DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 219

[Docket No. 150413360–5500–01]

RIN 0648–BF02

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Northeast Fisheries Science Center Fisheries Research

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS' Office of Protected Resources has received a request from NMFS' Northeast Fisheries Science Center (NEFSC) for authorization to take marine mammals incidental to fisheries research conducted in a specified geographical region, over the course of five years from the date of issuance. As required by the Marine Mammal Protection Act (MMPA), NMFS is proposing regulations to govern that take, specific to each geographical region and requests comments on the proposed regulations.

DATES: Comments and information must be received no later than August 10, 2015.

ADDRESSES: You may submit comments on this document, identified by NOAA–NMFS–2015–0078, by any of the following methods:

• *Electronic submission:* Submit all electronic public comments via the federal e-Rulemaking Portal. Go to *www.regulations.gov,* enter 0648–BF02 in the ''Search'' box, click the ''Comment Now!'' icon, complete the required fields, and enter or attach your comments.

• *Mail:* Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East West Highway, Silver Spring, MD 20910.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. To help NMFS process and review comments more efficiently, please use only one method to submit comments. All comments received are a part of the public record. NMFS will generally post the comments on *www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information. NMFS will accept anonymous comments (enter N/A in the required fields if you wish to remain anonymous).

FOR FURTHER INFORMATION CONTACT: Jeannine Cody, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Availability

The public may obtain a copy of the NEFSC's 2014 application, the 2015 addendum to the application, and any supporting documents as well as a list of the references cited in this document by visiting the Internet at: *www.nmfs.noaa.gov/pr/permits/incidental/research.htm.* In case of problems accessing these documents, please call the contact listed above (see **FOR FURTHER INFORMATION CONTACT**).

Executive Summary

These proposed regulations, under the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*), establish frameworks for authorizing the take of marine mammals incidental to the NEFSC's fisheries research activities in a specified geographical region (the Atlantic coast region which includes the Northeast U.S. Continental Shelf Large Marine Ecosystem (Northeast LME) and a portion of the Southeast Continental Shelf Large Marine Ecosystem (Southeast LME)).

The NEFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. Depending on the research, the NEFSC's conducts the following types of research: (1) Fishery-independent research directed by NEFSC scientists and conducted onboard NOAA-owned and operated vessels or NOAA-chartered vessels; (2) fishery-independent research directed by cooperating scientists (other agencies, academic institutions, and independent researchers) conducted onboard non-NOAA vessels; and (3) fishery-dependent research conducted onboard commercial fishing vessels, with or without NOAA scientists onboard.

Purpose and Need for This Regulatory Action

We received an application from the NEFSC requesting five-year regulations and authorization to take multiple species of marine mammals. Take would occur by Level B harassment incidental to the use of active acoustic devices in the Atlantic coast region, and by Level A harassment, serious injury, or mortality incidental to the use of fisheries research gear. The proposed regulations would be valid from 2015 to 2020. Please see ''Background'' below for definitions of harassment.

Section 101(a)(5)(A) of the MMPA directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if, after notice and public comment, the agency makes certain findings and issues regulations. These proposed regulations would contain mitigation, monitoring, and reporting requirements.

Legal Authority for the Regulatory Action

Section 101(a)(5)(A) of the MMPA and the implementing regulations at 50 CFR part 216, subpart I provide the legal basis for issuing the five-year regulations and any subsequent Letters of Authorization.

Summary of Major Provisions Within the Proposed Regulations

The following provides a summary of some of the major provisions within the proposed rulemakings for the NEFSC fisheries research activities in the Atlantic coast region. We have preliminarily determined that the NEFSC's adherence to the proposed mitigation, monitoring, and reporting measures listed below would achieve the least practicable adverse impact on the affected marine mammals. They include:

• Required monitoring of the sampling areas to detect the presence of marine mammals before deployment of pelagic trawl nets, pelagic or demersal longline gear, dredge gear, fyke nets, and beach seines.

• Required implementation of standard tow durations of not more than 30 minutes to reduce the likelihood of incidental take of marine mammals.

• Required implementation of the mitigation strategy known as the ''move-on rule,'' which incorporates best professional judgment, when necessary during pelagic trawl and pelagic longline operations.

• Required compliance with applicable vessel speed restrictions.

• Required compliance with applicable and relevant take reduction plans for marine mammals.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as ''an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.''

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Summary of Request

On December 17, 2014, we received an adequate and complete request from the NEFSC for authorization to take marine mammals incidental to fisheries research activities. We received an initial draft of the request on February 12, 2014, followed by revised drafts on September 19 and October 1, 2014. On December 29, 2014 (79 FR 78065), we published a notice of receipt of the NEFSC's application in the **Federal Register,** requesting comments and information related to the NEFSC request for thirty days. We received comments from the Humane Society of the United States and Whale and Dolphin Conservation, which we considered in development of this proposed rule and which are available on the Internet at: *www.nmfs.noaa.gov/pr/permits/incidental/research.htm*.

The NEFSC proposes to conduct fisheries research using the following types of gear: pelagic trawl gear used at various levels in the water column, pelagic and demersal longlines with multiple hooks, bottom-contact trawls, gillnets, fyke nets, dredges, and other gear. If a marine mammal interacts with gear deployed by the NEFSC, the outcome could potentially be Level A harassment, serious injury (any injury that will likely result in mortality), or mortality. However, information upon which to base a prediction of what the outcome may be for any particular interaction is limited. Therefore, the NEFSC has pooled the number of incidents of take expected to result from different gear interactions, and we have assessed the potential impacts accordingly. The NEFSC also uses various active acoustic devices in the conduct of fisheries research, and use of these devices has the potential to result in Level B harassment of marine mammals. Level B harassment of pinnipeds hauled out on the shoreline may also occur, in some locations within the Atlantic coast region, as a result of visual disturbance from vessels conducting NEFSC research. The proposed regulations would be valid for five years from the date of issuance.

The NEFSC conducts fisheries research surveys in the Atlantic coast region which spans from the U.S.-Canada border to Florida. This specified geographic region includes the following subareas: The Gulf of Maine, Georges Bank, Southern New England waters, the Mid-Atlantic Bight, and the coastal waters of northeast Florida. Within the specified geographic region of the Atlantic coast, the NEFSC requests authorization to take individuals of 12 species by Level A harassment, serious injury, or mortality (hereafter referred to as M/SI + Level A) and of 33 species by Level B harassment.

Contents

Description of the Specified Activity

Overview

The NEFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. NEFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels. For other types of surveys, cooperating scientists may conduct fishery-independent research onboard non-NOAA vessels. Finally, the NEFSC sponsors some fishery-dependent research conducted onboard commercial fishing vessels, with or without NOAA scientists onboard.

The NEFSC proposes to administer and conduct approximately 48 survey programs over the five-year period. The gear types used fall into several categories: Pelagic trawl gear used at various levels in the water column, pelagic and demersal longlines, bottom-contact trawls, gillnets, fyke nets, and other gear. The use of pelagic and bottom trawl nets, gillnets, fyke nets, and pelagic longline gears are likely to result in interaction with marine mammals. The majority of these surveys also use active acoustic devices.

The federal government has a responsibility to conserve and protect living marine resources in U.S. waters and has also entered into a number of international agreements and treaties related to the management of living marine resources in international waters outside the United States. NOAA has the primary responsibility for managing marine fin and shellfish species and their habitats, with that responsibility delegated within NOAA to NMFS.

In order to direct and coordinate the collection of scientific information needed to make informed fishery management decisions, Congress created six Regional Fisheries Science Centers, each a distinct organizational entity and the scientific focal point within NMFS for region-based federal fisheries-related research. This research is aimed at monitoring fish stock recruitment, abundance, survival and biological rates, geographic distribution of species and stocks, ecosystem process changes, and marine ecological research. The NEFSC is the research arm of NMFS in the greater Atlantic region of the U.S. The NEFSC conducts research and provides scientific advice to manage fisheries and conserve protected species in Northeast and Southeast LME and provides scientific information to support the New England Fishery Management Council, the Mid-Atlantic Fishery Management Council, the Atlantic States Marine Fisheries Commission, and numerous other domestic and international fisheries management organizations.

Dates and Duration

The specified activity may occur at any time during the five-year period of validity of the proposed regulations. Dates and duration of individual surveys are inherently uncertain, based on congressional funding levels for the NEFSC, weather conditions, or ship contingencies. In addition, the cooperative research program is designed to provide flexibility on a yearly basis in order to address issues as they arise. Some cooperative research projects last multiple years or may continue with modifications. Other projects only last one year and are not continued. Most cooperative research projects go through an annual competitive selection process to determine which projects should be funded based on proposals developed by many independent researchers and fishing industry participants. NEFSC survey activity does occur during most months of the year; however, most trawl surveys occur during the spring, summer, and fall. Longline surveys occur either biannually in the spring or annually in the summer and a small number of gillnet surveys occur annually in the summer.

Specified Geographical Region

Please see Figure 1 for a map of the research areas described in this section. The NEFSC would conduct fisheries research activities off the Atlantic coast of the U.S. primarily within 200 miles of the shoreline from the U.S.-Canada border to Florida. In addition to general knowledge and other citations contained herein, this section relies upon the descriptions found in Sherman and Hempel (2009) and Wilkinson *et al.* (2009). As referred to here, productivity refers to fixated carbon (*i.e.,* g $C/m^2/yr$) which relates to the carrying capacity of an ecosystem.

