station within 15 minutes before gear deployment, transit to a different section of sampling area to maintain minimum distance of 1nm from marine mammal(s). Use professional judgment whether to move again or forego sampling if marine mammal(s) remain within 1nm of sampling location • If gear deployment or retrieval is suspended due to presence of marine mammals, resume operations only after there are no sightings for at least 15 minutes within 1nm of sampling location. • Chumming is prohibited.
Rotary Screw Trap Surveys	• Conduct rotary screw trap deployments as soon as is practicable upon arrival at the sampling site. • Visually survey the area prior to setting and retrieval of the rotary screw trap gear. If marine mammals are observed in the sampling area, NEFSC shall suspend or delay the sampling. NEFSC may use best professional judgement in making this decision. • Tend to the trap on a daily basis to monitor for marine mammal interactions with the gear. • If the rotary screw trap catches a marine mammal, NEFSC shall carefully remove and release the animal as soon as possible.
Pot/Trap Surveys	• Same protocols as longline.
Fyke Net Surveys	• Deploy gear as soon as practicable upon arriving at station. • Conduct monitoring and retrieval of gear every 12–24-hour soak period. • A 2-m fyke net will be fitted with a Marine Mammal Excluder Device (MMED). • If marine mammals are within 100 m of setting location, consider moving. If there is risk of interaction with marine mammals, retrieve gear.
Gillnet Surveys	• For all gillnet deployments, the OOD, CS or other member and crew standing watch on the bridge will scan for marine mammals using binoculars during all daytime operations. • Initiate marine mammal watches upon arrival on station. Scan the surrounding waters with the naked eye and range finding binoculars. • If marine mammals are sighted around the vessel before setting the gear, the OOD may decide to implement the "move-on" rule and transit to a different section of the sampling area. Gillnet gear will not be deployed if sea turtles or marine mammals are sighted near the ship unless there is no risk of interaction as determined by the OOD or CS. • After moving on, if marine mammals are still visible from the vessel and appear at risk, the OOD may decide to move again or skip the station. The OOD and CS may discuss strategies to avoid takes of these species. • If placement of the gillnet is delayed because of marine mammal presence, operations only resume when the animals have no longer been sighted or are no longer at risk. If a marine mammal is sighted during the soak and appears to be at risk of interaction with the gear, then the gear is pulled immediately. • Conduct gillnet operations upon arrival on station to the extent practicable.

Survey Type	Proposed Action
Gillnet Surveys, cont'd.	• Continue visual monitoring while gillnet is soaking. If marine mammals are sighted before gear retrieval, the CS, watch leader, or OOD will determine the best action to minimize interactions with animals. • Set only new of fully repaired gill nets thereby eliminating holes, and modify nets to avoid more than a 4-in. gap between float and lead line when set. • Set gillnets with minimal slack and a short marker buoy at the deep end. • Clean gear prior and during deployment. Empty gear as quickly as possible to ensure no marine mammals are entangled. For the COASTSPAN gillnet surveys, NEFSC shall actively monitor for potential bottlenose dolphin entanglements by hand-checking the gillnet every 20 minutes. • On Observer Training cruises, acoustic pingers and weak links are used on all gillnets consistent with the regulations and TRPs for commercial fisheries. All NEFOP protocols are followed as per current NEFOP Observer Manual. Soak duration time is 12–24 hours. • On COASTSPAN gillnet surveys, gillnets are continuously monitored during the three hour soak time; if animals are seen approaching the net, the gear should be removed. • Also, on COASTSPAN surveys, minimize soak time by utilizing the 'last out/first in' strategy in grids where marine mammals have been encountered within the last five years.

11.1. Trawl Surveys (Beam, Mid-water, and Bottom)

11.1.1. Monitoring Methods

Marine mammal watches will be conducted during all daytime operations to determine if protected species are near the proposed trawl set location. Visual scans for marine mammals will be initiated no less than 15 minutes prior to deploying or retrieving gear during all daytime operations. Marine mammal watches will be conducted using any binocular or monocular sighting instrument, with a means to estimate distance to infringing protected species during daytime, and the best available means of observation during nighttime observations. This typically occurs during transit leading up to arrival at the sampling station because of another mitigation measure intended to reduce the risk of attracting curious marine mammals, immediate deployment of trawl gear upon arriving at station. However, in some cases it may be necessary to conduct a bongo plankton tow prior to deploying trawl gear. In these cases, the visual watch will continue until trawl gear is ready to be deployed.

11.1.2. Operational Procedures

In many cases, trawl operations will be the first activity undertaken upon arrival at a new station, in order to reduce the opportunity to attract marine mammals to the vessel. However, in some cases it will be necessary to conduct plankton tows prior to deploying trawl gear in order to avoid trawling through extremely high densities of jellies and similar taxa that are numerous enough to severely damage trawl gear.

"Move-On" Rule. If marine mammals (with the exception of baleen whales) are sighted around the vessel before setting the gear, the OOD may decide to implement the "move-on" rule and transit to a different section of the sampling area. Trawl gear will not be deployed if protected species are sighted near the ship unless there is no risk of interaction as determined by the OOD or CS. If after moving on, protected species are still visible from the vessel and appear at risk, the OOD may decide to move again or skip the station. The OOD and CS may discuss strategies for avoid takes of these species. Strategies are based on the species encountered, their numbers and behavior, their position and vector relative to the vessel, and other factors. For instance, a whale transiting through the area and heading away from the vessel may not require any move, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if the dolphins follow the vessel. In most cases, research trawl gear is not deployed if marine mammals have been sighted near the ship unless those animals do not appear to be in danger of interactions with the trawl, as determined by the judgment of the OOD and CS. The efficacy of the “move-on” rule is limited during nighttime or other periods of limited visibility; research gear is deployed as necessary when visibility is poor, although operational lighting from the vessel illuminates the water in the immediate vicinity of the vessel during gear setting and retrieval.

Once the trawl net is in the water, observations will continue around the vessel to maintain a lookout for the presence of marine mammals. If marine mammals are sighted before the gear is fully retrieved, resume only after there are no sightings for 15 minutes within 1 nm of the sampling location. The OOD may also use the most appropriate response to avoid incidental take in consultation with the CS and other experienced crew as necessary. This judgment will be based on his/her past experience operating gears around marine mammals and NEFSC training sessions that will facilitate dissemination of Chief Scientist / Captain expertise operating in these situations (e.g., factors that contribute to marine mammal gear interactions and those that aid in successfully avoiding these events). These judgments take into consideration the species, numbers, and behavior of the animals, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. For instance, a whale transiting through the area off in the distance might only require a short move from the designated station while a pod of dolphins gathered around the vessel may require a longer move from the station or possibly cancellation if they follow the vessel. It may sometimes be safer to continue trawling until the marine mammals have lost interest or transited through the area before beginning haulback operations. In other situations, swift retrieval of the net may be the best course of action. If trawling is delayed because of protected species presence, trawl operations only resume when the animals have no longer been sighted or are no longer at risk. In any case, no gear will be deployed if marine mammals or other protected species have been sighted that may be a risk of interaction with gear.

Care will be taken when emptying the trawl to avoid damage to any marine mammals that may be caught in the gear but are not visible upon retrieval. The gear will be emptied as quickly as possible after retrieval in order to determine whether or not marine mammals, or any other protected species, are present.

11.1.3. Tow Duration

The NEFSC will implement standard tow durations excluding deployment and retrieval time of not more than 30 minutes at target depth for distances less than 3 nm. The exceptions to the 30-minute tow duration are the Atlantic Herring Acoustic Pelagic Trawl Survey and the Deepwater Biodiversity Survey where total time in the water (deployment, fishing, and haul-back) is 40 to 60 minutes, and 180 minutes, respectively.

Bottom trawl tows will be made in either straight lines or following depth contours, whereas AHAPTS tows target fish aggregations and deep-water biodiversity tows may be made along oceanographic or bathymetric features. Sharp course changes will be avoided in all surveys.

Trawl tow distances will be not more than 3 nautical miles (nm) to reduce the likelihood of incidentally taking marine mammals. Typical tow distances are 1-2 nm, depending on the survey and trawl speed.

11.1.4. Speed Limits and Course Alterations

NOAA vessels are subject to ship strike management measures. No collisions with large whales have been reported from any fisheries research activities conducted or sponsored by the NEFSC. That, combined with adherence to the above mentioned mitigation measures, indicate that vessel collisions are possible, but unlikely to occur, and anticipated impacts to most species would be negligible to minor. When research vessels are actively sampling, cruise speeds are less than 5 kts, typically 2–4kts, a speed at which the probability of collision and serious injury of large whales is low. However, transit speed between active sampling stations will range from 10–12 kts, except in areas where vessel speeds are regulated to lower speeds.

Several mitigation measures, to which NEFSC-affiliated research vessels adhere, were implemented to minimize the risk of vessel collisions with right whales. Other species also benefit. The compliance guide for the right whale ship strike reduction rule states that all vessels 19.8m in overall length or greater must slow to speeds of 10 kts or less in seasonal management areas. Northeast U.S. Seasonal Management Areas include: Cape Cod Bay (1 Jan–15 May), off Race Point (1 Mar–30 Apr) and GSC (1 Apr–31 July). Mid-Atlantic Seasonal Management Areas include several port or bay entrances from 1 November to 30 April. When operating in these Seasonal Management Areas, Dynamic Management Areas, or in the vicinity of right whales or surface active groups of large baleen whales the vessel’s speed will not exceed 10 kts. The purpose of this mandatory regulation is to reduce the likelihood of deaths and serious injuries to these endangered whales that result from collisions with a vessel (78 FR 73726, December 9, 2013). Further, because vessels of all sizes can strike a whale, NEFSC research vessels will also reduce speed and change course in the vicinity of resting groups of large whales.

As noted above, if marine mammals are sighted prior to deployment of the trawl net, the vessel may be moved away from the animals to a new station at the discretion of the OOC. At any time during a survey or in transit, any crew member that sights marine mammals that may intersect with the vessel course will immediately communicate their presence to the bridge for appropriate course alteration or speed reduction as possible to avoid incidental collisions.

11.2. Dredges (Hydraulic, New Bedford-type, Commercial, and Naturalist)

11.2.1. Monitoring Methods

The monitoring procedures for dredge gear are the same as described for trawl gear.

11.2.2. Operational Procedures

The "move-on" rule and other decisions regarding the best course of action to avoid potentially adverse interactions with protected species are similar to those as described for trawl gear.

11.3. Longline Surveys (Pelagic or Demersal)

11.3.1. Monitoring Methods

There have been no marine mammal mortalities, serious injury, or Level A takes associated with this gear. Longline surveys are conducted aboard smaller vessels and with fewer crew than most trawl surveys but the monitoring procedures for longline gear are the same as described for trawl gear. Once the longline gear is set, the crew continually monitors the set for protected species that may interact with the gear or for signs that protected species may be entangled in the gear. No longline sets are made if marine mammals or other protected species have been sighted and are at risk of interacting with gear. The move-on rule is implemented if these taxa are present, and the CS, watch leader, and OOD uses professional judgment to minimize the risk to protected species from potential gear interactions.

11.3.2. Operational Procedures

The precautions for setting longline gear are similar to those described for trawl gear; longline sets may be delayed if marine mammals have been detected near the vessel in the 15 minutes prior to setting the gear (The Apex Predators Bottom Longline Coastal Shark Survey uses a one nautical mile radius around the vessel as a guide for this decision). The vessel may be moved to a new location if marine mammals are present, and the OOD uses professional judgment to minimize the risk to marine mammals from potential gear interactions.

During longline sets, the OOD, CS, and crew standing watch will monitor the gear as best as possible to look for hooked, trapped, or entangled marine mammals and other protected species.

NEFSC longline sets are conducted with either drifting pelagic gear marked at both ends with high flyers or radio buoys and at specific intervals throughout the line with buoys or bottom set gear also marked at both ends with high flyers and buoys at specific intervals throughout the line (Appendix B). The COASTSPAN surveys use circle hooks; 12/0 Mustad circle hooks for juveniles, and 15/0 or 16/0 circle hooks for larger fish. For the smaller gear a 30 minute soak time is used; soak time for larger gear ranges from 40 minutes to 2 hours.

NEFSC longline protocols specifically prohibit chumming (releasing additional bait to attract target species to the gear). Bait is removed from hooks during retrieval and retained on the vessel until all gear is removed from the area. The crew will not discard offal or spent bait while longline gear is in the water to reduce the risk of marine mammals detecting the vessel or being attracted to the area.

If marine mammals are detected while longline gear is in the water, the OOD exercises similar judgments and discretion to avoid incidental take of marine mammals as described for trawl gear. The species, number, and behavior of the marine mammals are considered along with the status of the ship and gear, weather and sea conditions, and crew safety factors.

If marine mammals are present during setting operations, immediate retrieval or halting the setting operations may be warranted. If setting operations have been halted due to the presence of marine mammals, resumption of setting will not begin until no marine mammals have been observed for at least 15 minutes within 1nm of the vessel. When visibility allows, the OOD, CS, and crew standing watch will conduct set checks every 15 minutes to look for hooked, trapped, or entangled marine mammals.

If marine mammals are present during retrieval operations, haul-back will be postponed until the OOD determines that it is safe to proceed. Marine mammals caught during longline sampling are typically only caught during retrieval, so extra caution must be taken during this phase of sampling.

11.4. Fyke Nets

11.4.1. Monitoring Methods

Fyke nets are bag-shaped nets which are held open by frames or hoops. The fyke nets used in NEFSC survey activities are constructed of successively smaller plastic coated square metal tube frames that are covered with mesh net (0.6 centimeters for small, 1.9 centimeters for large). Each net has two throats tapering to a semi-rigid opening. The final compartment of the net is configured with a rigid framed live box (2 x 2 x 3 meters) at the surface for removal of catch directly from above without having to retrieve the entire net. Fyke nets are normally set inshore by small boat crews, who will visually survey areas prior to deployment of nets.