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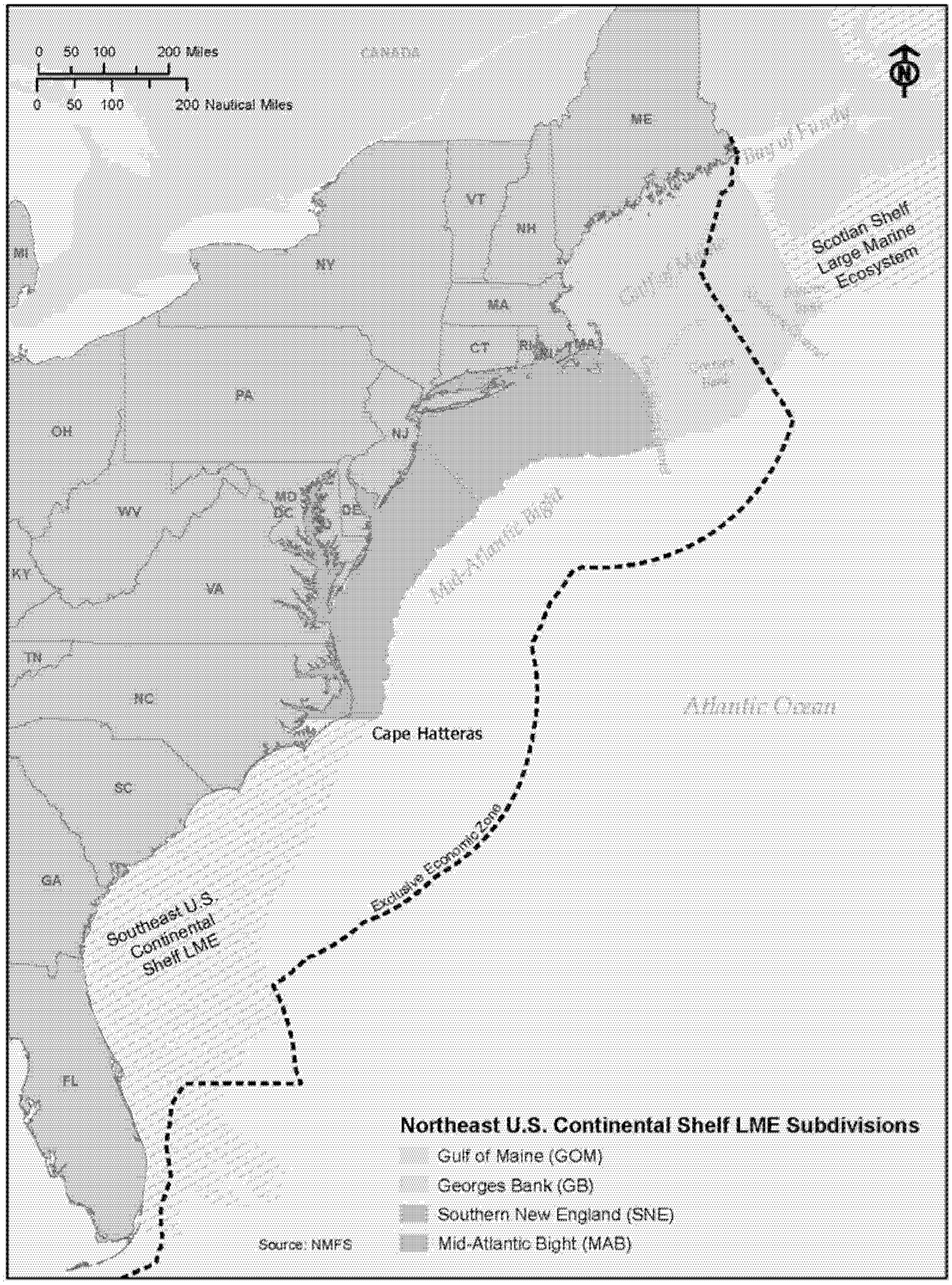
Figure 1 - Northeast Fisheries Science Center research areas.



Note: The NEFSC conducts the majority of research activities within the GOM, GB, SNE, and MAB. The NEFSC also conducts a small number of research activities in the U.S. Southeast Large Marine Ecosystem (SC, GA, and northeastern FL waters) not shown in this map.

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Atlantic Coast Region—The Atlantic coast region extends from the Gulf of Maine (to the U.S. and Canada border) past Cape Hatteras to Florida. The region is characterized by its temperate climate and proximity to the Gulf Stream, and is generally considered to be of moderately high productivity, although the portion of the region from Cape Cod to Cape Hatteras is one of the most productive areas in the world due to upwellings along the shelf break created by the western edge of the Gulf Stream. Sea surface temperatures (SST) exhibit a broad range across this region, with winter temperatures ranging from 2–20 °C in the north and 15–22 °C in the south, while summer temperatures, consistent in the south at approximately 28 °C, range from 15–27 °C in the northern portion.

The northern portion of this region (*i.e.,* north of Cape Hatteras) is more complex, with four major sub-areas: The Gulf of Maine, Georges Bank, southern New England, and the Mid-Atlantic Bight. Cold, low-salinity water transports in the Labrador Current from the Arctic Ocean into the Gulf of Maine and exits through the Great South Channel; upwellings occur around Georges Bank. South of Cape Cod, there is strong stratification along the coast where large estuaries occur (*e.g.,* Chesapeake Bay, Pamlico Sound).

The Gulf Stream is highly influential on both the northern and southern portions of the region, but in different ways. Meanders of the current directly affect the southern portion of the Gulf Stream, where it is closer to shore, while warm-core rings indirectly affect the northern portion (Belkin *et al.,* 2009). In addition, subarctic influences can reach as far south as the Mid-Atlantic Bight, but the convergence of the Gulf Stream with the coast near Cape Hatteras does not allow for significant northern influence into waters of the South Atlantic Bight.

Gulf of Maine—The Gulf of Maine (GOM) is an enclosed coastal sea characterized by relatively cold waters and deep basins. Several geographic features bound the GOM including Brown's Bank on the east, Maine and Nova Scotia to the north, Maine, New Hampshire, and Massachusetts on the west, and Cape Cod and Georges Bank to the south. Retreating glaciers (18,000–14,000 years ago) formed a complex system of deep basins, moraines, and rocky protrusions, leaving behind a variety of sediment types including silt, sand, clay, gravel, and boulders. There exists patchy distribution of sediments on the seafloor throughout the GOM, with occurrence largely related to the bottom topography.

Oceanic circulation in the GOM exhibits a general counterclockwise current, influenced primarily by cold water masses moving in from the Scotian Shelf and offshore. Although large-scale water patterns are generally counterclockwise around the GOM, many small gyres and minor currents do occur. Freshwater runoff from the many rivers along the coast into the GOM influences coastal circulation as well. These water movements feed into and affect the circulation patterns on Georges Bank and in Southern New England.

Georges Bank—Georges Bank (GB) is a shallow, elongate extension of the northeastern U.S. continental shelf, characterized by a steep slope on its northern edge and a broad, flat, and gently sloping southern flank. The Gulf of Maine lies to the north of GB, the Northeast Channel (between GB and Browns Bank) is to the east; the continental slope lies to the south, and the Great South Channel separates GB and Southern New England to the west. Although the top of GB is predominantly characterized by sandy sediment, glacial retreat during the late Pleistocene era resulted in deposits of gravel along the northern edge of GB, and some patches of silt and clay can be found on the sea floor. The most dominant oceanographic features of GB include a weak but persistent clockwise gyre that circulates over the whole bank, strong tidal flows (mainly northwest and southeast) and strong but intermittent storm-induced currents. The strong tidal currents result in vertically well-mixed waters over the bank. The southwestern flow of shelf and slope water that forms a countervailing current to the Gulf Stream drives the clockwise GB gyre.

Mid-Atlantic Bight—The Mid-Atlantic Bight (MAB) includes the continental shelf and slope waters from GB to Cape Hatteras, NC. The retreat of the last ice sheet shaped the morphology and sediments of the MAB. The continental shelf south of New England is broad and flat, dominated by fine grained sediments (sand and silt). Patches of gravel exist in places on the sea floor, such as on the western flank of the Great South Channel.

The shelf slopes gently away from the shore out to approximately 100 to 200 kilometers (km) (62 to 124 miles (mi)) offshore, where it transforms into the continental slope at the shelf break (at water depths of 100 to 200 m (328 to 656 ft). Along the shelf break, numerous deep-water canyons incise the slope and shelf. The sediments and topography of the canyons are much more heterogeneous than the predominantly sandy top of the shelf, with steep walls and outcroppings of bedrock and deposits of clay.

The southwestern flow of cold shelf water feeding out of the GOM and off GB dominates the circulatory patterns in this area. The countervailing Gulf Stream provides a source of warmer water along the coast as warm-core rings and meanders break off from the Gulf Stream and move shoreward, mixing with the colder shelf and slope water. As the shelf plain narrows to the south (the extent of the continental shelf is narrowest at Cape Hatteras), the warmer Gulf Stream waters run closer to shore.

Southern New England—The Southern New England (SNE) subarea extends from the Great South Channel in the east to the MAB in the west. The southwestern flow of cold shelf water feeding out of the GOM and off GB dominates the circulatory patterns in this area. The SNE continental shelf is a gently sloping region with smooth topography. The shelf is approximately 100 km (62 mi) wide, and the shelf break occurs at depths of between 100 to 200 m (328 to 656 ft). The continental slope extends from the shelf break to a depth of 2 km (6,562 ft). This zone has a relatively steep gradient, and the relief is moderately smooth. The continental rise (2 to 6 km; 500 to 19,700 ft) is similar to the slope in having only gradual changes in bathymetry. However, the overall gradient of the continental rise is less than that of the continental slope (Theroux and Wigley, 1998). Sediments of the SNE subarea consist of fine-grained sand and silt. Patches of gravel exist in places on the sea floor, such as on the western flank of the Great South Channel. Currents and historic disposal of dredged material may influence water and sediment quality within the SNE.

Southeast U.S. Continental Shelf Large Marine Ecosystem: This area covers the Atlantic Ocean extending approximately 930 miles from Cape Hatteras, NC south to the Straits of Florida (Yoder, 1991). The continental shelf in the region reaches up to approximately 120 miles offshore. The Gulf Stream Current influences the region with minor upwelling occurring along the Gulf Stream front. The area is approximately 115,000 square miles, includes several protected areas and coral reefs (Aquarone, 2008); numerous estuaries and bays, such as the Albemarle-Pamlico Sound, nearshore and barrier islands; and extensive coastal marshes that provide valuable ecosystem services and habitats for numerous marine and estuarine species. A six- to 12-mile wide coastal zone is characterized by high levels of primary production throughout the year, while offshore, on the middle and outer shelf, upwelling along the Gulf Stream front and intrusions from the Gulf Stream cause seasonal phytoplankton blooms. Because of its high productivity, this sub-region supports active commercial and recreational fisheries (Shertzer *et al.* 2009).

Detailed Description of Activities

The federal government has a trust responsibility to protect living marine resources in waters of the United States. These waters extend to 200 nautical miles (nmi) (370 km; 230 mi) from the shoreline and include the U.S. Exclusive Economic Zone (EEZ). The U.S. government has also entered into a number of international agreements and treaties related to the management of living marine resources in international waters outside of the U.S. EEZ (*i.e.,* the high seas). To carry out its responsibilities over U.S. and international waters, Congress has enacted several statutes authorizing certain federal agencies to administer programs to manage and protect living marine resources. Among these federal agencies, NOAA has the primary responsibility for protecting marine finfish and shellfish species and their habitats. Within NOAA, NMFS has been delegated primary responsibility for the science-based management, conservation, and protection of living marine resources under statutes including the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Atlantic Coastal Fisheries Cooperative Management Act (ACA), and the Atlantic Striped Bass Conservation Act.

Within NMFS, six Regional Fisheries Science Centers direct and coordinate the collection of scientific information needed to inform fisheries management decisions. Each Fisheries Science Center is a distinct entity and is the scientific focal point for a particular region. The NEFSC conducts research and provides scientific advice to manage fisheries and conserve protected species in the Atlantic coast region from Maine to northeast Florida. The NEFSC provides scientific information to support the Mid-Atlantic Fishery Management Council and other domestic fisheries management organizations.

The NEFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. NEFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels. For other types of surveys, cooperating scientists may conduct fishery-independent research onboard non-NOAA vessels. Finally, the NEFSC sponsors some fishery-dependent research conducted onboard commercial fishing vessels, with or without NOAA scientists onboard. The NEFSC proposes to administer and conduct approximately 48 survey programs over the five-year period.

The gear types used fall into several categories: Pelagic trawl gear used at various levels in the water column, pelagic and demersal longlines, bottom-contact trawls, anchored sinking gillnets, and other gear. The use of pelagic and bottom trawl nets, gillnets, fyke nets, and longline gears are likely to result in interaction with marine mammals. The NEFSC also uses various active acoustic devices in the conduct of fisheries research, and use of these devices has the potential to result in Level B harassment of marine mammals. Additionally, a small set of research activities along the Penobscot River estuary in Maine have the potential to behaviorally disturb marine mammals due to the physical presence of researchers near haulout areas.

Most of the vessel-based surveys use active acoustic devices. The NEFSC may conduct surveys aboard research vessels (R/V), including the NOAA Ship R/V *Henry B. Bigelow,* R/V *Gordon Gunter,* R/V *Pisces,* R/V *Nauvoo,* R/V *Harvey,* R/V *Chemist,* R/V *Resolute,* R/V *Hassler,* R/V *C.E. Stillwell,* and R/V *Gloria Michelle;* aboard R/V and fishing vessels (F/V) owned and operated by cooperating agencies and institutions including the F/V *Robert Michael,* F/V *Darana R,* R/V *Hugh R. Sharp,* and F/V *Eagle Eye II;* or aboard charter vessels.

In the following discussion, we summarily describe various gear types used by the NEFSC and then describe specific fisheries and ecosystem research activities conducted by the NEFSC within the Atlantic coast region. This is not an exhaustive list of gear and/or devices that the NEFSC may use, but it is representative of gear categories and is complete with regard to all gears with potential for interaction with marine mammals. Additionally, we describe the relevant active acoustic devices that the NEFSC commonly uses in its survey activities in a subsequent section. Please see Appendix A of the NEFSC's LOA application and draft programmatic EA for more detailed descriptions and schematic diagrams of the research gear types.

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 that 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 top of a net is called the headrope, and the bottom is called the footrope.

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 travel at speeds of 2 to 5 knots (kt) (2.3 to 5.7 miles per hour (mph)) while towing the net for time periods up to several hours, whereas most NEFSC trawl surveys involve slower tow speeds from 1.4 to 4 kt (1.6 to 4.6 mph) with shorter tow durations from 15 to 60 minutes (min). The duration of the tow depends on the purpose of the trawl, the catch rate, and the target species. At the end of the tow, personnel retrieve the net and empty the contents of the cod end 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 (described later) 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. Most 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.

1. 4-Seam, 3-Bridle Bottom Trawl: Several NEFSC research programs use a 4-seam, 3-bridle bottom trawl, manufactured using 12-centimeter (cm) (5-inch (in) and 6-cm (2 in) mesh. The effective mouth opening of the 4-seam, 3-bridle bottom trawl is approximately 70 square meters (753 square ft) (14 meter spread by 5 meters high; 46 ft by 16 ft), spread by a pair of trawl doors. The footrope of the trawl is 27 m (89 ft) in length, ballasted with heavy rubber discs or roller gear. The head rope is approximately 24 m (79 ft) in length supported by 60 Nokalon #508 eight-inch center-holed, orange trawl floats. For certain research activities, the cod end may have a sewn-in liner to minimize the loss of small fish.

2. High-Speed Mid-water Rope Trawl: Several NEFSC research programs use the Gourock High Speed Midwater Rope Trawl (HSMRT) for fisheries acoustics surveys. The HSMRT employs a four-seam box design with a 5-m (174-ft) headrope, footrope, and breastlines. The mouth opening of the HSMRT is approximately 13.3 meters vertical and 27.5 meters horizontal. Once personnel deploy the net, they can change in the

position of the net in the water column by increasing or decreasing the speed of the vessel, or by bringing in or letting out trawl wire. NEFSC also uses active acoustics to monitor the ship and net positions and status. Pelagic trawl nets do not have any contact with the seafloor because they do not have bobbins or roller gear, which are often used to protect the foot rope of a bottom trawl net when it contacts the seafloor.

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. Typical gillnets consist 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. A specific mesh size will catch a target species of a limited size range, allowing this gear type to be very selective.

1. Anchored sinking gillnets: A few NEFSC research program use anchored sinking gillnets which are fixed to the ocean floor or at a set distance above the bottom (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 up the net. NEFSC survey activities use gillnets that range from 15 to 99 m (50 to 325 ft) in length, 2 to 3 m (8 to 10 ft) in height, with mesh sizes from 16 to 30 cm (6.5 to 12 in). In some cases, the gillnet configuration may consist of 10-panel strings up to 914 m (3,000 ft) in length. Gillnets used in NEFSC research programs use weak links of particular strength and locations on the gear, as specified by the Atlantic Large Whale Take Reduction Plan in order to minimize the risk of large whale entanglement in the gear. Soak times for long-term surveys are typically 3 hours, but short-term cooperative research projects have used soak times up to 96 hours.

Pound nets—A pound net is a stationary fishing device. It consists of poles or stakes secured into the bottom with attached netting. The structure includes a pound with a netting floor, a heart-shaped enclosure, and a straight wall or leader. 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. Fish swimming laterally along the shoreline encounter the leader and generally turn towards deeper water to circumvent the obstruction. The heart and pound portions of the net located at the deep end of the leader, non-selectively direct and trap the fish to prevent escape. The pound is usually a rectangular enclosure constructed of small mesh and is approximately 6 to 13 m (20 to 43 ft) long.

Longlines—Longline vessels fish with baited hooks attached to a mainline (or groundline). 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. Personnel attach hooks to the mainline 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 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. Fishers often use radar reflectors, radio transmitters, and light sources to determine the location of the longline gear prior to retrieval.

A commercial pelagic longline can extend over 100 km (62 mi) long and have thousands of hooks attached, although longlines used for research surveys are shorter. The pelagic longline gear used for NEFSC research surveys typically use 100 to 400 hooks attached to steel or monofilament mainline that is approximately 3 to 16 km (2 to 10 mi) long. One exception is a small-scale survey that typically uses 25 to 50 hooks attached to a 305-m (1,000-ft) mainline.

For NEFSC research activities, the length of the gangion and the distance between each gangion depends on the purpose of the fishing activity. There are no internationally recognized standard measurements for hook size, and a given size may be inconsistent between manufacturers. Fishers reference larger hooks, such as those used in longlining, by increasing whole numbers followed by a slash and a zero as size increases (*e.g.,* 1/0 up to 20/0). The numbers represent relative sizes, normally associated with the gap (the distance from the point tip to the shank). Because pelagic longline gear does not anchor to the seafloor, it floats freely in the water and may drift considerable distances between the time of deployment and the time of retrieval. The time period between deployment and retrieval of the longline gear is the soak time, which is an important parameter for calculating fishing effort. For commercial fisheries the goal is to optimize the soak time in order to maximize catch of the target species while minimizing the bycatch rate and minimizing damage to target species that may result from predation by sharks or other predators.

1. Yankee swordfish-style pelagic longline gear: This gear configuration consists of 5/16-inch tarred nylon mainline with 7- to 10-m (24- to 33-ft) gangions composed of 4 m (13 ft) of 3/16-inch nylon, 2 m (7 ft) of 3/32 inche stainless steel leader, and a #40 Japanese tuna hook. For research purposes, researchers bait the hooks with whole Atlantic mackerel (*Scomber scombrus*) attached at 52-m (170-ft) intervals. Researchers attach floats at five hook intervals on 12-m (40-ft) float lines. Flag buoys (*i.e.,* high flyers) are located at each end of the gear.

2. Florida commercial-style bottom longline gear: This gear configuration consists of consists of 940-pound test monofilament mainline with 4-m (12-ft) gangions made of 730-pound test monofilament with a longline clip at one end and a 3/0 shark hook at the other. Researchers bait the hooks with chunks of spiny dogfish (*Squalus acanthias*) and attach them to the mainline at roughly 18-m (60-ft) intervals. Researchers attach 5-pound weights at 15-hook intervals and 15-pound weights and small buoys at 50-hook intervals. To ensure that the gear fishes on the bottom, researchers place 20-pound weights at the beginning and end of the mainline after deploying a length of line two to three times the surveyed water depth. Researchers attach a 20-ft flag buoy (*i.e.,* high flyers) equipped with radar reflectors and flashing lights 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 gear retrieval.