11.4.2. Operational Procedures

A 2-m fyke net will be deployed with a marine mammal excluder device that reduces the effective mouth opening to <15 cm. The exclusion device consists of a grate the dimensions of which were based on exclusion devices on Penobscot Hydroelectric fishway facilities that are four to six inches and allow for passage of numerous target species including river herring, eels, striped bass, and adult salmon. The 1-m fyke net does not require an excluder device as the opening is 12 cm. These small openings will prevent marine mammals from entering the nets.

Monitoring is done prior to setting and during net retrieval. Monitoring/retrieval is conducted every 12 to 24-hour soak period. If marine mammals are in close proximity (~100 m) of the setting location, the field team will make a determination if the set location needs to be moved. If marine mammals are observed to be interacting with the gear during the setting, it will be lifted and removed from the water.

11.5. Rotary Screw Trap

11.5.1. Monitoring Methods

Rotary screw traps (RSTs) enable live capture of smolts emigrating from several coastal rivers, including the Narraguagus, Penobscot, Pleasant, and Sheepscot Rivers in Maine. RSTs are used to estimate smolt populations, enumerate and sample smolts (and other co-occurring species), and to better understand factors that limit smolt production and migration success. Rotary screw traps (RST) are deployed in April and removed according to sampling schedule (generally June). Sites are visually surveyed for marine mammals prior to set, and the traps are tended daily by sampling crews. Sampling period can be modified (shortened), delayed, or concluded depending on the numbers of marine mammals nearby and their potential for interacting with the gear, as determined by the professional judgment of the researchers. Under most conditions the live car (i.e., catch holding pen) is about 75 percent full of water, which would allow trapped mammals to breath.

11.5.2. Operational Procedures

RSTs are made of heavy gage aluminum and are anchored to trees, ledge, or boulders within the river/estuary using six strand 9.5 mm (3/8 in) steel cable. Traps operated by the NEFSC are in three sizes 1.2 m (4 ft), 1.5 m (5 ft) and 2.4 m (8 ft). RST tending schedules are adjusted according to conditions of the river /estuary and threats to protected species (i.e., presence of ESA-listed fish or marine mammals in the area). Sampling period can be modified (shortened), delayed, or concluded according to the threat to Atlantic salmon or other protected species.

11.6. Gillnet

11.6.1. Monitoring Methods

Gillnets consist of vertical netting held in place by floats and weights to selectively target fish of uniform size depending on the netting size. A specific mesh size will catch a target species of a limited size range, allowing this gear type to be very selective. Generally, the types of gillnets used in NEFSC survey activities are anchored sinking gillnets. The monitoring procedures for gillnets are similar to those described for trawl gear. The NEFSC does not propose to use pelagic gillnets in any survey.

11.6.2. Operational Procedures

The following operational mitigation procedures for the use of gillnet (including trammel nets) by the NEFSC are consistent with those implemented through regulation by the SEFSC on May 6, 2020 (85 FR 27028).

Similar to other survey types dedicated marine mammal observation monitoring will begin 15 minutes prior to deploying the gear and continue through deployment and haulback. Delay or pull all gear immediately and implement the move-on rule if marine mammal is at-risk of entanglement. If a marine mammal is sighted during the monitoring period the nets are not deployed until the animal has left the area, is on a path away from where the net would be set, or has not been resighted within 15 minutes.

The exception is for animals that, because of their behavior, travel vector or other factors, do not appear to be at risk of interaction with the gillnet gear. If no marine mammals are present, the gear is set and monitored during the soak. If a marine mammal is sighted during the soak and appears to be at risk of interaction with the gear, then the gear is pulled immediately. If fishing operations are halted, operations resume when animal(s) have not been sighted within 15 minutes or are determined to no longer be at risk

Conduct gillnet and trammel net research activities during daylight hours only and soak times will be limited to the least amount of time required to conduct sampling;

For the COASTSPAN surveys, the NEFSC will actively monitor for potential bottlenose dolphin entanglements by hand-checking the gillnet every 20 minutes by lifting the foot net. Pull gear immediately if disturbance in the nets is observed. In the unexpected case of an entanglement, the NEFSC would request and arrange for expedited genetic sampling in order to determine the stock and would photograph the dorsal fin and submit to the Southeast Stranding Coordinator for identification/matching to bottlenose dolphins in the Mid-Atlantic Bottlenose Dolphin Photo-identification Catalog. Additional gillnet mitigation measures are shown in Table 11-1.

NEFSC-affiliated cooperative research projects involving commercial vessels and gear, as well as the NEFOP Observer Training Gillnet Surveys currently deploy acoustic pingers on anchored sinking gillnets in areas where they are required by commercial fisheries to comply with requirements in the Harbor Porpoise Take Reduction Plan (50 CFR 229.33). A pinger is an acoustic deterrent device which, when immersed in water, broadcasts a 10 kHz (±2 kHz) sound at 132 dB (±4 dB) re 1 µPa at 1 m, lasting 300 milliseconds (±15 milliseconds), and repeating every 4 seconds (±.2 seconds). Pingers are designed to decrease the probability of entanglement or unintended capture of marine mammals. Pingers will be deployed during all gillnet operations. Following implementation of the Harbor Porpoise Take Reduction Plan (HPTRP) along the northeastern United States (63 FR 66464, 2 December 1996) acoustic pingers were shown to effectively deter harbor porpoise from becoming entangled in the Gulf of Maine gillnet fishery (Kraus, Read et al. 1997, Dawson, Northridge et al. 2013).

11.7. Plankton Nets, Oceanographic Sampling Devices, ROVs, and Video Cameras

The NEFSC deploys a wide variety of gear to sample the marine environment during all of their research cruises. These types of sampling devices are not considered to pose any risk to protected species and are therefore not subject to specific mitigation measures. Many of these sampling methods (plankton nets, CTDs) are employed during other surveys such as the groundfish surveys and, as a result, all the mitigation measures in place for those surveys also include these sampling methods. Generally, similar to the mitigation methods described for the trawl surveys, and other survey types, the OOD and crew monitor for any unusual circumstances that may arise at a sampling site and use their professional judgment and discretion to avoid any potential risks to protected species during deployment of all research equipment.

11.8. Handling Procedures for Incidentally Captured Individuals

The NEFSC has implemented a number of handling, data collection and reporting protocols to minimize potential harm to protected species that are incidentally taken during the course of fisheries research activities. In general, protocols have already been prepared for use on commercial fishing vessels. Because many parallels exist between commercial fishing operations and NEFSC fisheries research, the NEFSC is adopting these protocols for use on its surveys on NOAA and charter vessels. In addition to the benefits implementing these protocols are believed to have on the animals through increased post-release survival, the NEFSC believes adopting these protocols for data collection will also increase the information on which “serious injury” determinations are based and improve scientific knowledge about protected species that interact with fisheries research gears and the factors that contribute to these interactions.

11.8.1. Protected Species Handling

In general, following a “common sense” approach to handling protected marine mammal species will present the best chance of minimizing injury to the animal and of decreasing risks to scientists, officers and crew. There are inherent safety concerns associated with handling/disentangling marine mammals, so using judgment and ensuring human safety is paramount.

NEFSC researchers will be provided with the guide to "Identification, Handling and Release of Protected Species". See Appendix D of NMFS (2016) for specific guidance on protected species handling. In addition to including this guide, Appendix D.1 of NMFS (2016) contains data forms NEFSC will use for protected species interactions. The guide demonstrates how to identify different species, bring an individual aboard a vessel, assess the level of consciousness, remove fishing gear, return an individual to water and log activities pertaining to the interaction. The handling guide for marine mammals demonstrates how to handle, disentangle, and also record interaction activities for small whales and dolphin encounters.

For longline surveys, the NEFSC will record interaction information on the Marine Mammal Biological Data Form prepared by the Pacific Islands Regional Office Longline Observer Program (NMFS 2016, Appendix D.2). To aid in serious injury determinations and comply with the current NMFS Serious Injury Guidelines, researchers will also answer a series of supplemental questions on the details of marine mammal interactions. Forms and supplemental questions are provided in (NMFS 2016, Appendix D.3). For trawl surveys, the NEFSC will follow the same protocol as mentioned above for longline surveys.

Finally, for any marine mammals that may be seriously injured or killed during fisheries research activities, scientists will collect data and samples pursuant to the NEFSC MMPA and ESA research and salvage permit and to the "Detailed Sampling Protocol for Marine Mammal and Sea Turtle Incidental Takes on NEFSC Research Cruises" (Appendix D). Although the NEFSC is taking several significant measures to avoid incidentally killing marine mammals during the course of its fisheries research it also recognizes the scientific value of collecting samples from these animals to learn more about wild marine mammal populations.

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12. MITIGATION MEASURES TO PROTECT SUBSISTENCE USES

The proposed activity will take place in the Northeast LME and adjacent offshore region, and it would not affect Arctic marine mammals that are harvested for subsistence use. Therefore, there are no relevant subsistence uses of marine mammals implicated by this action as identified in MMPA Section 101(a)(5)(A)(i).

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13. MONITORING AND REPORTING

13.1 Monitoring

Marine mammal monitoring measures are described in Section 11.1 and Table 11-1. Marine mammal watches are a standard part of fisheries research activities, particularly when using gears such as trawls, gillnets, longlines, and fyke nets that would be expected, or are known to interact with marine mammals. While underway, watches are generally conducted by vessel crew or members of the scientific party (those navigating or working on the vessel and other crew) at all times when the vessel is being operated. These individuals are referred to as 'watch-standers'. The primary focus for this type of watch is to avoid striking marine mammals and to generally avoid navigational hazards. The watch-standers do not record or report marine mammal sightings except when gear is being deployed or retrieved. In most cases, these watches are not conducted by dedicated staff; these personnel may have other duties associated with navigation and other vessel operations.

Observing and monitoring for marine mammals is conducted prior to deploying longlines, purse seines and trawl gear, and continues until gear is returned on board. Observations and monitoring are conducted by dedicated scientists with no other responsibilities during the watch period. If marine mammals are sighted near the longline or mid-water trawl survey location and are at risk of entanglement, then the sampling station is either moved, delayed until the mammals have moved from the area, or canceled. However, if small numbers of pinnipeds (generally less than five) are seen in the vicinity but do not appear to be in the direct way of the setting operation, the purse seine may be set. Observers record the species and number of animals present and their behaviors. This information can be valuable in understanding whether some species may be attracted to vessels or gears.

13.1. Reporting

The NEFSC will coordinate with the local Regional Stranding Coordinator and the NMFS Stranding Coordinator to report any unusual marine mammal behavior and any stranding, beached (alive or dead), or floating marine mammals that are encountered during field research activities. In addition, Cruise Leaders or Chief Scientists provide reports to NEFSC leadership and to the OPR by event, survey leg and cruise. When marine mammals interact with the gear and are killed or released alive, the report will fully describe any observations of the animals, the context (vessel speed and conditions), decisions made and rationale for decisions made in vessel and gear handling. The circumstances of these events are critical in enabling NEFSC and the OPR to better evaluate the conditions under which takes are most likely occur and potentially avoid some of these situations in the future.

The NMFS has established a formal incidental take reporting system, the PSIT database, requiring that incidental takes of protected species be reported within 48 hours of the occurrence. The PSIT generates automated messages to agency leadership and other relevant staff and alerts them to the event and that updated information describing the circumstances of the event have been inputted into the database. The PSIT and Chief Scientist reports represent not only a valuable real-time reporting and information dissemination tools, but also serve as an archive of information that could be mined at later points in time to study why takes occur, by species, gear, etc. Ultimately, the NEFSC would hope that a single reporting tool capable of disseminating and archiving all relevant details of protected species interactions during fisheries research activities could be developed and implemented. Until that time, the NEFSC will both input data into the PSIT database and provide detailed event reports.

A final and equally important component of reporting being implemented by the NEFSC will facilitate serious injury (SI) determinations for marine mammals that are released alive. As discussed in Section 11, NEFSC is requiring that scientists complete data forms (already developed and used by commercial fisheries observer programs) and address supplemental questions, both of which have been developed to aid in SI determinations. The NEFSC understands the critical need to provide scientists who make serious injury determinations with as much relevant information as possible about marine mammal interactions to inform their decisions.

14. SUGGESTED MEANS OF COORDINATION

The NMFS provides annual funding to universities, research institutions, Federal laboratories, private companies, and independent researchers around the world to study marine mammals. The NEFSC actively participates on Take Reduction Teams and in Take Reduction Planning, and conducts a variety of studies, convenes workshops and engages in other activities aimed at developing effective bycatch reduction technologies, gears and practices.

Under the conditions of the 2016 LOA, NEFSC is required to conduct annual environmental compliance training for chief scientists and other personnel responsible for implementing mitigation measures, data collection and reporting requirements. A portion of the training must be dedicated to discussion on the use of best professional judgement to avoid marine mammal interactions to gain an understanding of successful versus unsuccessful decisions. In addition, annual forums with scientists are held post-completion of the year's field season to discuss the following: 1) an overview of current mitigation measures and effect on the current year's data collection; 2) the need/want for improvements of environmental compliance and incidental take authorization measures; and 3) implementation of new or additional mitigation measures to assist in reducing take while achieving survey goals.