3. Anchored bottom longline gear: A few NEFSC research programs use two types of anchored bottom longline gear: One for targeting small juvenile sharks and the other for targeting large juveniles and adult sharks. Researchers use previously frozen Atlantic mackerel or herring (*Clupea harengus*) as bait for both juvenile and large juvenile/adult shark longline gear.

The juvenile gear consists of 305-m (1,000 ft) of quarter-inch braided nylon mainline with at least 61 m (200 ft) of additional line on each side for scope, and 50 gangions attached at 6-m (20-ft) intervals, comprised of 12/0 Mustad circle hooks with barbs depressed, 20 inches of 1/16 stainless cable, and 40 inches of quarter-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 12-m (40-ft) 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.

Fyke nets—Fyke nets are bag-shaped nets held open by frames or hoops. The fyke nets used in NEFSC survey activities consist 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-m wings extend from the opening of each fyke at an angle of approximately 30 degrees. The wings have a weighted footrope and floats on the head-rope and are the same height (either 0.91 m or 1.83 m high; 2.9 or 6 ft 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 entrapment in the live box. For the large fyke, the final compartment of the net consists of a rigid framed live box (2 x 2 x 3 m; 6.5 x 6.5 x 9.8 ft) at the surface for removal of catch directly from above without having to retrieve the entire net. The NEFSC attaches a marine mammal excluder device to the outer-most throat of the larger fyke to stop marine mammals from entering the net which could lead to incidental entrapment. The exclusion device consists of a grate constructed of aluminum bars. The size of the opening is approximately 14 centimeters, which effectively prohibits marine mammals from entering the net.

Dredges—This is a fishing method where fishers drag a dredge across the sea floor, either scraping or penetrating the bottom. A typical dredge consists of a mouth frame with an attached collection bag. Scraping dredges collect target species (*e.g.,* oysters, scallops, clams, and mussels) in the top layer of seafloor sediment with rakes or teeth that scoop up the substrate. Penetrating dredges use pressurized water jets to chase animals out from beneath muddy or rocky bottom substrate and into the collection bag.

1. New Bedford-type dredge: The NEFSC uses this type of dredge primarily 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. The bag consists of metal rings which drag 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. This gear also includes seasonal modifications (*i.e.,* the addition of a chain mat between the sweep and the cutting bar) to reduce the potential interactions with marine turtles.

2. Hydraulic dredge: This type of dredge uses pressurized water jets to wash Atlantic surfclams (*Spisula solidissima*) and Ocean quahogs (*Arctica islandica*) 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 separated from the sediment and guides them into the body (*i.e.,* cage) of the dredge. The hydraulic dredges used for the NEFSC surfclam/ocean quahog survey use a 3.8-m (12.5-ft) blade towed at approximately 1.5 kt (1.7 mph). During survey tows, researchers deploy the dredge at depth for approximately 5 min.

3. Naturalist dredge: NEFSC surveys use this gear to obtain samples of megafaunal species (*e.g.,* oysters, crabs, mussels, whelks). The Naturalist dredge is typically small (1 m (3 ft) wide) and towed along the seafloor over a relatively short distance (9 to 61m; 30 to 200 ft) in order avoid overfilling the dredge and losing part of the sample. NEFSC researchers manually pull out all megafauna from the dredge samples and process them on deck after retrieving the dredge. Due to the small size of the Naturalist dredge and the limited deployment periods, interactions with protected species would be minimal. However, dredges do disturb bottom habitats.

Traps/Pots—Traps and pots are submerged, three-dimensional wire or wood devices that permit organisms to enter the enclosure but make escape extremely difficult or impossible. Researchers use secured bait in the trap to lure organisms inside, where they wait to retrieve the catch and re-bait the traps.

1. 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 select for particular species by configuring the entrances, mesh, and escape tunnels (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 retrieval, 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 (*Centropristis striata*) in southern New England and Mid-Atlantic waters uses unvented pots 43.5 inches long, 23 inches wide, and 16 inches high made with 1.5 inch by 1.5 inch coated wire mesh, a single mesh entry head, and a single mesh inverted parlor nozzle. Other NEFSC research activities targeting various finfish and shellfish species use different pot configurations depending on the species of interest.

2. Rotary screw trap (RST): This type of gear enables live capture of smolts emigrating from several coastal rivers, including the Narraguagus, Penobscot, Pleasant, and Sheepscot Rivers. The NEFSC uses RSTs 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.

This gear type is also a platform for telemetry studies that provides valuable data on smolt behavior and migratory success. Researchers position the trap within 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 (1.2, 1.5, and 2.4 m; 4, 5, and 8 ft models). As the river current turns the cone, the fish travel downstream into a live car and remain confined in river water until sample retrieval. Researchers tend to the traps on a daily basis and monitor river conditions frequently. RSTs require adequate water depth and current to rotate the cone for most effective fishing. RSTs can operate in high flow conditions, although they sometimes become jammed with debris. RSTs have a hubodometer, a device that records the number of revolutions of the cone to estimate catch per unit of effort.

Other towed nets—NEFSC surveys utilize various small, fine-mesh, towed nets designed to sample small fish and pelagic invertebrates. The NEFSC broadly categorizes these nets as small trawls (distinct from large trawl nets due to the discountable potential for interaction with marine mammals; see ''Potential Effects of the Specified Activity on Marine Mammals and Their Habitat'') and plankton nets.

1. The Isaacs-Kidd midwater trawl (IKMT): The NEFSC uses this gear to collect deepwater biological specimens larger than those taken by standard plankton nets. The mouth of the net is approximately 1.5 by 2 m (5 by 7 ft), 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. The IKMT is a long, round net approximately 6.5 m (21 ft) long, with a series of hoops

decreasing in size from the mouth of the net to the codend, which maintain the shape of the net during towing (Yasook *et al.,* 2007). Because of the high level of drag exerted by the net in the water, fishers must tow trawls at speeds of 1 to 2 kt (1.1 to 2.3 mph). Conversely, researchers can tow an IKMT at speeds as high as 5 kt (8 mph).

2. The Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS): The NEFSC uses this gear for specialized zooplankton surveys. The 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 which continuously monitor the functioning of the nets, frame angle, horizontal velocity, vertical velocity, volume filtered, and selected environmental parameters, such as salinity and temperature.

3. Tucker trawl: The NEFSC uses this type of mid-water zooplankton trawl to study pelagic fish and zooplankton. The Tucker trawl, similar to the MOCNESS, consists of a stepping motor that opens and closes a series of nets sequentially without retrieving the net from the fishing depth. The Tucker trawl used for NEFSC research surveys uses 333 micron plankton nets with 1 by 1.4 m (3.2 by 4.6 ft) openings. The nets operate at a 45-degree angle during fishing, which results in an effective fishing area of 1 square m (10.8 square ft). Researchers use this gear for deep oblique tows where they can sequentially operate up to three replicate nets by a double release mechanism. The NEFSC typically equips the trawl with a full suite of instruments, including inside and outside flow meters, conductivity, temperature, and depth (CTD) instruments, and pitch sensor.

4. Beam trawl: A beam trawl is a type of bottom trawl that uses a wood or metal beam to hold the net open as researchers tow it along the sea floor. The beam holds open the mouth of the net eliminating the need for trawl doors. Beam trawls are generally smaller than other types of bottom trawls. Commercial beam trawls have beam lengths of up to 12 m (39.4 ft); while beam trawls for research purposes typically use beams 2 to 4 m (6.6 to 13.1 ft) in length.

Sediment grab sampler—The NEFSC uses sediment grab samplers to collect sediments and assess populations of benthic fauna from the seafloor.

1. Van Veen sediment grab sampler: The Van Veen grab sampler consists of a hinged pair of scoops deployed over the side of the vessel and lowered to the seafloor on a cable. 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, personnel lock the sampler with the safety key in place, deploy it over the side of the vessel, and remove the safety key while slowly lowering it to the bottom. After making bottom contact (indicated by slack in the cable), personnel slowly increase the tension on the cable which causes the scoops to close. Once the sampler is back on board, personnel open the top doors to inspect the sediment sample.

Plankton nets—The remainder of nets described here are plankton nets, which usually consist of fine mesh attached to a weighted frame which spreads the mouth of the net to cover a known surface area in order to sample plankton and fish eggs from various parts of the water column.

1. Bongo nets: The NEFSC uses Bongo nets to collect zooplankton for research purposes only. Bongo nets, which consist of a bucket attached to the codend of the net, move through the water at an oblique angle to collect plankton samples over a range of depths. The Bongo nets used by the NEFSC have openings 61 cm in diameter and employ either a 333-or 505-micrometer (µm) mesh. The nets are 3 m (9.8 ft) in length with a 1.5 m (4.9 ft) cylindrical section, coupled to a 1.5 m (4.9 ft) conical portion that tapers to a detachable codend constructed of 333-µm or 505-µm nylon mesh. During each plankton tow, personnel deploy the bongo nets to a depth of approximately 210 m (689 ft) and then retrieve the net at a controlled rate so that the volume of water sampled is uniform across the range of depths. In shallow areas, NEFSC researchers may adjust the sampling protocol to prevent contact between the bongo nets and the seafloor.

Instruments—Research vessel surveys are generally conducted 24-hours a day when the vessels are at sea. NEFSC research surveys provide opportunities to collect environmental information (*e.g.,* temperature, salinity, pollution levels, etc.) and to allow other researchers to piggyback on surveys to collect a host of environmental data not directly related to the stock assessment. All research vessel surveys conducted by the NEFSC collect and archive an extensive array of environmental measurements and usually have a shopping list of samples to obtain for researchers at academic institutions, other government agencies, and the private sector.

1. Conductivity, temperature, and depth profilers (CTD): A CTD profiler is the primary research tool for determining chemical and physical properties of seawater. A shipboard CTD consists of a set of small probes attached to a large (1 to 2 m in diameter) metal rosette wheel. Personnel lower the rosette through the water column on a cable, and researchers observe the CTD data 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 personnel can trigger to close at different depths in order to collect a suite of water samples used to determine additional properties of the water over the depth of the CTD cast. A standard CTD cast, depending on water depth, requires two to five hours to complete.

A computer plots data from a suite of samples collected at different depths (*i.e.,* a depth profile) with the value of the variable of interest on the x-axis and the water depth on the y-axis. Researchers compare depth profiles for different variables in order to glean information about physical, chemical, and biological processes occurring in the water column. Conductivity measurements serve as a proxy for salinity expressed in practical salinity units representing the sum of the concentrations of several different ions. A high-sensitivity thermistor housed inside a thin-walled stainless steel tube measures the temperature. The thermistor measures resistance as personnel lowers the CTD profiler through the water column. This gives a continuous profile of the water temperature at all water depths. An electronic pressure sensor continuously monitors the depth of the CTD sensor array. Salinity, temperature, and depth data measured by the CTD instrument are essential for characterization of seawater properties.

2. Expendable bathythermographs (XBT): The NEFSC uses XBTs to provide ocean temperature versus depth profiles. A standard XBT system consists of an expendable probe, a data processing/recording system, and a launcher. An electrical connection between the probe and the processor/recorder is made when the canister containing the probe is placed within the launcher and the launcher breech door is closed. Following launch, wire de-reels from the probe as it descends vertically through the water. Simultaneously, wire de-reels from a spool within the probe canister, compensating for any movement of the ship and allowing the probe to freefall

from the sea surface unaffected by ship motion or sea state.

The XBT probes consist of a metal weight surrounding a temperature probe, attached to a copper wire that conducts the signal to the vessel. The copper wire is protected within a plastic housing. Probes are generally launched from the leeward side of the vessel and as far aft as possible. Launching from these locations helps obtain high reliability and minimizes the chances that the fine copper probe wire will come in contact with the ship's hull which may cause spikes in the data or a catastrophic wire break. A portable shipboard data acquisition system records, processes, and interprets the data the probes collect.

XBT drops occur at predetermined times along with surface chlorophyll sampling. Opportunistic drops may also occur. Typically, three XBT drops are made per survey day. XBT drops may be repeated if the displayed profile does not show a well-defined mixed layer and thermocline. Deep Blue probes are preferred, as they survey to a depth of 760 m and take approximately two minutes per drop. Probes are launched using a hand-held launcher. As the XBT probes are expendable, they are not retrieved and are left on the seafloor after data collection.

3. Remotely operated vehicles (ROV): The NEFSC maintains and deploys several ROVs. They use ROVs to count fish and shellfish, photograph fish for identification, and provide views of the bottom for habitat-type classification studies via still and video camera images. Precise georeferenced data from ROV platforms also enables SCUBA divers to use bottom time more effectively for collection of brood stock and other specimens.

The NEFC operates a Seabed Observation and Sampling System (SEABOSS) designed for rapid, inexpensive, and effective collection of seabed images and sediment samples in coastal/inner-continental shelf regions. Researchers use the observations from video and still cameras, along with sediments collected in the sampler, in conjunction with 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. These components attach to a stainless steel frame that personnel deploy 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. A modified Van Veen sampler takes undisturbed samples in the vicinity of the system. The system begins imaging the sea floor with a 35-millimeter camera before touching bottom, at 30 inches height above bottom. The system annotates scale, time, and exposure number on each image. A downward-looking video camera overlaps the field of view of the still camera. The second video camera, mounted in a forward-looking orientation, provides 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.

Summary of Planned Research

Next we describe the long-term surveys and research activities planned by the NEFSC and its research partners in the Atlantic coast region. The NEFSC anticipates that these long-term surveys would likely continue during the next five-year period, although not necessarily every year. Please see Table 1.1 of the NEFSC's application for a detailed summary of these surveys.

1. *Benthic Habitat Survey:* The benthic habitat survey occurs annually during the summer (Jul) or fall (Oct) in an area that extends from the Hudson Canyon to the Georges Bank. It assesses seafloor disturbance by commercial fishing and changes as the benthic ecosystem recovers from chronic fishing impacts and collects data on seasonal migration, bottom data for mapping and indication of climate change through species shifts. Survey operations are on a 24-hour schedule.

The protocol for the July Hudson Canyon survey includes deploying a 4-seam, 3-bridle bottom trawl at approximately 2.5 kt (2.9 mph) for 30-minute tows at a target depth. The survey averages 54 tows per year and requires about 20 days at sea (DAS) using the R/V *H.B. Bigelow,* R/V *G. Gunter,* or R/V *Pisces.* The survey also uses a CTD profiler and rosette water sampler, Brooke Ocean moving vessel CTD, plankton light trap, Van Veen sediment grab, beam trawl, naturalists dredge, and SeaBoss benthic camera vehicle. Additional protocols include the use of use of multi-frequency active acoustics (output frequencies: 18, 38, 120, 200, 400, and 450 kilohertz (KHz).

2. *Changes in the Community Structure of Benthic Fishes:* This survey occurs annually during the summer (Jul) in the Hudson River Estuary, NY. It quantifies the abundance and distribution of benthic associated fishes of the Hudson River Estuary ecosystem. Survey operations are on a 24-hour schedule.

The protocol for the survey includes deploying a 16-ft bottom trawl net towed at approximately 2.5 kt for 5 minutes. The survey averages 176 trawls annually and requires approximately 20 DAS using the R/V *Nauvoo.* Protocols also include the deployment of a Yellow Spring YSI 6000 water quality meter and Kemmerer water sampling bottles. Additional protocols include the use of use of multi-frequency active acoustics: (Output frequencies: 38 and 120 kHz).

3. *Fish Collection for Laboratory Experiments:* This survey occurs annually, as needed throughout the year in the New York Bight and in Sandy Hook Bay, NJ. Survey operations are on a 24-hour schedule. It catches high-quality fish for laboratory experiments.

Protocols include deployment of a 16-ft or 30-ft bottom trawl nets towed at approximately 2.5 kt for 10 min, or hook and line fishing. The number of tows varies depending on scientific need, typically enough trawls to capture 10 to 60 specimens. The survey requires approximately 10 DAS on the R/V *Nauvoo,* R/V *Harvey,* or R/V *Chemist.* Additional protocols include the deployment of a Sea Cam video sled, CTD, Tucker plankton net, an Acoustic Doppler Current Profiler (ADCP, output frequencies of 38 and 120 kHz), Ponar grab, and Kemmerer water sampling bottles.

4. *Habitat Characterization:* This survey occurs annually throughout the year in Sandy Hook Bay, Barnegat Bay, and offshore New York and New Jersey. Survey operations are on a 24-hour schedule. It characterizes and maps coastal marine habitats and living marine resources in waters and wetlands around New York and New Jersey.

The NEFSC conducts the survey under the terms of a Memorandum of Understanding with the New Jersey Sea Grant Consortium. Protocols include deploying a 16-ft or 30-ft bottom trawl net (simple Memphis net and twine ''shrimp trawl) towed at approximately 2.5 kt for 10 min. The survey requires about 60 tows per year and approximately 30 DAS on the R/V *Nauvoo* or R/V *Resolute.* Researchers may also deploy of a Sea Cam 5000 12v video cam, CTDs, YSI 6000 water quality meter, Tucker plankton net, Kemmerer bottle, and Ponar grab. Additional protocols include the use of multi-frequency active acoustics (38 and 120 kHz) and an ADCP (600 kHz).

5. *Habitat Mapping Survey:* This survey occurs annually during the summer in the ocean shelf off the Maryland coast. It maps shallow reef

habitats of fisheries resource species, including warm season habitats of black sea bass, and to locate sensitive habitats (*e.g.,* shallow temperate coral habitats) for habitat conservation. Survey operations are on a 24-hour schedule.

Survey protocols include deploying a 4-seam, 3-bridle bottom trawls towed at 3.0 kts for 30 minutes at target depth. The survey requires about 54 tows per year and approximately 11 DAS using the R/V *Hassler.* Additional protocols include deployment of a CTD Profiler, Brooke Ocean Moving Vessel CTD profiler, split beam sonar, plankton light trap, beam trawl (tow speed 2.0 kt for 20 min), a naturalists dredge (tow speed 2 to 3 kt for 1 minute at depth), SeaBoss benthic camera vehicle, and continuous use of four multi-frequency acoustic devices with output frequencies of 18, 38, 120, 200, 400, and 450 kHz.

6. *Living Marine Resources Center Survey:* The survey is conducted annually in January from Cape Hatteras to New Jersey. It determines distribution, abundance, and recruitment patterns for multiple species. The survey operates on 24-hour schedule.

Protocols include deployment of a 4-seam, 3-bridle bottom trawl towed at 3 kt for 30 min. The survey averages 25 tows per year and requires about 11 DAS using the R/V *H. B. Bigelow* or a similar vessel type. Protocols also include the use of a 2-m wide beam trawl at 2 kt for 20 min 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).

7. *Massachusetts Division of Marine Fisheries (MADMF) Bottom Trawl Surveys:* The MADMF spring (May) and fall (Sep) annual bottom trawl surveys have been conducted since 1978 during daylight hours within 5 nm of the Massachusetts coast, thus includes some federal waters, from the Rhode Island to New Hampshire borders. It tracks abundance of mature and juvenile fishes.

The protocol includes deploying an otter trawl at approximately 2.5 kt for 20 min. The surveys average 206 tows per year and require about 30 to 36 DAS using the R/V *G. Michelle.*

The trawl has a 39 ft headrope and 51 ft footrope, rigged with a 3.5 inch rubber disc sweep and has a half inch stretched nylon liner at the cod end to retain small fish. The net spread is 72 in by 40 in 325 pound wooden trawl doors connected to the net via 63 ft ⅜ in chain bottom legs and 60 ft ⅜ in wire top legs.

8. *Northeast Area Monitoring and Assessment Program (NEAMAP) Near Shore Trawl Program:* The survey occurs annually from April–June and October–December in two segments during daylight hours. The northern segment extends from the U.S.-Canada border to New Hampshire-Massachusetts from shore to the 300 ft depth, whereas the southern segment extends from Montauk, New York to Cape Hatteras from 20 to 90 ft depth. This program collects data in support of single and multispecies stock assessments in the mid-Atlantic.