To reduce marine mammal takes over time, the NEFSC maximizes efficient use of charter and NOAA ship time, and engages in operational planning with the Northeast Fisheries Science Center to delineate respective research responsibilities and to reduce duplication of effort. The NEFSC implements an adaptive management approach to evaluating actual takes and continues to revisit mitigation measures. In consultation with Office of Protected Resources, if actual takes exceed those estimated in Section 6 of this application NEFSC may change current mitigation strategy to improve efficacy or to implement additional measures to reduce take levels.

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APPENDIX A

Marine Mammal Densities

Comparison of Densities from the 2016 Final Rule (81FR53061) to Current Density Estimates (Sources Cited)

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Marine Mammal	Current Estimated Abundance	Avg Density East Coast (#/km2)	Density from 2014 LOA Application LME Region/Area (#/km2)	Density from 2014 LOA Application Offshore Region (#/km2)	Stock Area	Notes	Sources
Cetaceans							
Atlantic spotted dolphin	39,921		0.0000	0.0208	Western North Atlantic		Cetacean Mapping Tool (http://seamap.env.duke.edu/models/mapper/USECGOM)
Spring Summer Fall		0.0181 0.0241 0.0202					
Atlantic white-sided dolphin	93,233		0.0244	0.0000	Western North Atlantic		Cetacean Mapping Tool
Spring Summer Fall		0.0199 0.0417 0.0453					
Beaked Whales Cuvier's beaked whale	21,818	0.0062	0.0021	0.0156	Western North Atlantic	Abundance Estimate includes Gervais' beaked whales and Blainville's beaked whales for the Gulf of Mexico stocks, and all species of undifferentiated beaked whales in the Atlantic. Density for Cuvier's from Sea Map is annual average for EC.	Cetacean Mapping Tool
Blainville's beaked whale Gervais' beaked whale Sowerby's beaked whale True's beaked whale		0.0046				Density for all others in EC is N/A but was recorded as an annual average of 0.00 415 in the Gulf of Mexico and abundance was recorded as 2,910	Cetacean Mapping Tool

Marine Mammal	Current Estimated Abundance	Avg Density East Coast (#/km2)	Density from 2014 LOA Application LME Region/Area (#/km2)	Density from 2014 LOA Application Offshore Region (#/km2)	Stock Area	Notes	Sources
Blue whale	402	0.000009	0.0000	0.0026	Western North Atlantic. This represents N_{min}. N_{best} is reported as unknown.	Annual density only for EC	Cetacean Mapping Tool
Bottlenose dolphin *Coastal stocks*	N. Migratory 6,639 S. Migratory 3,715 SC/GA 6,027 N. FL 877				Western North Atlantic, northern and southern migratory coastal SC/G, N. FL		
Spring Summer Fall		0.0315 0.1359 0.0957					Cetacean Mapping Tool
Offshore stock, western North Atlantic	62,851		0.0060	0.0526	Western North Atlantic, offshore		
Spring Summer Fall		0.1611 0.1183 0.1615					Cetacean Mapping Tool
Clymene dolphin	4,921	0.0032			Western North Atlantic	Average Density is annual for the EC. Abundance is from the OBIS-SEAMAP database	

Marine Mammal	Current Estimated Abundance	Avg Density East Coast (#/km2)	Density from 2014 LOA Application LME Region/Area (#/km2)	Density from 2014 LOA Application Offshore Region (#/km2)	Stock Area	Notes	Sources
Fin whale	7,418		0.0036	0.0007	Western North Atlantic		
Spring Summer Fall		0.0042 0.0048 0.0041					Cetacean Mapping Tool
Fraser's dolphin	Unknown	0.0004			Western North Atlantic	Average Density is annual for the EC	Cetacean Mapping Tool
Harbor porpoise (GOM/ Bay of Fundy)	95,543		0.0193	0.0000	GOM/Bay of Fundy		
Spring Summer Fall		0.0339 0.0403 0.0288					Cetacean Mapping Tool
Humpback whale (GOM Stock)	1,396		0.0009	0.0006	GOM		
Spring Summer Fall		0.0007 0.0015 0.0016					Cetacean Mapping Tool
Killer whale (Western North Atlantic)	12,188	0.000009				EC density is annual average. Abundance from OBIS-SEAMAP data for EC	Cetacean Mapping Tool
Kogia sp. Pygmy sperm whale Dwarf sperm whale	7,750	0.0050	0.00002	0.0020	Western North Atlantic	Estimate includes dwarf and pygmy sperm whales. Density is annual average	Cetacean Mapping Tool
Melon-headed whale	1,175	0.0010			Western North Atlantic	EC density is annual average. Abundance from OBIS-SEAMAP data for EC	Cetacean Mapping Tool

Marine Mammal	Current Estimated Abundance	Avg Density East Coast (#/km2)	Density from 2014 LOA Application LME Region/Area (#/km2)	Density from 2014 LOA Application Offshore Region (#/km2)	Stock Area	Notes	Sources
Minke whale	24,202		0.0066	0.0000	Canadian east coast		
Spring Summer Fall		0.0015 0.0020 0.0017					Cetacean Mapping Tool
North Atlantic Right Whale	428		0.0018	0.0000	Western North Atlantic		Pettis, H.M. et al. 2020. North Atlantic Right Whale Consortium 2019 Annual Report Card. Report to the North Atlantic Right Whale Consortium; Fitzgerald 2018 as cited in 2019 SAR
Spring Summer Fall		0.0030 0.0020 0.0020					(Roberts, Schick et al. 2020)
Northern bottlenose whale	90	0.00009	0.0000	0.0017	Western North Atlantic	Average Density is annual for the EC. Abundance is from OBIS-SEAMAP data for the EC.	Cetacean Mapping Tool
Pantropical spotted dolphin	6,593	0.0015	0.0000	0.0000	Western North Atlantic	Average Density is annual for the EC.	Cetacean Mapping Tool
Pilot Whales Long-finned pilot whale	39,215	0.0220	0.0345	0.0256	Western North Atlantic	Estimate includes all *Globicephala sp.*, though it is presumed that only short-finned pilot whales are present in the Gulf of Mexico.	Cetacean Mapping Tool
Short-finned pilot whale	28,924	0.0220	0.0345	0.0256			

Marine Mammal	Current Estimated Abundance	Avg Density East Coast (#/km2)	Density from 2014 LOA Application LME Region/Area (#/km2)	Density from 2014 LOA Application Offshore Region (#/km2)	Stock Area	Notes	Sources
Pygmy killer whale	Unknown	0.0030			Density for EC not available – use killer whale as a proxy?	GOM annual average density from OBIS-SEAMAP is 0.003/km2	Cetacean Mapping Tool
Risso's dolphin	35,493		0.0020	0.0844	Western North Atlantic	Mean group sizes for species derived from Kenney and Vigness-Raposa (2010)	Kenney RD, Vigness-Raposa KJ (2010) Marine mammals and sea turtles of Narragansett Bay, Block Island sound, Rhode Island sound, and nearby waters: an analysis of existing data for the Rhode Island Ocean special area management plan. Technical report no. 10. Coastal Resources Management Council, Wakefield, p 337.
Spring Summer Fall		0.0042 0.0128 0.0063					Cetacean Mapping Tool
Rough-toothed dolphin	136	0.0010	0.0000	0.0016	Western North Atlantic	Average Density is annual for the EC.	Cetacean Mapping Tool
Sei whale	6,292		0.0027	0.00004	Nova Scotia		
Spring Summer Fall		0.0006 0.0008 0.0003					Cetacean Mapping Tool
Short-beaked common dolphin	172,825		0.2115	0.1875	Western North Atlantic		
Spring Summer Fall		0.0605 0.0716 0.0891					Cetacean Mapping Tool

Marine Mammal	Current Estimated Abundance	Avg Density East Coast (#/km2)	Density from 2014 LOA Application LME Region/Area (#/km2)	Density from 2014 LOA Application Offshore Region (#/km2)	Stock Area	Notes	Sources
Sperm whale	4,349		0.00001	0.0152	North Atlantic		
Spring Summer Fall		0.0019 0.0056 0.0018					Cetacean Mapping Tool
Spinner dolphin	4,102	0.0002			Western North Atlantic	Average Density is annual for the EC.	Cetacean Mapping Tool
Striped dolphin	67,036	0.0614	0.0000	0.0016	Western North Atlantic	Average Density is annual for the EC.	Cetacean Mapping Tool
White-beaked dolphin	536,016	0.00003	0.0081	0.0000	Western North Atlantic	Average Density is annual for the EC.	Cetacean Mapping Tool
Pinnipeds							
Harbor seal	75,834	0.2844	0.2844		Western North Atlantic		
Gray seal	27,131	0.0948			Western North Atlantic		

APPENDIX B

Gear and Vessel Descriptions

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1. Trawl Nets

A trawl is a funnel-shaped net towed behind a boat to capture fish. The codend, or 'bag,' is the fine-meshed portion of the net most distant from the towing vessel where fish and other organisms larger than the mesh size are retained. In contrast to commercial fishery operations, which generally use larger mesh to capture marketable fish, research trawls often use smaller mesh to enable estimates of the size and age distributions of fish in a particular area. The body of a trawl net is generally constructed of relatively coarse mesh that functions to gather schooling fish so they can be collected in the codend. The opening of the net, called the 'mouth', is extended horizontally by large panels of wide mesh called 'wings.' The mouth of the net is held open by hydrodynamic force exerted on the trawl doors attached to the wings of the net. As the net is towed through the water, the force of the water spreads the trawl doors horizontally apart.

The trawl net is usually deployed over the stern of the vessel, and attached with two cables, or 'warps,' to winches on the deck of the vessel. The cables are played out until the net reaches the fishing depth. Commercial trawl vessels may travel at speeds between two and five knots while towing the net for up to several hours, whereas most NEFSC trawl surveys involve tow speeds from 1.4 to 4.0 knots, and tow durations from 15 to 60 minutes. The speed and duration of the tow depend on the purpose of the trawl, the catch rate, and the target species. At the end of the tow, the net is retrieved and the contents of the codend are emptied onto the deck. For research purposes, the speed and duration of the tow and the characteristics of the net must be standardized to allow meaningful comparisons of data collected at different times and locations. Active acoustic devices incorporated into the research vessel and the trawl gear monitor the position and status of the net, speed of the tow, and other variables important to the research design.

NEFSC research trawling activities use both 'pelagic' (surface or mid-water) trawls, which are designed to operate at various depths within the water column, as well as 'bottom' trawls, which are designed to capture target species at or near the seafloor (see Figure B-1). Marine mammals can become entangled by trawl gear when swimming with risks differing widely between species. Many species of marine mammals forage and swim at mid-water depths, putting them at risk of being captured or entangled in pelagic trawls. In the Northeast United States, pilot whales and white-sided dolphins are particularly susceptible to being caught in mid-water trawls in nearshore areas. Species that forage on or near the seafloor are at risk of being captured or entangled in bottom trawl netting or tow lines. Humpback whales in the southern Gulf of Maine commonly feed along the seafloor (Ware et al. 2013), making them vulnerable to entanglement in bottom trawl gear. There is also potential for marine mammals to interact with bottom trawl equipment near the surface of the water, as the gear is retrieved from fishing depth and brought aboard the vessel. Historically, the NEFSC has recorded marine mammal interactions with both bottom trawl and pelagic trawl nets (Section 4.2.4).

4-seam, 3-bridle bottom trawl

Several NEFSC research programs utilize a 4-seam, 3-bridle bottom trawl, manufactured using 12 centimeter and 6 cm mesh. The effective mouth opening of the 4-seam, 3-bridle bottom trawl is approximately 70 square meters (14 meter spread x 5 meters high), spread by a pair of trawl doors. The footrope of the trawl is 89 feet in length, and is ballasted with heavy rubber discs or roller gear. The head rope is approximately 79 feet in length and is supported by 60 Nokalon #508, eight inch center hole, orange trawl floats. For certain research activities, a liner may be sewn into the codend to minimize the loss of small fish.

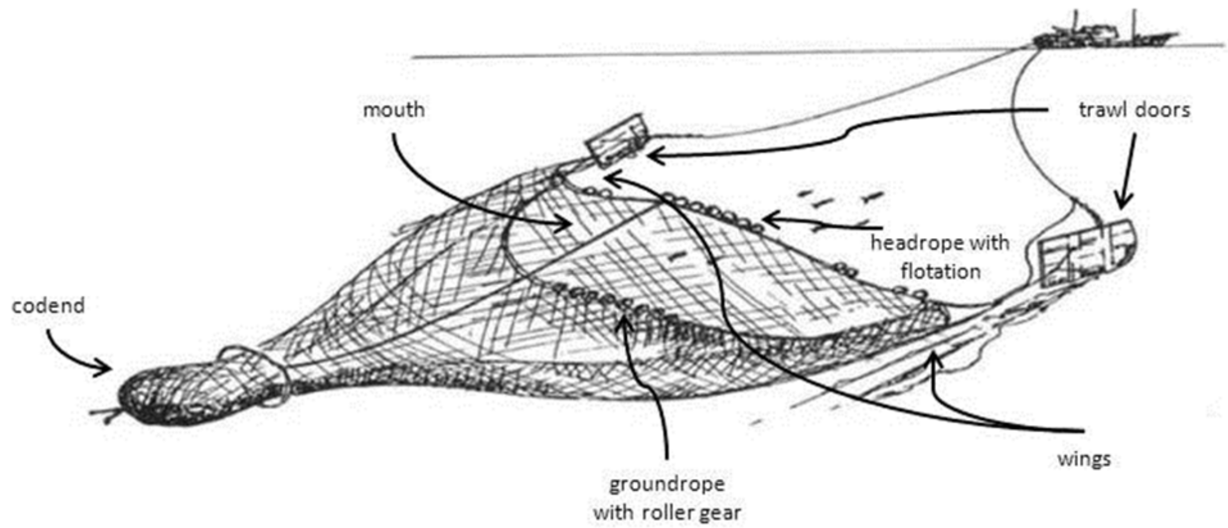

Figure B-1. Bottom trawl illustration

NEFSC uses the 4-seam, 3-bridle bottom trawl for a variety of research programs along the U.S. east coast. The objectives of these cruises include tracking mature animals, determination of juvenile abundance, assessment of habitat distribution, and collection of data on seasonal migrations. The trawl is fished at depth for 15–60 minutes at a time at speeds of 1.5–4 knots.