The protocol in the northern segment includes deploying a modified Gulf of Maine shrimp trawl, typically used by commercial vessels in Maine and New Hampshire, at approximately 2.2 kt for 20 min. The survey averages 200 tows per year and requires approximately 30 to 50 DAS using the F/V *R. Michael.* In the southern segment a 4-seam, 3-bridle bottom trawl is deployed at approximately 3.0 kt for 20 min. The survey averages 300 tows per years and requires approximately 30–50 DAS using the F/V *Darana R.* The net has a 58-ft headrope, 70-ft footrope, 24-ft siderope, with 1 inch poly stretch mesh, and #7.5 Bison doors.

9. *Northeast Observer Program (NEFOP) Observer Bottom and Mid-water Trawl Training Trips:* This is a certification training program for new NEFOP Observers. It occurs from Maine to North Carolina annually, using one-day trips throughout the year as needed, totaling about 18 DAS on contracted commercial fishing vessels. The protocol includes deployment of a commercial fishing net (net size, tow speed, and other details vary depending on the vessel and gear used). The trips do not use active acoustic gear as part of the training and approximately 108 tows may occur annually.

10. *Northern Shrimp Survey:* The NEFSC conducts these surveys annually in July in the Gulf of Maine during daylight hours. It determines the distribution and abundance of northern shrimp and collects related data. The protocol includes deployment of 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 *G. Michelle.*

11. *NEFSC Standard Bottom Trawl Surveys (BTS):* This survey has been conducted annually in spring (Mar–May, occasionally to June) and fall (Sep–Nov) from Cape Hatteras to the western Scotian Shelf. The survey operates on a 24-hour schedule. It tracks mature fish species and juvenile abundance over their range of distribution.

Protocols include deployment of a 4-seam, 3-bridle bottom trawl at 3 kts for 20 min. The combined surveys average 800 tows and require 120 DAS using the R/V *H.B. Bigelow,* or a similar size vessel. The net size is 31 m long, 19 m wide and 5 m high. Additional protocols include the use of CTD profiler, bongo net equipped with CTD, ADCP (output frequencies: 150 or 300 kHz), and the use of split beam and multibeam active acoustics (output frequencies: 18, 38, 70, 120, and 200 kHz).

12. *Atlantic Herring Survey:* This survey is conducted in September and October, as funding allows, on Georges Bank and in the Gulf of Maine. Survey operations occur on a 24-hr schedule. The survey collects fisheries independent herring spawning biomass data and also includes survey equipment calibration and performance tests.

Protocols included deployment of the Gourock high speed midwater rope trawl at 4 kt for 5 to 30 min. Approximately, 70 tows occur, which require about 34 DAS using the R/V *H.B. Bigelow* or similar size vessel. The net size is 15 m high and 30 m wide. Trawling protocols also include 20 deployments of the 4-seam, 3-bridle bottom trawl at 3 kts for 10–20 minutes using the R/V *H.B. Bigelow,* R/V *Pisces,* or similar size vessel. 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).

13. *Atlantic Salmon Trawl Survey:* This survey is conducted annually in May, as funding allows, in inshore waters of Gulf of Maine and Penobscot Bay during daylight hours. It evaluates the marine ecology of Atlantic salmon.

Protocols include deployment of a modified mid-water trawl that fishes at the surface via pair trawling at 2–6 kt for 30 to 60 min. Approximately 130 tows occur which require approximately 21 DAS using contracted commercial vessels.

14. *Deepwater Biodiversity Survey:* This survey is conducted annually in summer, as funding allows, in deep-water from Cape Hatteras to the mid-Atlantic Ridge (international waters). Survey operations are on a 24-hour schedule. It is intended to collect fish, cephalopod and crustacean specimens from 1,000 to 2,000 m for tissue samples, specimen photos, and documentation of systematic characterization.

Protocols include deployment of the 4-seam, 3-bridle bottom trawl with roller gear and the International Young Gadoid pelagic trawl. 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 min). The surveys average approximately 18 tows per year and require about 16 DAS (R/V *H.B. Bigelow,* R/V *Pisces* or equivalent). Additional protocols include the use of multi-frequency active acoustics (output frequencies: 18, 38, 70, 120, and 200 kHz).

15. *Penobscot Estuarine Fish Community and Ecosystem Survey:* This survey is conducted annually year round during daylight hours in Penobscot Estuary and Bay using a contracted commercial vessel. It is intended to survey and collect fish and invertebrates samples for biometric and population analysis of estuarine and coastal species.

The protocol for the survey is to deploy a Mamou shrimp trawl modified to sample at the surface which is towed at 2 to 4 kt. The trawl has a mouth opening 12 x 6 m as is towed for 20 min. Approximately 200 trawl tows are conducted per year and require about 12 DAS.

16. *Northeast Integrated Pelagic Survey:* This survey is conducted annually each quarter (*e.g.,* Feb, May, Jun, Aug, and Nov) in an area that expends from Cape Hatteras to the western Scotian Shelf. It assesses 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. Survey operations are on a 24-hour schedule.

NEFSC protocols include deploying a variety of fishing trawls:

• Hydroacoustic midwater rope trawl. The net is 15 m high, 30 m wide and towed at 4 kt for 5 to 30 min 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 kt for a maximum of 30 min; approximately 160 tows are conducted per year.

• Mid-water trawl. The trawl is for use in shallow water (greater than 15 m depth). The net has an 8 m x 8 m opening and is towed at 2.5 kt for a maximum of 30 min; approximately 80 tows are conducted per year.

The surveys require about 80 DAS and are conducted on one of several vessels including: R/V *H.B. Bigelow,* R/V *Pisces,* and R/V *G. Gunter.* Additional protocols also include the use of CTD, rosette water sampler, bongo net equipped with CTD, the continuous use of split beam and multibeam active acoustics (output frequencies: 18, 38, 70, 120, 200 kHz) and ADCP (300 or 150 kHz).

17. *Apex Predators Bottom Longline Coastal Shark:* This survey is conducted bi-annually (Apr–May), contingent upon funding, in an area extending from Florida to Delaware. It assesses 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.

Protocols for 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 lightsticks, soak time is 3 hours, and the gear is hauled during daylight. There are about 56 sets per survey, which require 47 DAS using charter vessels.

18. *Apex Predators Pelagic Nursery Grounds Shark:* This research is conducted aboard commercial swordfish vessels in October on Georges Bank and the Grand Banks off Newfoundland. This collaborative work offers NEFSC researchers the opportunity to sample and tag bycaught sharks. Further, it offers a unique opportunity to sample and tag blue sharks and shortfin makos in a potential nursery area on the Grand Banks. Sharks are released after tagging.

Protocols for this research are based on commercial fishing operations. The commercial swordfish longline gear is set at night, with lightsticks, and hauled in the morning—vessel operations are on a 24-hour schedule. Commercial trips require 21 to 55 DAS using the F/V *Eagle Eye II.*

19. *Cooperative Atlantic States Shark Pupping and Nursery Survey (COASTSPAN):* This survey is conducted annually from Jun–Aug in coastal Delaware, New Jersey, and Rhode Island waters. 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.

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: 1000 ft/1000 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 NEFSC-conducted surveys require 25 DAS, whereas the cooperating institutions surveys require about 40 DAS using the R/V *C.E. Stillwell* and partner vessels.

20. *NEFOP Observer Bottom Longline Training Trips:* As with the NEFOP Observer bottom and mid-water trawl training trips discussed earlier, these trips are certification training for NEFOP observers. However, the NEFSC has not implemented this training to date but expect it to occur when funding becomes available. The trips will occur from Maine to North Carolina annually 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. Survey protocols do not include the use of lighsticks in training trip fishing operations.

21. *Annual Assessments of Sea Scallop Abundance and Distribution in Selected Closed/Rotational Areas:* The Atlantic Sea Scallop Research Set Aside rotational surveys occur at various times within the April—September period, depending on the area studied (see Table 1–1 in the NEFSC's LOA application for specific sampling dates and ships used). The survey region includes: Large areas in Georges Bank, Closed Areas I & II, Hudson Canyon, DelMarVa, Nantucket, Gulf of Maine Mid-Atlantic areas, and other scallop fishing grounds. It monitors 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.

Survey protocols include commercial and standardized NMFS scallop dredges, towed simultaneously. Survey operations are 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 tow speed is approximately 3.8–4.0 kt for 15 min. The NEFSC completes about 100 dredge tows per year in each rotational area when sampled using that method. The average number of dredge tows per year is approximately 200 in all areas.

Additional protocols include the use of a towed photographic and sonar hydroacoustic imaging system (HABCAM) and a drop camera, and underwater video system. The HABCAM photographic system has 1 m field of view in each photograph, 5–10 frames per second with greater than 50 percent overlap at 5 kt towing speed. Photo system coupled with two Imagenix side scan sonars or Teledyne Benthos C3D side scan sonars. Between 350 and 690 nm of transects using digital photography by HABCAM each year. The drop camera typically samples over 400 stations on a 1.57 km sampling grid.

22. *NEFOP Observer Scallop Dredge Training Trips:* As described earlier, these trips are certification training for NEFOP observers and occur from Maine to North Carolina annually, with one-day trips (daylight tows) throughout the year as needed. The trips require approximately 6 DAS on contracted commercial fishing vessels using commercial scallop gear such as a turtle deflector dredge (4 to 5 m wide). The tow duration lasts approximately 1 hour with 2 to 3 tows per trip.

23. *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. It assesses distribution and abundance of sea scallops and collects related data. Survey operations are on a 24-hour schedule.

The protocol, since 2008, is to use the chartered vessel R/V *H.R. Sharp* from the University of Delaware to conduct the standardized survey. The vessel deploys a NEFSC 8-ft 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 tow intervals with a 3.5:1 tow wire to depth ratio (scope). Approximately 450 stations are sampled each year and require about 36 DAS. Additional protocols may include deploying a stereo-optic towed camera array to count and measure sea scallops and associated fauna utilizing automated digital imagery. The camera system was towed during the 2012 standard survey for half of the sea days. The non-invasive vehicle is towed by a 2-inch fiber optic cable that keeps the vehicle about 1.5 m off the sea floor.