Midwater Rope Trawl

the High Speed Midwater Rope Trawl (Gourock HSMRT design R202825A) used for the NEFSC's fisheries acoustics surveys employs a four-seam box design with a 174 feet headrope, footrope, and breastlines (see Figure B-2). The mouth opening of the HSMRT is approximately 13.3 meters vertical and 27.5 meters horizontal. Once the net is deployed, changes in the position of the net in the water column are made by increasing or decreasing the speed of the vessel, or by bringing in or letting out trawl wire. Active acoustics are also deployed to monitor the ship and net positions and status. As with bottom trawl nets, protected species may interact with pelagic trawl nets during the deployment and retrieval of the net when the net is at or near the surface of the water. However, because pelagic nets are operated above the seafloor, impacts related to bottom habitat degradation and interactions with bottom-dwelling species are minimal. Because pelagic trawl nets are not designed to contact the seafloor, they do not have bobbins or roller gear, which are often used to protect the foot rope of a 'bottom' trawl net as it is dragged along the bottom.

Figure B-2. Emptying the codend of the High Speed Midwater Rope Trawl
Credit: NEFSC Photo Archives.

Figure B-3. The Isaacs-Kidd Midwater Trawl (IKMT) net
Credit: Joe Warren, Stony Brook University

Other Towed Nets

In addition to the nets described above, NEFSC uses various small, fine-mesh, towed nets designed to sample plankton, small fish, and pelagic invertebrates. The Isaacs-Kidd Midwater Trawl (IKMT), shown in Figure B-3, is used to collect deep water biological specimens larger than those taken by standard plankton nets. The mouth of the net is approximately 1.5 meters wide by 2 meters high, and is attached to a wide, V-shaped, rigid diving vane that keeps the mouth of the net open and maintains the net at depth for extended periods (Yasook et al. 2007). The IKMT is a long, round net approximately 6.5 meters long, with a series of hoops decreasing in size from the mouth of the net to the codend that maintain the shape of the net during towing (Yasook et al. 2007). While most trawls must be towed at speeds of 1 to 2 knots because of the high level of drag exerted by the net in the water, an IKMT can be towed at speeds as high as five knots. The MOCNESS, or Multiple Opening/Closing Net and Environmental Sensing System, uses a stepping motor to sequentially control the opening and closing of the net. The MOCNESS uses underwater and shipboard electronics to control the device. The electronics system continuously monitors the functioning of the nets, frame angle, horizontal velocity, vertical velocity, volume filtered, and selected environmental parameters, such as salinity and temperature. The MOCNESS is used for specialized zooplankton surveys. Similarly, the Tucker trawl is an opening and closing mid-water zooplankton trawl. It is typically equipped with a full suite of instruments, including inside and outside flow meters, CTD, pitch sensor and stepper motor. The Tucker trawl used for NEFSC research surveys uses 333 micron plankton nets with 1.0 meter by 1.4 meter openings. The nets operate at a 45 degree angle during fishing which results in an effective fishing area of 1.0 square meter. The Tucker trawl is designed for deep oblique tows where up to three replicate nets can be sequentially operated by a double release mechanism. There has never been an interaction with a protected species for any of the gear types described in this paragraph during NEFSC research activity.

A beam trawl is a type of bottom trawl that uses a wood or metal beam to hold the net open as it is towed along the sea floor (see Figure B-4). The beam holds open the mouth of the net so that no trawl doors are needed. Beam trawls are generally smaller than other types of bottom trawls. Commercial beam trawls have beam lengths of up to 12 meters, while beam trawls for research purposes typically use beams two to four meters in length.

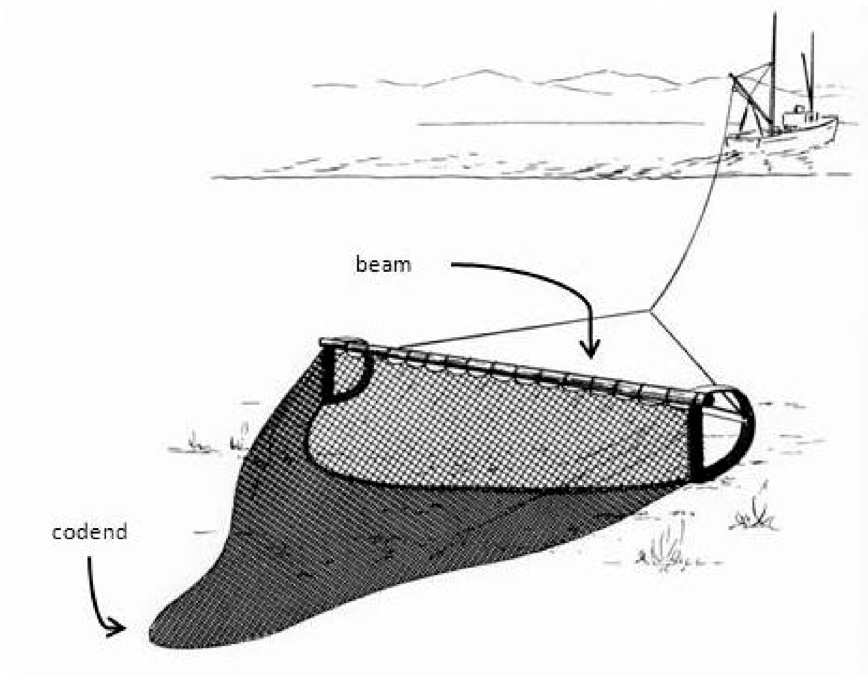

Figure B-4. Beam trawl illustration
Credit: FAO 2001

2. Fyke nets

Fyke nets are bag-shaped nets which are held open by frames or hoops. The fyke nets used in NEFSC survey activities are constructed of successively smaller plastic coated square metal tube frames that are covered with mesh net (0.6 centimeters for small, 1.9 centimeters for large). Two 9.1 meters wings extend from the opening of each fyke at an angle of approximately 30 degrees (Figure B-5). The wings have a weighted footrope and floats on the head-rope and are the same height (either 0.91 meters or 1.83 meters high) and comprised of the same net mesh as the fyke net itself. Each net has two throats tapering to a semi-rigid opening of 12.7 centimeters for the small net and 45.7 centimeters for the larger net. The fish pass through these throats before becoming trapped in the live box. For the large fyke, the final compartment of the net is configured with a rigid framed live box (2 x 2 x 3 meters) at the surface for removal of catch directly from above without having to retrieve the entire net.

A marine mammal excluder device is attached to the outer-most throat of the larger fyke to stop marine mammals from entering the net and becoming trapped. The exclusion device consists of a grate constructed of aluminum bars as shown in Figure B-6. The size of the openings is approximately 14 centimeters, which effectively prohibits marine mammals from entering the net. The dimensions of the grate openings were based on exclusion devices on Penobscot Hydroelectric fishway facilities that are four to six inches and allow for passage of numerous target species including river herring, eels, striped bass, and adult salmon.

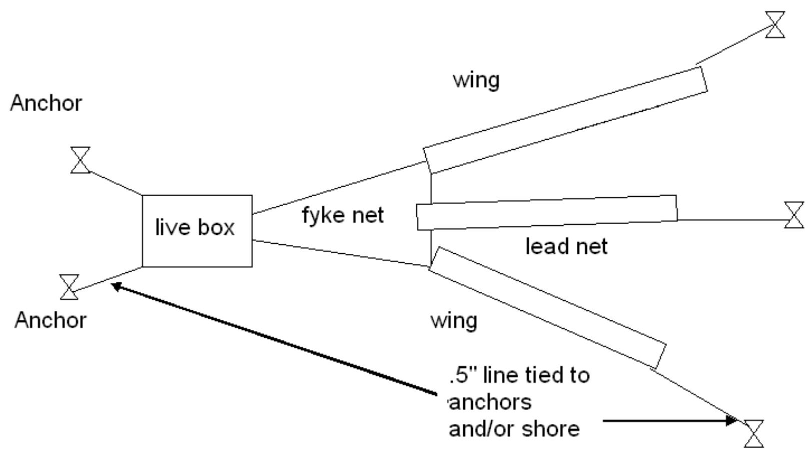

Figure B-5. Sketch of typical fyke net deployment

Orientation may be into, opposite, or perpendicular to flow as appropriate for site.

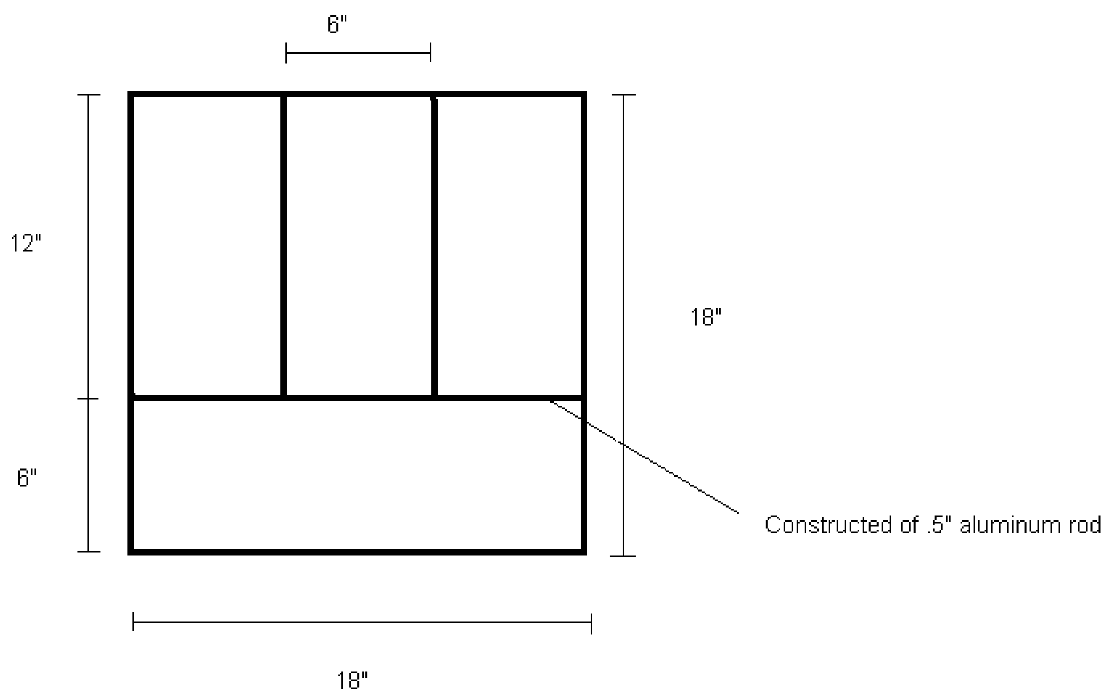

Figure B-6. Sketch of marine mammal excluder device used in the fyke net

The bottom of the grate is parallel to the net bottom as to not exclude small semi-benthic fish.

3. Gillnets

Gillnets consist of vertical netting held in place by floats and weights to selectively target fish of uniform size depending on the netting size (Walden 1996). Typical Gillnets are made of monofilament, multi-monofilament, or multifilament nylon constructed of single, double, or triple netting/paneling of varying mesh sizes, depending on their use and target species (Hovgård and Lassen 2000). A specific mesh size will catch a target species of a limited size range, allowing this gear type to be very selective.

The types of gillnets used in NEFSC survey activities are anchored sinking gillnets. Anchored sinking gillnets are fixed to the ocean floor or at a set distance above (typically in the lower one-third of the water column), held in place by anchors or ballasts with enough weight to counteract the buoyancy of the floats used to hold the net up (Nedelec and Prado 1990). Figure B-7 provides an example of an anchored sinking gillnet. NEFSC survey activities use gillnets that range from 50 to 325 feet in length, 8 to 10 feet in height, with mesh sizes from 6.5 to 12 inches. In some cases, gillnets may be configured in 10-panel strings totaling 3,000 feet long. All gillnets used in NEFSC research use weak links of particular strength and locations on the gear, as specified by the Large Whale Take Reduction Plan, in order to minimize the risk of large whales becoming entangled in the gear. Soak times for long-term surveys are typically 3 hours (Table 2.2-1) but short-term cooperative research projects have used soak times up to 96 hours (Table 2.2-2).

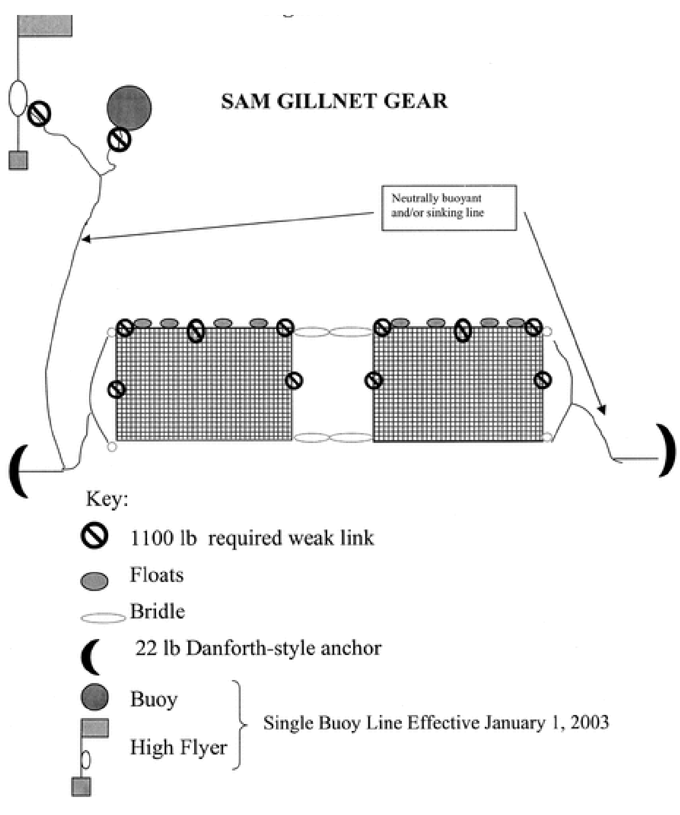

Figure B-7. Anchored sinking gillnet

Credit: 67 FR 1142

4. Pound nets

A pound net is a fixed fishing device that consists of poles or stakes secured into the bottom with netting attached. The structure includes a pound with a netting floor, a heart-shaped enclosure, and a straight wall or leader (Figure B-8). Pound nets are generally set close to shore and the leader is set perpendicular to the shore to guide migrating fish into the pound. The leader is a wall of mesh webbing that extends from the sea floor to approximately the sea surface and may be up to several hundred meters in length (Silva et al. 2011).

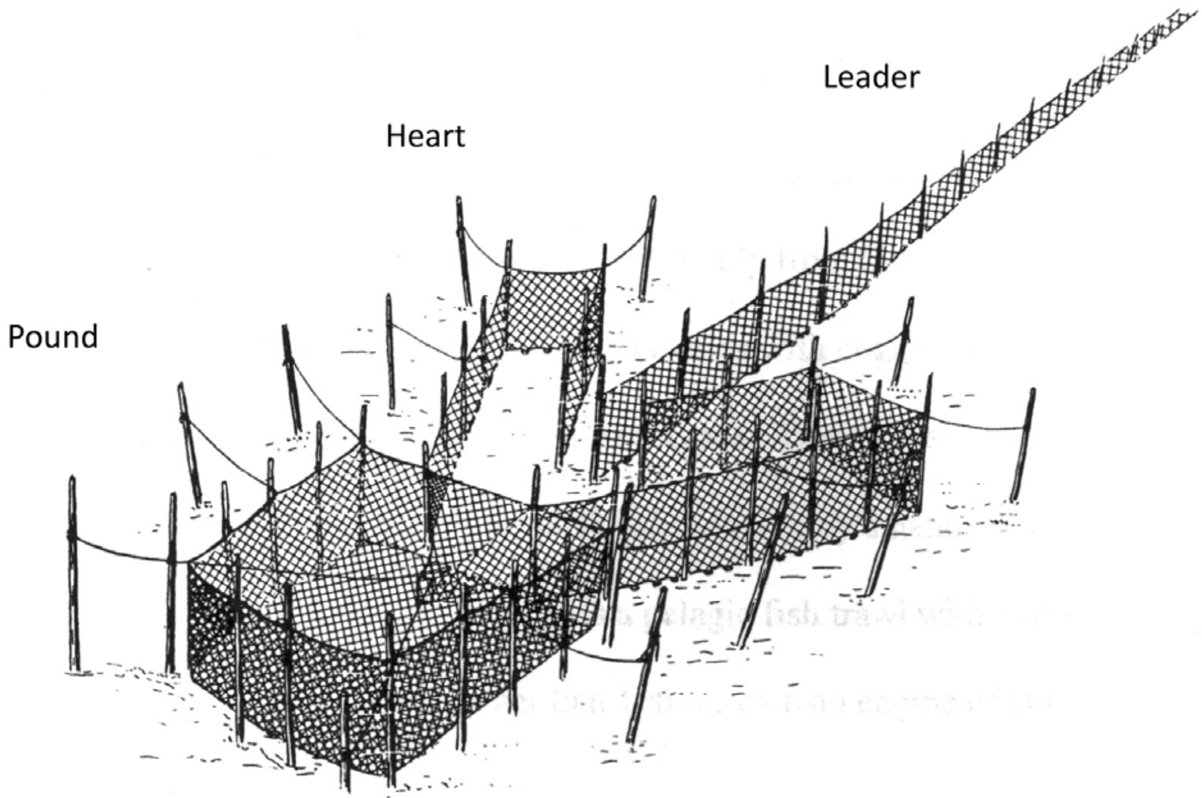

Figure B-8. Pound net diagram
Credit: Silva et al. 2011

Fish swimming laterally along the shoreline encounter the leader and generally turn towards deeper water to circumvent the obstruction (DeAlteris *et al.* 2005). The heart and pound portions of the net, located at the deep end of the leader, direct and trap the fish so they cannot escape. The pound is usually a rectangular enclosure 6 to 13 meters long constructed of small mesh (DeAlteris *et al.* 2005). Pound nets are relatively non-selective, and are used to capture several species of live fish (DeAlteris et al. 2005). NEFSC has previously conducted research focused on the relationships between pound net leader design and bycatch of sea turtles and other protected species (DeAlteris *et al.* 2005; Silva *et al.* 2011).

5. Longline

Longline vessels fish with baited hooks attached to a mainline or 'groundline'(see Figure B-9). The length of the longline and the number of hooks depend on the species targeted, the size of the vessel, and the purpose of the fishing activity. Commercial longlines can be over 62 miles long and can have thousands of hooks attached, however longlines used for research purposes are usually shorter. The longline gear used for NEFSC research purposes typically uses 100-400 hooks attached to a line 2 to 10 miles in length, except for the small-scale Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) surveys that typically use 25-50 hooks attached to a 1,000 feet mainline. Hooks are attached to the longline by another thinner line called a 'gangion' The length of the gangion and the distance between gangions depends on the purpose of the fishing activity.

Depending on the fishery, longline gear can be deployed on the seafloor (bottom longline), in which case weights are attached to the mainline, or longline gear can be deployed near the surface of the water (pelagic longline), in which case buoys are attached to the mainline to provide flotation and keep the baited hooks suspended in the water. Radar reflectors, radio transmitters, and light sources are often used to help fishers determine the location of the longline gear prior to retrieval. Light sources may also be attached to the gangions to attract target species to the gear. Because pelagic longline gear is not anchored to the seafloor, it floats freely in the water, and may drift considerable distances between the time of deployment and the time of retrieval.

'Yankee' swordfish-style pelagic longline gear consists of 5/16 inches tarred nylon mainline, with 24-33 foot gangions composed of 13 feet of 3/16 inches nylon, 7 feet of 3/32 inches stainless steel leader, and a #40 Japanese tuna hook. For research purposes, the hooks are baited with whole Atlantic mackerel, and attached at 170 feet intervals. Floats are attached at five hook intervals on 40 feet float lines. Flag buoys, or 'high flyers,' are located at each end of the gear.

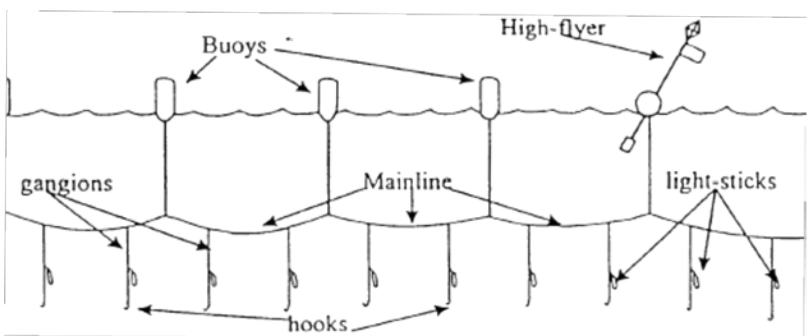

Figure B-9. Pelagic longline gear diagram

'Florida' commercial-style bottom longline gear consists of 940-pound test monofilament mainline with 12 feet gangions made of 730-pound test monofilament with a longline clip at one end and a 3/0 shark hook at the other. Hooks are baited with chunks of spiny dogfish and are attached to the mainline at roughly 60 feet intervals. Five-pound weights are attached at 15 hook intervals, and 15-pound weights and small buoys are attached at 50 hook intervals. To ensure that the gear fishes on the bottom, 20-pound weights are placed at the beginning and end of the mainline after a length of line two to three times the water depth is deployed. A 20 feet flag buoy ('high flyer') equipped with radar reflectors and flashing lights is attached to each end of the mainline. The flag buoys used for bottom longline gear use long buoy lines to allow the weighted groundline to rest on the seafloor while the attached buoys float on the surface to enable retrieval of the gear.

The small-scale COASTSPAN surveys use two types of anchored bottom longline gear: one for targeting small juvenile sharks and the other targets large juveniles and adult sharks. The juvenile gear consists of 1000 feet of 1/4 inches braided nylon mainline with at least 200 feet of additional line on each side for scope, and 50 gangions attached at 20 feet intervals, comprised of 12/0 Mustad circle hooks with barbs depressed, 20 inches 1/16 stainless cable, and 40 inches of 1/4 inch braided nylon line with 4/0 longline snaps. The large juvenile/adult survey uses the same type and length of mainline as the juvenile gear with 25 gangions attached at 40 feet intervals, comprised of 16/0 Mustad circle hooks with barbs depressed, 20 inches of 3/32 stainless cable, and 80 inches of 3 mm clear monofilament with 4/0 longline snaps. Previously frozen Atlantic mackerel or herring are purchased and used as bait for both juvenile and large juvenile/adult shark longline gear.

The time between deployment and retrieval of the longline gear is the ‘soak time.’ Soak time is an important parameter for calculating fishing effort. For commercial fisheries the goal is to optimize the soak time to maximize catch of the target species while minimizing the bycatch rate, and minimizing damage to target species caught on the hooks that may result from predation by sharks or other predators. Soak time can also be an important factor for controlling longline interactions with protected species. Marine mammals, turtles, and other protected species may be attracted to bait, or to fish caught on the longline hooks. Protected species may become caught on longline hooks or entangled in the longline while attempting to feed on the catch before the longline is retrieved.

Birds may be attracted to the baited longline hooks, particularly while the longline gear is being deployed from the vessel. Birds may get caught on the hooks, or entangled in the gangions while trying to feed on the bait. Birds may also interact with longline gear as the gear is retrieved.

6. Hydraulic dredge

Hydraulic dredges are used to harvest Atlantic Surfclams (*Spisula solidissima*) and Ocean Quahogs (*Arctica islandica*) using pressurized water jets to wash clams out of the seafloor. The water jets penetrate the sediment in front of the dredge and help to propel the dredge forward. A blade on the front of the dredge then lifts the clams that have been separated from the sediment, and guides them into the body, or “cage,” of the dredge. The hydraulic dredges used for the NEFSC surfclam/ocean quahog survey employ a 12.5 feet blade and are towed at a rate of 1.5 knots. During survey tows, the dredge is deployed at depth for a duration of five minutes. As they are towed along the seafloor, hydraulic dredges may interact with sea turtles, and considerable effort has been made to develop devices and modify dredge design in order to minimize interactions between hydraulic dredges and sea turtles. Turtle mats and excluder devices (described below) may reduce the severity of some turtle interactions by preventing turtles from entering the dredge (Murray 2011).

7. New Bedford-type dredge

The New Bedford-type dredge is primarily used to harvest sea scallops in the Georges Bank and Mid-Atlantic scallop fisheries. The forward edge of the New Bedford-type dredge uses a cutting bar to create turbulence that drives scallops from the sediment into the bag of the dredge (see Figure B-10). The bag is made of metal rings and drags on the seafloor. Towing times for commercial scallop dredges are highly variable, depending on the size of the bag and the density of sea scallops at the fishing location. New

Bedford-type dredges may interact with sea turtles, and NEFSC surveys use a turtle mat to minimize the impacts of dredge sampling on turtles.

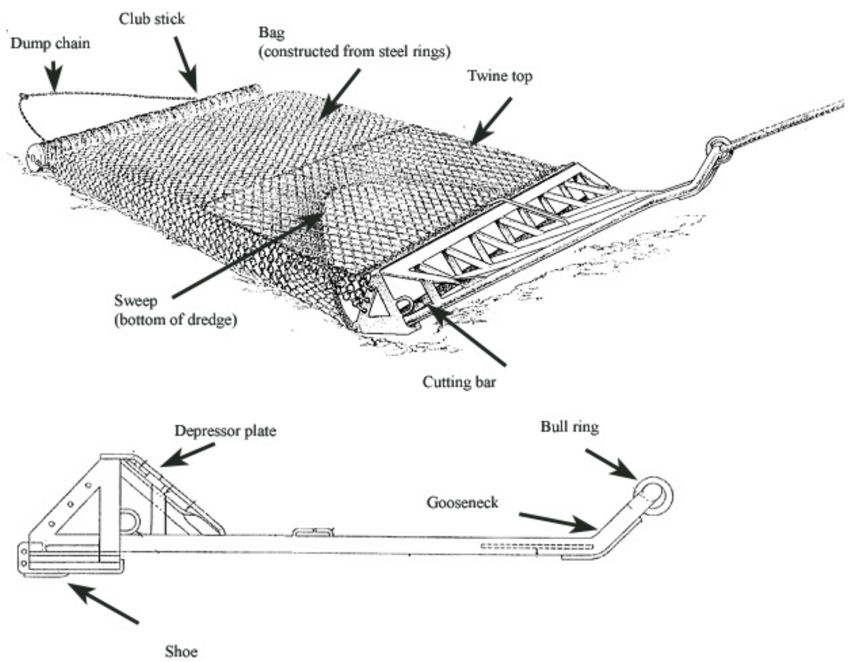

Figure B-10. Standard New Bedford sea scallop dredge

In response to the observed capture of sea turtles in scallop dredge gear, including serious injuries and mortality as a result of capture, NMFS proposed a modification to scallop dredge gear (70 FR 30660, May 27, 2005). The rule, finalized as proposed (71 FR 50361, August 25, 2006), required federally permitted scallop vessels fishing with dredge gear in Mid-Atlantic waters south of 41 °9'N from the shoreline to the outer boundary of the EEZ between May and November to modify their gear by adding an arrangement of horizontal and vertical chains (hereafter referred to as a "chain mat" or "turtle mat") between the sweep and the cutting bar (see Figure B-11). The requirement was subsequently modified by emergency rule on November 15, 2006 (71 FR 66466), and by a final rule published on April 8, 2008 (73 FR 18984). On May 5, 2009, NMFS proposed additional minor modifications to the regulations on how chain mats are configured (74 FR 20667). Chain mats consist of vertical and horizontal chains hung between the sweep and cutting bar and are intended to reduce the severity of some turtle interactions by preventing turtles from entering the dredge bag (Murray 2011). Monitoring the effectiveness of chain mats is difficult because interactions could still be occurring, but the chain mat prevents the turtle from being captured and observed (Murray 2011). However, chain mats are not expected to reduce the overall number of sea turtle interactions with scallop dredge gear.