24. *Surf Clam and Ocean Quahog Dredge Survey:* The NEFSC standard surf clam and quahog survey occurs every three years during Jun–Aug in an area that extends from southern Virginia to Georges Bank. It assesses distribution and abundance of surf clams and quahogs and collects related data. Survey operations are on a 24-hour schedule. Until 2012 the surveys were conducted using the F/RV *Delaware II.*

The protocol is to use commercial vessels to conduct the survey. The contract vessel will deploy a standard commercially sized hydraulic-jet clam dredge (13 ft blade width). The dredge will be towed at 1.5 kts for 5 min with a 2:1 tow wire to depth ratio (scope). The survey averages 150 tows per survey and requires 15 DAS.

25. *Beach Seine Survey, Maine:* The Maine beach seine survey occurs annually during Apr–Nov in the Penobscot River estuary. It monitors the salmon community within the estuary. Survey operations are during daylight hours.

The protocol is to set the seine biweekly. Seines are deployed with one end held on shore by a crew member and the other end attached to a boat traveling in an arc, and then retrieved by pulling both ends onto shore. The seine is 45 m in length with 5 mm nylon mesh. Typical seine heals are less than 15 min with the resultant catch sampled and released. The survey averages 5 sets per day and 100 sets per year and requires approximately 20 DAS.

26. *Beach Seine Survey, New Jersey:* The New Jersey beach seine survey occurs in summer (Jun–Aug) in Sandy Hook Bay and in the Navesink River, NJ. It monitors the fish community at fixed locations, and survey operations are conducted from shore during daylight hours.

The protocol is to set seines in close proximity to shore by small boat crews. Seines are deployed with one end held on shore by a crew member and the net slowly deployed by boat in an arc and then retrieved by pulling both ends onto shore. The seine is 45 m in length with 5 mm nylon mesh. Typical seine heals are less than 15 min with the resultant, catch sampled and released. The survey averages 90 sets per year.

27. *Coastal Maine Telemetry Network:* This research is conducted year round in the Gulf of Maine and April–November in the Penobscot River, estuary, and bay. The survey operates on a 24-hour schedule. This project monitors tagged fish (*e.g.,* Atlantic salmon, Atlantic sturgeon, and short-nose sturgeon) entering the Penobscot Bay System and exiting the system into the Gulf of Maine. A contracted commercial vessel is used to service the array and requires 10 DAS.

The protocol 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 to scan the 69 kHz frequency. Data acquisition is obtained by hauling each buoy and downloading the data.

28. *Deep-sea Coral Survey:* The deep-sea coral survey occurs annually between April–August in deep water (greater than 500 meters) from Cape Hatteras to the eastern Scotain Shelf. It assesses the species diversity, community composition, distribution, and extent of deep sea coral and sponge habitats along the continental shelf margin, slope, and submarine canyons. Survey operations are on a 24-hour schedule. The survey averages 16 DAS, using the R/V *H.B. Bigelow.*

Protocols include deploying a 2-m beam trawl (optional) which is 2 m wide and towed at 2 kt for 20 min at depth with a maximum of 30 tows; towing a tethered ROV (10 dives) at 3 kt; a towed camera system at 0.25 kt for 8 hours (18 dives); and CTD profiler with Niskin 12-bottle rosette water sampler. Additional protocols include the use of ADCP (300 or 150 kHz) and split beam and multi-beam acoustics (output frequencies: 18, 38, 70, 120, and 200 kHz).

29. *DelMarVa Habitat Characterization:* This survey occurred one time in August, 2013 in coastal waters off Delaware, Maryland, and Virginia (DelMarVa). The purpose was to characterize and determine fish use of bottom habitats in coastal waters off the DelMarVa Peninsula, as an adjunct to the DelMarVa Reef Survey. Survey operations were during daylight hours aboard the R/V *Resolute* and required 5 DAS.

The protocol was to perform water column acoustic surveys using a single beam, dual frequency (38 and 120 kHz) sonar system. Acoustic transects were performed for periods of 4–6 hours at speeds of 2–4 kt, interrupted periodically to obtain vertical CTD casts recording profiles for temperature, conductivity, chlorophyll a, and turbidity.

30. *DelMarVa Reefs Survey:* This survey occurs annually during August in coastal waters off Delaware, Maryland, and Virginia. The 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 *Sharp* and requires 5 DAS. The protocol is to deploy and continuously tow a HabCam towed camera vehicle at 5 kt and a CTD.

31. *Diving Operations:* Daylight diving operations are conducted on a year-

round basis in Long Island Sound. It collects growth data on hard clams, oysters and bay scallops. The survey is conducted, using the R/V *Loosanoff,* R/V *Milford 17,* or R/V *Milford 22* and requires 20 DAS.

The 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.

32. *Ecology of Coastal Ocean Seascapes:* This survey is conducted annually in spring, summer, and fall within the New York Bight. It provides information required for a next generation spatially and temporally explicit population simulation model for commercially important stocks such as summer flounder. Approximately 80 tows are conducted using the R/V *Nauvoo* or R/V *Resolute,* and the survey requires 35 DAS.

The protocol is to deploy a video sled containing a Sea Cam 5000 12 v video cam towed at 1 kt for 300 m. Additional protocols include deployment of CTD, YSI, (1.4 m x 1 m Tucker trawl), plankton net, multi-nutrient analyzer (EcoLAB 2) and Kemmerer bottle. Active acoustics include an ADCP (600 kHz) and multi-frequency echosounder (output frequencies: 38 and 120 kHz).

33. *Finfish Nursery Habitat Study:* This survey is conducted from May through October in Long Island Sound during daylight hours within two hours of high tide. It collects fish eggs, larvae, and juvenile fish from the seabed to identify essential habitats, and to track movements of juvenile fish. The survey is conducted using the R/V *Loosanoff,* R/V *Milford 17,* or *Milford 22* and requires 10 DAS.

The protocol is to deploy: (1) An epibenthic sled (1 m x 333 cm opening) towed on the seabed at 1.5 kts for 5 min; (2) bongo net tow at 0.5 kts at varying depths between the surface and bottom; and (3) Neuston plankton net (1 m x 0.5 m opening a 1 kt at the surface). An additional protocol is to implant 30 acoustic (70 kHz) tags on juvenile fish. The tags have a 14-month battery life.

34. *Gear Effects on Amphipod Tubes:* This survey occurs annually in July and August in Sandy Hook, Barnegat, and Great South Bay, NJ. It assesses the abundance of amphipod tubes and the effects of bull raking and crab dredging. Sampling is conducted during day and night using the R/V Nauvoo, R/V Resolute, and R/V Harvey and requires 20 DAS. The protocol is to deploy a Ponar sediment grab, YSI, 1 m x 1 m Tucker trawl, and a plankton net. The number of samples varies.

35. *Gulf of Maine Ocean Observing System Mooring Cruise:* This survey occurs annually during May and Oct in the Gulf of Maine and northern portion of Georges Bank. It services oceanographic moorings operated by the University of Maine. The vessels used are the R/V *H.B. Bigelow,* R/V *Pisces,* and R/V *G. Gunther* which operate on a 24-hour schedule. The cruise requires 12 DAS. The protocol is to operate the ADCP (300 kHz) during vessel transects to moorings and service ADCP (300 and 75 kHz) on moorings.

36. *Hydroacoustic Surveys:* This survey occurs from spring to autumn (Apr–Nov) in Penobscot Bay and estuary. The purpose of the hydroacoustic component of the estuary surveys is to describe 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 which require 25 DAS operate during daylight hours using the R/V *Silver Smolt* or similar size charter vessel. The protocol is to operate active multi-frequency acoustics: Split-beam (38 and 120 kHz) and DIDSON sonars (1.1 megahertz (MHz)).

37. *Maine Estuaries Diadromous Survey:* This survey occurs annually (Apr–Nov) in the Penobscot River estuary. It assesses the fish community. Survey operations are on a 24-hour schedule.

Protocols include setting a 2 m (2 m x 2 m; 1.9 cm mesh) or 1 m (1m x 1 m; 0.6 cm mesh) inshore by small boat crews during daylight at low tide. The fyke net soaks overnight and is hauled the next day. A marine mammal excluder device is incorporated into the 2 m net (but not the 1 m net). The marine mammal excluder device is a grate of metal bars with 14 centimeter spacing between the bars. The 1 m net has a throat opening of only 12.7 centimeters, which is too small for marine mammals to enter the net. From April–May the nets are set weekly, then twice per month through Nov. The survey averages 100 sets per year which requires about 100 days to complete.

38. *Miscellaneous Fish Collections and Experimental Survey Gear Trials:* These small-scale and opportunistic projects are conducted in all seasons in New York Bight estuary waters. The research activities are conducted on the R/V *Nauvoo,* R/V *Resolute,* R/V *Harvey,* or R/V *Chemist.*

The survey protocol depends on the sampling or gear trial protocols. Potential gear are: (1) Combination bottom trawl—net size: 23 ft head rope, 32 ft sweep, 7 ft rise, tow speed 2.5 kts for 20 min;

(2) Lobster pots—18 in x 24 in x 136 in wire pot connected by ⅜ in rope with 7 in x 14 in surface float. One to 60 posts are set for 24 to 96 hours between retrievals;

(3) Fish pots—9 in x 9 in x 18 in wire pots with ⅛ in mesh liner, connected by ⅜ in rope with 7 in x 14 in surface floats. One to 60 pots are set for 24–96 hours between retrievals;

(4) A 2-m beam trawl towed at 2 kts for 15 minutes, up to 5 tows per year;

(5) A seine net; and

(6) Trammel nets—multi trammel net, 12 in walling, 3 in mesh, 6 ft deep x 25 ft long.

39. *NEFOP Observer Gillnet Training Trips:* As described earlier, these one day trips are certification training for NEFOP observers and occur from Maine to North Carolina annually for 6 to 10 DAS on contracted commercial fishing vessels using the contracted vessel's gillnet gear. The nets are strings of 3 to 5 panels each soaked for 12 to 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.