Figure B-11. Turtle chain mat on traditional scallop dredge frame

Additional design modifications to a traditional New Bedford style scallop dredge were evaluated by NEFSC in cooperation with the Coonamesset Farm Foundation to prevent loggerhead sea turtles from snagging on top of the dredge frame or becoming trapped under the dredge bale, while maintaining efficiency for dredging sea scallops (Smolowitz *et al.* 2008). The final design, the Coonamesset Farm turtle excluder dredge (see Figure B-12), proved effective at guiding turtles over the top of the dredge by eliminating most of the bale bars and forming a ramp with a forward positioned cutting bar and closely spaced struts leading back at a forty-five degree angle (Smolowitz *et al.* 2008).

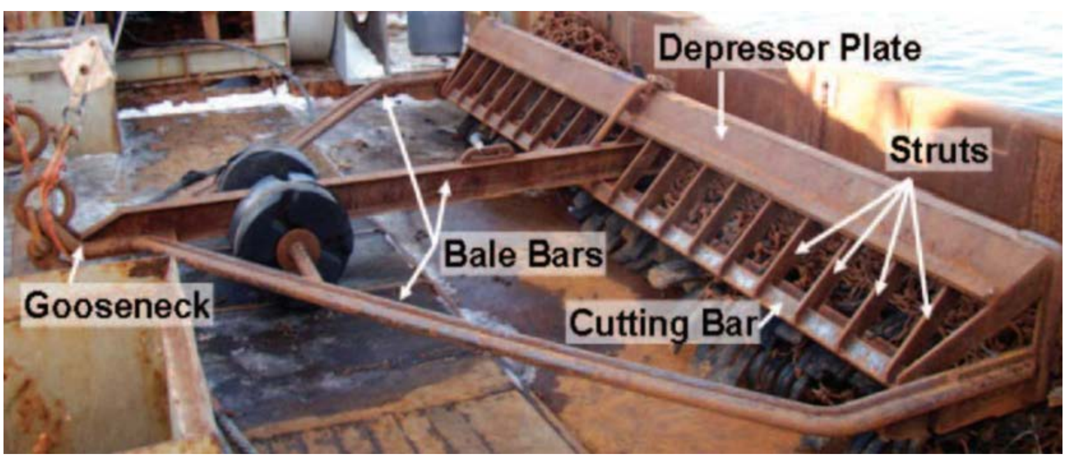

Figure B-12. Coonamessett Farm turtle deflector dredge

8. Naturalist dredge

The Naturalist dredge, shown in Figure B-13, is primarily used to obtain samples of megafaunal species, such as oysters, crabs, mussels and whelks. The Naturalist dredge is typically small (1 meter wide) and towed along the seafloor over a relatively short distance (30 to 200 feet) in order avoid overfilling the dredge and losing part of the sample. All megafauna from the dredge samples are picked out by hand and processed on deck after retrieval of the dredge. Due to the small size of the Naturalist dredge and the limited periods of time over which it is deployed, interactions with protected species are expected to be minimal. However, dredges do disturb bottom habitats, and may potentially interact with sea turtles.

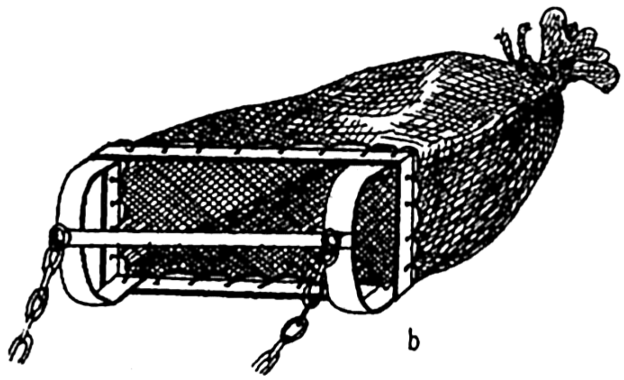

Figure B-13. Naturalist dredge

9. Fish / Lobster Pots

Several NEFSC and cooperative research surveys use fish or lobster pots to selectively capture species for research, tagging studies, and sample collection. Fish pots can be designed to select for particular species by configuring the entrances, mesh, and escape tunnels (or “vents”) to allow retention of the target species, while excluding larger animals, and allowing smaller animals to escape from the pot before retrieval. In many instances, animals remain alive in the pot until it is pulled, making pots a preferred method for collecting some species for tagging or mark / recapture studies.

The NEFSC research set aside program targeting black sea bass in southern New England (SNE) and Mid-Atlantic waters uses unvented pots 43½ inches long, 23 inches wide, and 16 inches high made with 1½ inches by 1½ inches coated wire mesh, a single mesh entry head, and a single mesh inverted parlor nozzle (see Figure B-14).

Figure B-14. Retrieval of a pot targeting black sea bass

Other NEFSC research activities targeting various finfish and shellfish species use different pot configurations, depending on the species of interest. Figure B-15 shows examples of different types of pots.

Figure B-15. Examples of pot equipment

10. Rotary Screw Trap

Rotary screw traps (RSTs) enable live capture of smolts emigrating from several coastal rivers, including the Narraguagus, Penobscot, Pleasant, and Sheepscot Rivers. RSTs are used to estimate smolt populations, enumerate and sample smolts (and other co-occurring species), and to better understand factors that limit smolt production and migration success. Figure B-16 shows a RST that was used on the Sheepscot River to capture Atlantic salmon smolts. RSTs are also platforms for telemetry studies that provide valuable data on smolt behavior and migratory success. RSTs are positioned in the water channels to maximize fish capture. Fish enter the trap through the large end of a revolving and half-submerged screen cone suspended between two pontoons. The NEFSC uses RSTs with different size openings (4 ft, 5 ft, and 8 ft models). As the river current turns the cone, the fish are guided downstream into a live car, where they are held in river water until retrieved for sampling. Traps are tended daily, so fish spend as little time as possible in the live car. As smolts tend to move downstream at night, they often confined for less than 12 hours.

RSTs require adequate water depth and current to rotate the cone for most effective “fishing.” Although RSTs can be used in high flow conditions, they sometimes become jammed with debris. River conditions are monitored closely to prevent fish injury. RSTs are equipped with a hubodometer that records the number of revolutions of the cone, allowing for an estimation of catch per unit of effort.

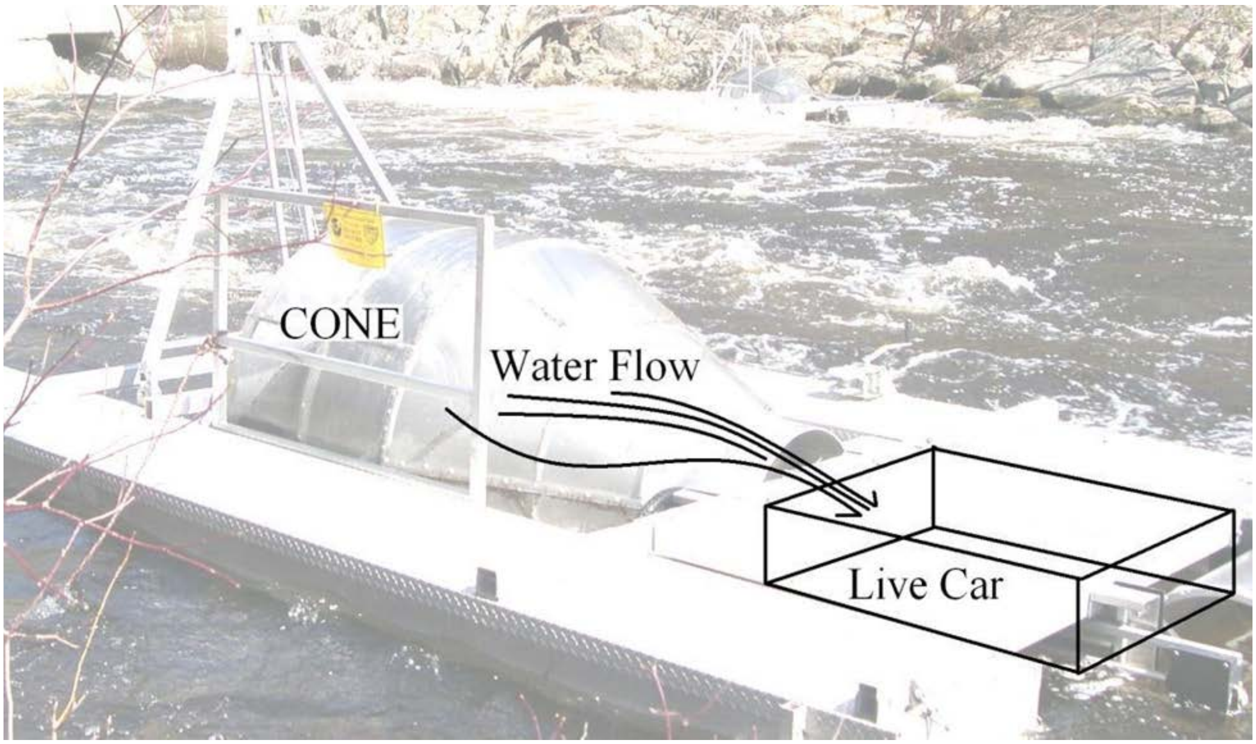

Figure B-16. Rotary screw trap
Credit: NOAA archives

11. Various plankton nets (Bongo Nets)

NEFSC research activities include the use of several plankton sampling nets that employ very small mesh to sample plankton and fish eggs from various parts of the water column. Plankton sampling nets usually consist of fine mesh attached to a weighted frame. The frame spreads the mouth of the net to cover a known surface area. The Bongo nets used for NEFSC surveys typically have openings 61 centimeters in diameter and employ either 333 micrometer or 505 micrometer mesh. The nets are 3 meters in length with a 1.5 meters cylindrical section coupled to a 1.5 meters conical portion that tapers to a detachable codend constructed of 333 micrometers or 0.505 micrometer nylon mesh (Figure B-17).

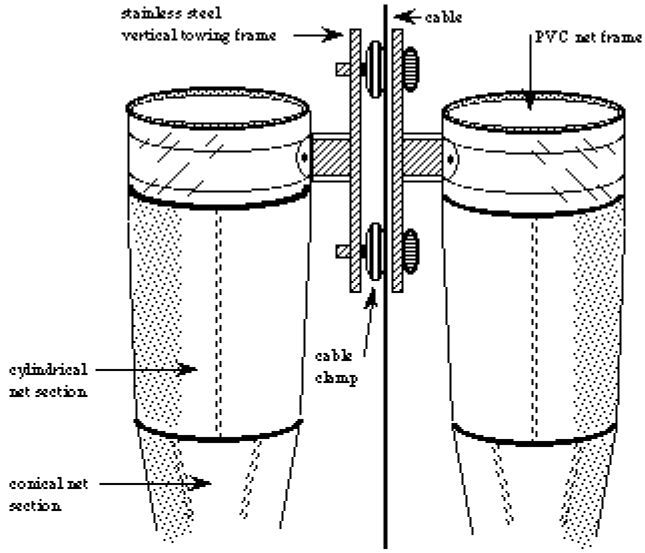

Figure B-17. Bongo net diagram

Credit: Aquatic Research Instruments (2011)

The bongo nets are towed through the water at an oblique angle to sample plankton over a range of depths. During each plankton tow, the bongo nets are deployed to a depth of approximately 210 meters and are then retrieved at a controlled rate so that the volume of water sampled is uniform across the range of depths. In shallow areas, sampling protocol is adjusted to prevent contact between the bongo nets and the seafloor. A collecting bucket, attached to the codend of the net, is used to contain the plankton sample. When the net is retrieved, the collecting bucket can be detached and easily transported to a laboratory. Some bongo nets can be opened and closed using remote control to enable the collection of samples from particular depth ranges. A group of depth-specific bongo net samples can be used to establish the vertical distribution of zooplankton species in the water column at a site. Bongo nets are generally used to collect zooplankton for research purposes, and are not used for commercial harvest.

12. Van Veen sediment grab sampler

Sediment grab samplers are used to collect sediments and assess populations of benthic fauna from the seafloor. The Van Veen grab sampler is comprised of a hinged pair of scoops that can be deployed over the side of the vessel and lowered to the seafloor on a cable (see Figure B-18). The scoops are approximately 31 centimeters wide to allow sampling of a 0.1 square meter area of the seafloor. Sharp cutting edges on the bottoms of the scoops enable them to penetrate up to about 40 centimeters into the sediment. The grab sampler may be galvanized, stainless steel, or Teflon-coated.

Prior to deployment, the sampler is cocked with the safety key in place. The sampler is then deployed over the side of the vessel, the safety key is removed, and the sampler is slowly lowered to the bottom. After bottom contact has been made (indicated by slack in the cable), the tension on the cable is slowly increased, causing the scoops to close. Once the sampler is back on board, the top doors are opened for inspection of the sediment sample (Stubbs et al. 1987).

The Van Veen sediment grab sampler is designed to collect sediments and invertebrates from the seafloor and potential interactions with marine mammals, turtles, or birds are believed to be negligible.

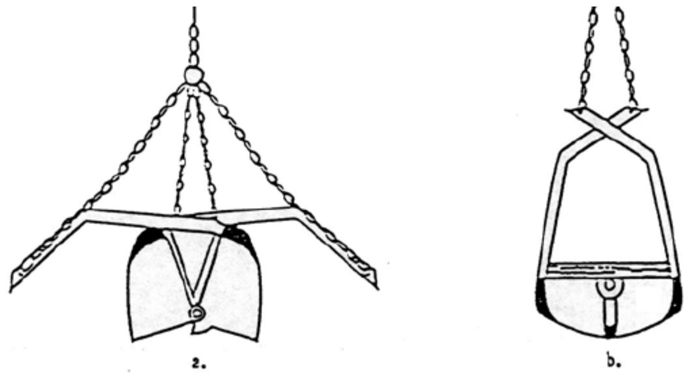

Figure B-18. Van Veen grab sampler: a) cocked position b) closed position
Credit: modified from Stubbs et al. (1987)

13. ADCP

An Acoustic Doppler Current Profiler, or ADCP, is a type of sonar used for measuring water current velocities simultaneously at a range of depths. In the past, current depth profile measurements required the use of long strings of current meters. ADCP enables measurements of current velocities across an entire water column, replacing the long strings of current meters. An ADCP anchored to the seafloor can measure current speed not just at the bottom, but also at equal intervals all the way up to the surface (WHOI 2011). An ADCP instrument can also be mounted to a mooring, or to the bottom of a boat.

The ADCP measures water currents with sound, using the Doppler Effect. A sound wave has a higher frequency when it moves towards the sensor (blue shift) than when it moves away (red shift). The ADCP works by transmitting "pings" of sound at a constant frequency into the water. As the sound waves travel, they ricochet off particles suspended in the moving water, and reflect back to the instrument (WHOI 2011). Due to the Doppler Effect, sound waves bounced back from a particle moving away from the profiler have a slightly lowered frequency when they return. Particles moving toward the instrument send back higher frequency waves. The difference in frequency between the waves the profiler sends out and the waves it receives is called the Doppler shift. The instrument uses this shift to calculate how fast the particle and the water around it are moving. Sound waves that hit particles far from the profiler take longer to come back than waves that strike close by. By measuring the time it takes for the waves to return to the sensor, and the Doppler shift, the profiler can measure current speed at many different depths with each series of pings (WHOI 2011).

ADCPs operate at frequencies between 75 and 600 kilohertz. High frequency pings yield more precise data, but low frequency pings travel farther in the water. Thus, a compromise must be made between the distance that the profiler can measure and the precision of the measurements (WHOI 2011).

ADCPs that are bottom-mounted need an anchor to keep them on the bottom, batteries, and a data logger. Vessel-mounted instruments need a vessel with power, a shipboard computer to receive the data, and a GPS navigation system so the ship's movements can be subtracted from the current velocity data (WHOI 2011).

14. CTD profiler

'CTD' is an acronym for Conductivity, Temperature, and Depth. A CTD profiler measures these parameters, and is the primary research tool for determining chemical and physical properties of seawater. A shipboard CTD is made up of a set of small probes attached to a large (1 to 2 meters in diameter) metal rosette wheel (see Figure B-19). The rosette is lowered through the water column on a cable, and CTD data are observed in real time via a conducting cable connecting the CTD to a computer on the ship. The rosette also holds a series of sampling bottles that can be triggered to close at different depths in order to collect a suite of water samples that can be used to determine additional properties of the water over the depth of the CTD cast. A standard CTD cast, depending on water depth, requires 2 to 5 hours to complete (WHOI 2011). The data from a suite of samples collected at different depths are often called a depth profile, and are plotted with the value of the variable of interest on the x-axis and the water depth on the y-axis. Depth profiles for different variables can be compared in order to glean information about physical, chemical, and biological processes occurring in the water column.

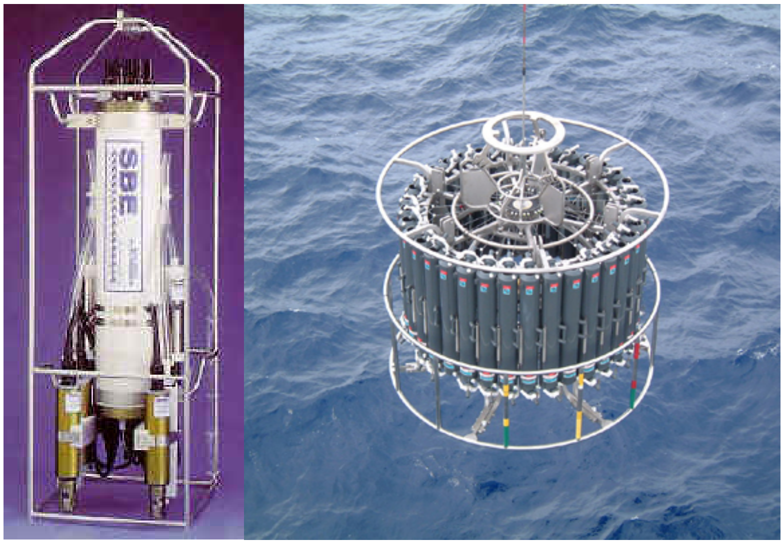

Figure B-19. Sea-Bird 911*plus* CTD profiler and deployment on a sampling rosette
Credit: Sea-Bird Electronics, Bellevue, WA

Conductivity is measured as a proxy for salinity, or the concentration of salts dissolved in the seawater. Salinity is expressed in 'practical salinity units' (psu) which represent the sum of the concentrations of several different ions. Salinity is calculated from measurements of conductivity. Salinity influences the types of organisms that live in a body of water, as well as physical properties of the water. For instance, salinity influences the density and freezing point of seawater.

Temperature is generally measured using a high-sensitivity thermistor protected inside a thin walled stainless steel tube. The resistance across the thermistor is measured as the CTD profiler is lowered through the water column to give a continuous profile of the water temperature at all water depths.

The depth of the CTD sensor array is continuously monitored using a very sensitive electronic pressure sensor. Salinity, temperature, and depth data measured by the CTD instrument are essential for characterization of seawater properties.

15. Still and video camera images taken from an ROV and towed camera array (HabCam)

The NEFSC maintains and deploys remotely operated vehicles (ROVs)(See Figure B-20). The ROVs are used to quantify fish and shellfish, photograph fish for identification, and provide information for habitat-type classification studies. Still and video camera images are also used to monitor the operation of bycatch reduction devices. Precise geo-referenced data from ROV platforms also enables SCUBA divers to use bottom time more effectively for collection of brood stock and other specimens.

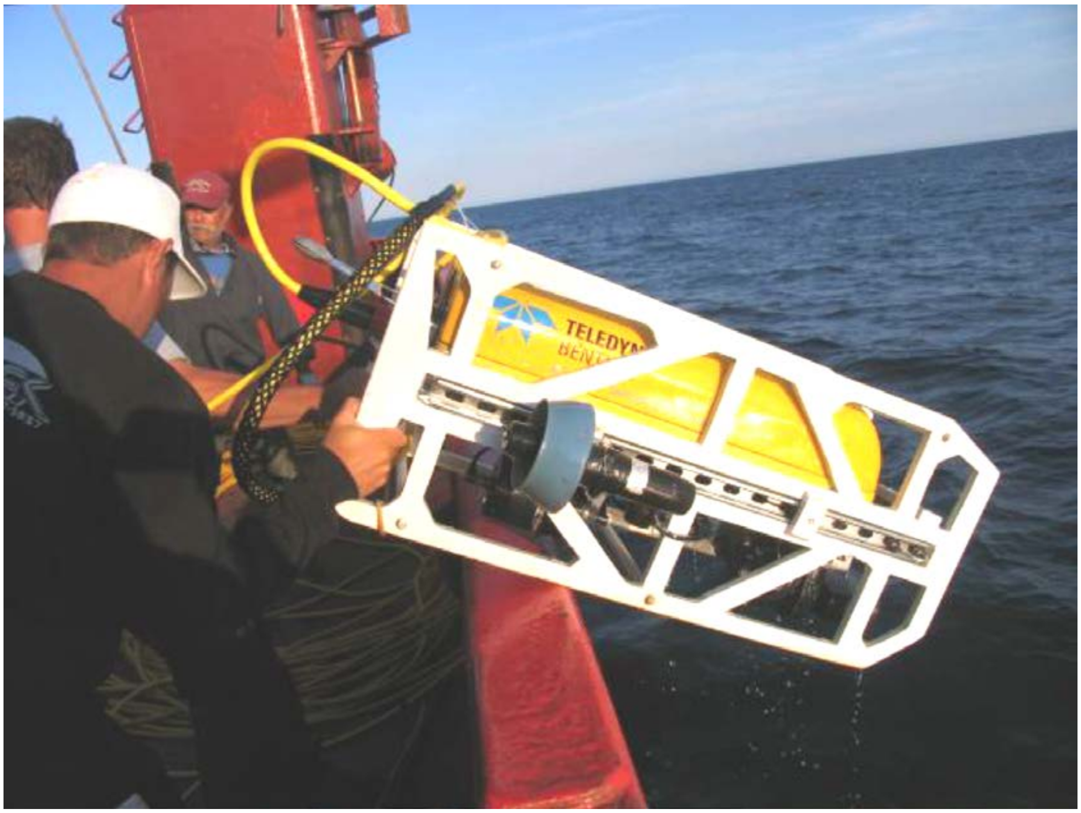

Figure B-20. ROV being deployed from scallop vessel

The Seabed Observation and Sampling System (SEABOSS) was designed for rapid, inexpensive, and effective collection of seabed images and sediment samples in coastal/inner-continental shelf regions. The observations from video and still cameras, along with sediments collected in the sampler, are used in conjunction geophysical mapping surveys to provide more comprehensive interpretations of seabed character.

The SEABOSS incorporates two video cameras, a still camera, a depth sensor, light sources, and a modified Van Veen sediment sampler (see Figure B-21). These components are attached to a stainless steel frame that is deployed through an A-frame, using a power winch, as the SEABOSS weighs 300 pounds. The SEABOSS frame has both a stabilizing fin capable of orienting the system while it drifts, and base plates that prevent over-penetration when the system rests on the sea floor. Undisturbed samples are taken with the modified Van Veen sampler. The system begins imaging the sea floor with a 35-millimeter camera before touching bottom, at 30 inches height above bottom. Scale, time, and exposure number are annotated on each image. These images are later scanned into a digital format. A downward-looking video camera overlaps the field of view of the still camera. The second video camera is mounted in a forward-looking orientation, providing an oblique sea floor view and enables a shipboard operator to monitor for proper tow-depth and for obstacles to the SEABOSS while operations are underway. (Blackwood *et al.* 2000).

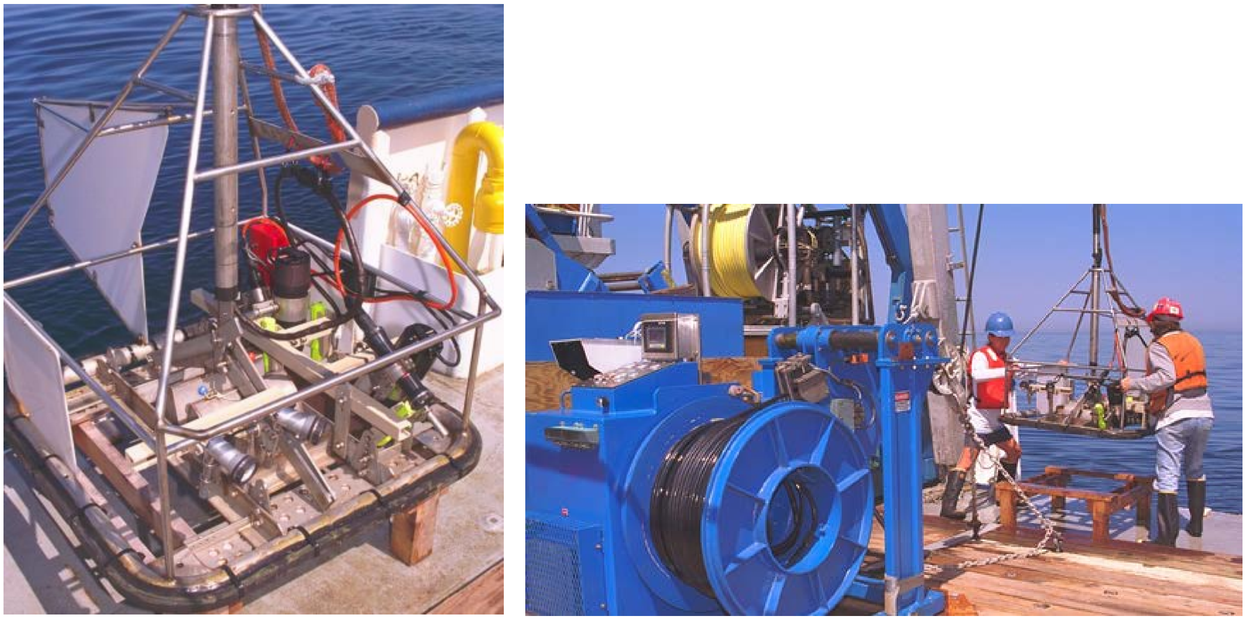

Figure B-21. The SEABOSS benthic observation system

The NEFSC utilizes a downward facing towed stereo-optic camera array (HabCam) to annually assess the sea scallop resource along the eastern continental shelf (see Figure B-22). The stereo images are collected in realtime using an armored towing fiber optic cable. The array is actively flown/towed about 1 – 2 meters above the sea floor. The camera system is capable of being deployed 24 hours a day and covers about 100 nm during that time.

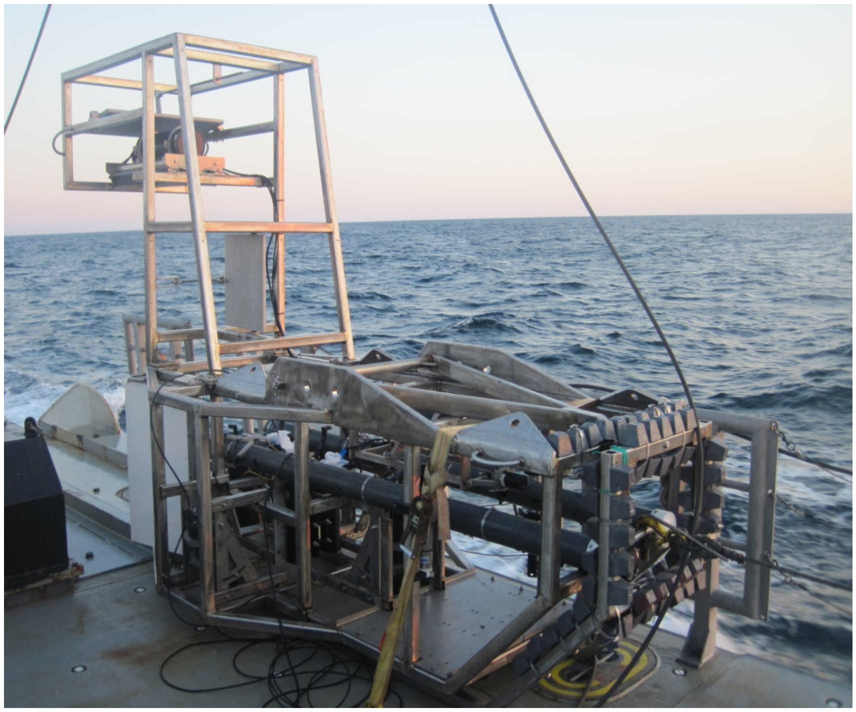

Figure B-22. The HabCam Stereo-Optic Towed Camera Array

16. Active Acoustic Sources used in NEFSC Fisheries Surveys

A wide range of active acoustic sources are used in NEFSC fisheries surveys for remotely sensing bathymetric, oceanographic, and biological features of the environment. Most of these sources involve relatively high frequency, directional, and brief repeated signals tuned to provide sufficient focus and resolution on specific objects. Important characteristics of the nine predominant NEFSC acoustic sources are provided below in Tables A-1, followed by descriptions of some of the primary sources.

Table B-1 Output characteristics for the seven predominant NEFSC active acoustic sources.

Active Acoustic System (product name and #)	Operating frequencies (kHz)	Maximum source level (dB re 1 µPa at 1 m)	Single ping duration	Nominal beam width (degrees)
Simrad EK60 Narrow Beam Scientific Echo Sounder	18, 38, 70, 120, 200, & 333	224	1 millisecond	11° at 18 kHz; 7° at 38, 120, 200 & 333 kHz
Simrad ME70 Multi-Beam Echo Sounder	70-120	205	150 microsecond	140°
Teledyne RD Instruments Acoustic Doppler Current Profiler (ADCP), Ocean Surveyor	75	224		30°
Simrad SX90 Narrow Beam Sonar (conservative assumption--pointed horizontally)	20-30	219		7°
Raymarine SS260 (DSM300 sounder)	50, 200	217		19° at 50 kHz; 6° at 200 kHz
NetMind	30, 200	190		50°
Simrad EQ50	50, 200	210		16° at 50 kHz; 7° at 200 kHz

17. Multi-frequency Narrow Beam Scientific Echo Sounders (Simrad EK60 - 18, 38, 70, 120, 200, 333 kilohertz)

Similar to multibeam echosounders, multi-frequency split-beam sensors are deployed from NOAA survey vessels to acoustically map the distributions and estimate the abundances and biomasses of many types of fish; characterize their biotic and abiotic environments; investigate ecological linkages; and gather information about their schooling behavior, migration patterns, and avoidance reactions to the survey vessel. The use of multiple frequencies allows coverage of a broad range of marine acoustic survey activity, ranging from studies of small plankton to large fish schools in a variety of environments from shallow coastal waters to deep ocean basins. Simultaneous use of several discrete echosounder frequencies facilitates accurate estimates of the size of individual fish, and can also be used for species identification based on differences in frequency-dependent acoustic backscattering between species. The NEFSC uses devices that transmit and receive at six frequencies ranging from 18 to 333 kilohertz.

18. Single Frequency Omnidirectional Sonars (Simrad SX-90)

Low frequency, high-resolution, long range fishery sonars including the SX-90 operate with user selectable frequencies between 20 and 30 kilohertz providing longer range and prevent interference from other vessels. These sources provide an omnidirectional imaging around the source with three different vertical beamwidths, single or dual vertical view and 180° tiltable vertical views are available. At 30 kilohertz operating frequency, the vertical beamwidth is less than seven degrees. This beam can be electronically tilted from +10 to -80 degrees, which results in differential transmitting beam patterns. The cylindrical multi-element transducer allows the omnidirectional sonar beam to be electronically tilted down to -60 degrees, allowing automatic tracking of schools of fish within the whole water volume around the vessel. The signal processing and beamforming is performed in a fast digital signal processing system using the full dynamic range of the signals.

19. Multi-beam echosounder (Simrad ME70)

Multibeam echosounders and sonars work by transmitting acoustic pulses into the water then measuring the time required for the pulses to reflect and return to the receiver and the angle of the reflected signal (see Figure B-23). The depth and position of the reflecting surface can be determined from this information, provided that the speed of sound in water can be accurately calculated for the entire signal path.

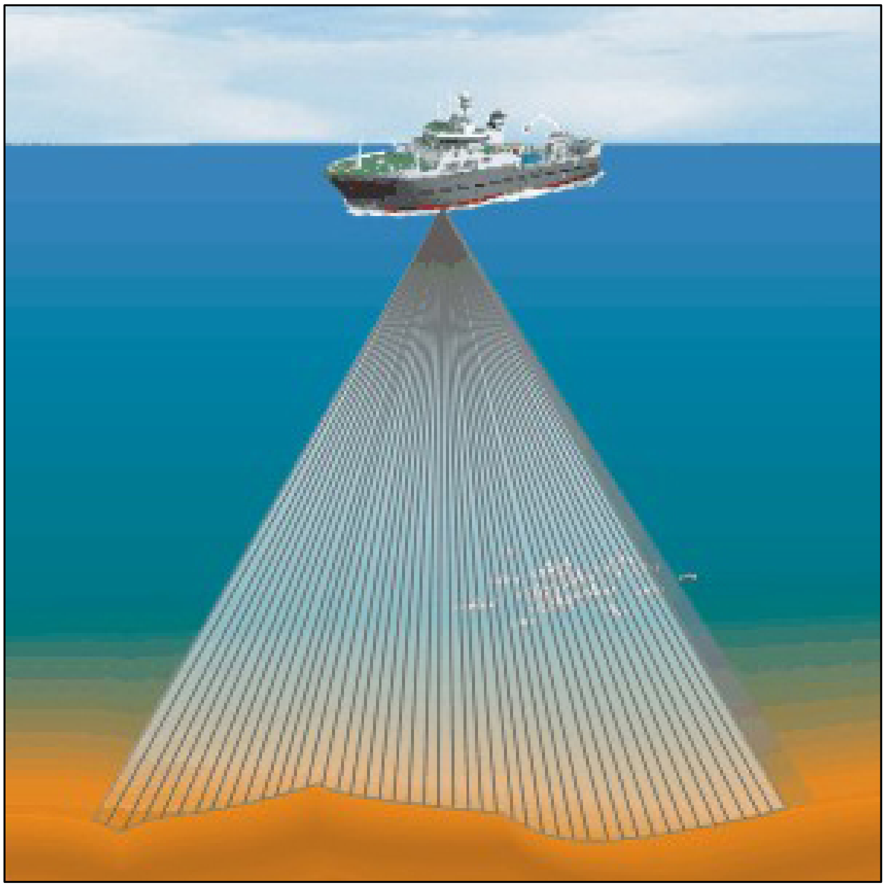

Figure B-23. Multi-beam echosounder
Credit: Simrad – www.kongsberg.com/simrad

The use of multiple acoustic 'beams' allows coverage of a greater area compared to single beam sonar. The sensor arrays for multibeam echosounders and sonars are usually mounted on the keel of the vessel and have the ability to look horizontally in the water column as well as straight down. Multibeam echosounders and sonars are used for mapping seafloor bathymetry, estimating fish biomass, characterizing fish schools, and studying fish behavior. The multibeam echosounders used by NEFSC are mounted to the hull of the research vessels and emit frequencies in the 70-120 kilohertz range.

20. NEFSC Vessels used for Survey Activities

NMFS employs NOAA-operated research vessels, chartered vessels, and vessels operated by cooperating agencies and institutions to conduct research, depending on the survey and type of research.

Figure B-24. R/V *Delaware II*

The NOAA research vessel (R/V) *Delaware II* was used for trawl surveys for many years during the Status Quo period considered in this DPEA. It was retired from NOAA service in 2012 and sold so it is not anticipated to be one of the vessels used in the future. The R/V *Delaware II* was a 155 foot steel-hulled, purpose-built research vessel powered by two General Motors diesel engines with a total of 1,230 horsepower (Figure B-24). The R/V *Delaware II* used a single propeller to achieve a sustained cruising speed of 10.0 knots. The deck equipment featured six winches, one deck crane, two A-frames, and a moveable stern gantry. Each of the winches served a specialized function ranging from trawling to hydrographic surveys. The ship had a beam of 30.2 feet and a draft of 14.8 feet, and could accommodate a crew of 32 people including up to 14 scientists for voyages of up to 16 days. The ship's normal operating area was the Gulf of Maine, Georges Bank, and the continental shelf and slope from Southern New England to Cape Hatteras, NC.

Figure B-25. R/V *Henry B. Bigelow*

The NOAA research vessel *Henry B. Bigelow*, shown in Figure B-25, was launched in 2005 to replace the *Albatross IV*. The 209 feet steel-hulled *Henry B. Bigelow* uses an integrated diesel electric drive system, with two 1,542 horsepower propulsion motors, and a single 14.1 feet propeller to achieve a sustained cruising speed of up to 12 knots. The ship has a beam of 49.2 feet and a draft of 19.4 feet and can accommodate up to 39 crew, including 15 scientists, for voyages of up to 40 days. The deck equipment features five winches, one deck crane, two A-frames, and a moveable stern gantry. The ship's primary operating area is offshore waters of the Northeast Continental Shelf LME. The *Henry B. Bigelow* has a number of features engineered specifically to reduce transmission of ship noise into the ocean, which enhances its utility for research because fish and marine mammals are less likely to react to ship noise.

Figure B-26. R/V *Hugh R. Sharp*

The R/V *Hugh R. Sharp*, shown in Figure B-26, is a 146 feet acoustically quiet research vessel operated by the University of Delaware Marine and Earth Studies program, as a member of the University-National Oceanographic Laboratory System (UNOLS). The vessel is powered by a diesel-electric propulsion system with twin Z-drives and a tunnel-style bow thruster. The vessel has a dynamic positioning system, enabling it to maintain a precise location 'on-station' during research activities. It has a nominal cruising speed of 11 knots, and can carry 14 to 20 scientists on cruises up to 18 days in duration. It typically operates in the coastal waters from Long Island, New York, to Cape Hatteras, North Carolina, as well as the Delaware and Chesapeake Bays. Projects occasionally require the vessel to work as far north as the Gulf of Maine, as far south as Florida, and as far offshore as Bermuda. Operational support for the R/V *Hugh R. Sharp* is provided primarily by the National Science Foundation (NSF), the Office of Naval Research (ONR), and the National Oceanic and Atmospheric Administration (NOAA). The R/V *Hugh R. Sharp* is a purpose-built research vessel designed with special attention to controlling underwater radiated noise to minimize effects on the marine environment.

Figure B-27. R/V *Gloria Michelle*

The R/V *Gloria Michelle* is a 72 feet steel–hulled stern trawler operated by NOAA and used for Gulf of Maine shrimp trawl surveys (Figure B-27). The vessel is powered by a Caterpillar 3406 producing 365 horsepower, driven through a single fixed-pitch 64 inches four-blade propeller. The R/V *Gloria Michelle* has a beam of 20 feet, a draft of 9.5 feet, and can accommodate a crew of two officers and eight scientists for voyages up to five days in length.

In addition to NOAA-operated research vessels, research activities may be conducted from chartered or cooperative vessels. A wide range of commercial fishing vessels participate in such cooperative research, ranging from small open boats to modern trawlers and longliners. The sizes of the vessels used for cooperative research, engine types, cruising speeds, etc. vary depending upon the location and requirements of the research for which the vessel is used.

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