40. *Nutrients and Frontal Boundaries:* This study is conducted quarterly in February, May–Jun, Aug, and Nov in the mid-Atlantic Bight (*i.e.,* coastal New Jersey and Long Island waters). The survey is conducted using the R/V *Resolute* and requires 10 DAS. Sampling occurs day and night. The survey protocol requires ADCP (600 kHz), multi-frequency active acoustic devices (38 and 120 kHz), and deployment of CTD.

41. *Ocean Acidification:* These studies are conducted quarterly in the Hudson River and adjacent coastal waters. The purpose is to develop baseline pH measurements in the Hudson River water. This is conducted using the R/V Resolute and requires 10 DAS. Sampling occurs day and night. The protocol is to deploy a YSI 6000, CTD, Kemmerer bottle, and EcoLAB2 multi-nutrient analyzer.

42. *Pilot Studies:* This project is conducted annually in June in Massachusetts coastal waters or on Georges Bank. The survey protocol is to deploy an autonomous underwater vehicle (AUV; Remus 100) during daylight hours to test equipment. The AUV is deployed from the R/V *G. Michelle* and requires 5 DAS.

43. *Rotary Screw Trap (RSTs) Survey:* Rotary screw trap sampling is conducted annually from Apr to Jun, daily (mornings) in the Penobscot River estuary. It assesses the fish community

within the estuary. This project requires 60 DAS.

The protocol is to deploy one to three traps depending on 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.

44. *Sea Bed Habitat Classification Survey:* This survey is conducted year round in Long Island Sound during daylight hours within two hours of high tide. It determines the composition of the surface layer of the seabed utilizing hydroacoustic equipment. The survey requires 20 DAS using the R/V *Loosanoff,* R/V *Milford 17,* or R/V *Milford 22.*

The protocol is to connect a Quester Tangent seabed classification system to the 50/200 kHz hull-mounted transducer while transects are made at 4.5 kts. In addition, a drop camera (24 in x 24 in x 24 in) in a water filled box is deployed 2 m or less above the seabed directly below the support vessel.

45. *Trawling to Support Finfish Aquaculture Research:* This work is conducted annually from May through Aug in Long Island Sound. It collects finfish broodstock for laboratory spawning and rearing and experimental studies.

The protocol is to deploy 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 gill net which is 150 ft long 8 ft high, with 4 in stretched mesh. The combination and shrimp trawls require 50 tows, the rod and reel 12 hooks fished for 1000 hr and 15 gillnet sets. The survey requires 30 DAS using the R/V *Loosanoff,* R/V *Milford 17,* or R/V *Milford 22.*

46. *U.S. Army Corps of Engineers Bottom Sampling:* Bottom grab samples are collected every two years in Woods Hole Harbor for habitat assessment monitoring. The protocol is to deploy a Peterson grab to collect 6 random samples. This is conducted by the R/V *G. Michelle* during daylight hours and requires one DAS.

47. *COASTSPAN Longline and Gillnet Surveys:* The purpose of this survey is to determine the location of shark nurseries, their 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. Cooperating institutions and agencies conduct this component of COASTSPAN (*e.g.,* South Carolina Department of Natural Resources, Georgia Department of Natural Resources, and University of North Florida). It occurs from Florida to Rhode Island annually during summer using 85 DAS on cooperating institution and agency vessels.

The protocol for the survey includes deployment of bottom longline gear or anchored sinking gillnet. There are two categories of longline gear characteristics based on the size of sharks targeted; small juvenile sharks and large juvenile/adult sharks. The mainline length is 1000 ft for both categories. Gangion length is 5 ft for small sharks and 8 ft for large sharks. Gangion spacing is 20 ft for small sharks and 40 ft for large sharks. Mustad circle hooks of size 12/0 are used for small sharks and size 16/0 for large sharks. Sets for small sharks use 50 hooks per set while large shark sets have 25 hooks. The bait is finfish (mackerel or herring) for both types of sets. Soak time is 30 minutes for small sharks and 2 hours for large sharks. Approximately 150 total sets are made per survey. The single panel anchored gillnet is 325 ft long x 10 ft high with 4 in stretch mesh made of #177 (20 lb test) nylon monofilament. The soak time is 3 hours, but the net is continuously checked to retrieve, tag and release target species and release all bycatch.

48. *Opportunistic Hydrographic Sampling:* This program consists of opportunistic plankton and hydrographic sampling during summer transits on the R/V *Okeanos Explorer* in waters less than 300 m deep. The protocol is to deploy small plankton nets (1 m x 2 m) to a depth of 25 m and to record hydrographic data from expendable bathythermographs.

Description of Active Acoustic Sound Sources

This section contains a brief technical background on sound, the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to the NEFSC's specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. We also describe the active acoustic devices used by the NEFSC.

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the ''loudness'' of a sound and is typically described using the relative unit of the decibel (dB). A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal [μPa]), and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1 μPa), while the received level is the SPL at the listener's position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Rms is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Rms accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 $\mu Pa^2 - s$) represents the total energy contained within a pulse, and considers both intensity and duration of exposure. For a single pulse, the numerical value of the SEL measurement is usually 5–15 dB lower than the rms sound pressure in dB re 1 μPa, with the comparative difference between measurements of rms and SEL measurements often tending to decrease with increasing range (Greene, 1997; McCauley *et al.,* 1998). Peak sound pressure is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source, and is represented in the same units as the rms sound pressure. Another common metric is peak-to-peak sound pressure (p-p), which is the algebraic difference between the peak positive and peak negative sound pressures. Peak-to-peak pressure is typically approximately 6 dB higher than peak pressure (Southall *et al.,* 2007).

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams (as for the sources considered here) or may radiate in all directions (omnidirectional sources). The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound. Ambient sound is defined as environmental background sound levels lacking a single source or point (Richardson *et al.,* 1995), and the sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.,* waves, earthquakes, ice, atmospheric sound), biological (*e.g.,* sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.,* vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including the following (Richardson *et al.,* 1995):

- Wind and waves: The complex interactions between wind and water surface, including processes such as breaking waves and wave-induced bubble oscillations and cavitation, are a main source of naturally occurring ambient sound for frequencies between 200 Hz and 50 kHz (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Surf sound becomes important near shore, with measurements collected at a distance of 8.5 km from shore showing an increase of 10 dB in the 100 to 700 Hz band during heavy surf conditions.
- Precipitation: Sound from rain and hail impacting the water surface can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times.
- Biological: Marine mammals can contribute significantly to ambient sound levels, as can some fish and shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz.
- Anthropogenic: Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, seismic surveys, sonar, explosions, and ocean acoustic studies. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly. Sound from identifiable anthropogenic sources other than the activity of interest (*e.g.,* a passing vessel) is sometimes termed background sound, as opposed to ambient sound.

The sum of the various natural and anthropogenic sound sources at any given location and time—which comprise ''ambient'' or ''background'' sound—depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10–20 dB from day to day (Richardson *et al.,* 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals. Details of source types are described in the following text.

Sounds are often considered to fall into one of two general types: Pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.,* Ward, 1997 in Southall *et al.,* 2007). Please see Southall *et al.* (2007) for an in-depth discussion of these concepts.

Impulsive sound sources (*e.g.,* explosions, airguns, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have a greater potential to affect hearing sensitivity as compared to sounds that lack these features.

Non-pulsed (*i.e.,* continuous) sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.,* rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems (such as those used by the U.S. Navy). The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

We use generic sound exposure thresholds (see Table 1 in this notice) to determine when an activity that produces sound might result in impacts to a marine mammal such that a take by harassment might occur. These thresholds should be considered guidelines for estimating when harassment may occur (*i.e.,* when an animal is exposed to levels equal to or exceeding the relevant criterion) in specific contexts; however, useful contextual information that may inform our assessment of effects is typically lacking and we consider these thresholds as step functions.

TABLE 1—CURRENT ACOUSTIC EXPOSURE CRITERIA

Criterion	Definition	Threshold
Level A harassment (underwater)	Injury (PTS—any level above that which is known to cause TTS).	180 dB (cetaceans)/190 dB (pinnipeds) (rms).
Level B harassment (underwater)	Behavioral disruption	160 dB (impulsive source)/120 dB (continuous source) (rms).

These are simple step-function thresholds that do not consider the repetition or sustained presence of a sound source nor does it account for the known differential hearing capabilities between species. Sound produced by the NEFSC's acoustic sources here are very short in duration (typically on the order of milliseconds), intermittent, have high rise times, and are operated from moving platforms. Thus, we consider them as impulsive sources.

NMFS is currently revising these acoustic guidelines; for more information on that process, please visit *www.nmfs.noaa.gov/pr/acoustics/guidelines.htm*. NMFS has determined that the 160-dB threshold for impulsive sources is most appropriate for use in considering the potential effects of the NEFSC's activities.

Sound Propagation Assumptions

The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, most notably the water bathymetry and presence or absence of reflective or absorptive conditions including in-water structures and sediments. Spherical spreading occurs in a perfectly unobstructed (free-field) environment not limited by depth or water surface, resulting in a 6-dB reduction in sound level for each doubling of distance from the source (20*log[range]). Cylindrical spreading occurs in an environment in which sound propagation is bounded by the water surface and sea bottom, resulting in a reduction of 3 dB in sound level for each doubling of distance from the source (10*log[range]). A practical spreading value of fifteen is often used under conditions where water increases with depth as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions. Practical spreading loss (4.5 dB reduction in sound level for each doubling of distance) is not assumed for this proposed rulemaking. The use of a spherical spreading remains a reasonable, if not conservative, assumption for a generalized approach assessing the Level B harassment zones around various echo-sounders for this proposed rulemaking.

For the frequencies of the echo sounders/sonars used in the fisheries acoustics applications (greater than 10 kHz) and the realistic water depths involved in the surveys (greater than 30 m), the ratio of depth to the wave length is typically greater than 200, unlikely causing any type of cylindrical-like spreading, *i.e.* waveguide effect.

Due to the relatively short distances these sounds travel before falling below threshold due to spreading loss and absorption of these typically high-frequency sources, most are unlikely to reach distances far enough from the source to transition to propagation loss approaching cylindrical spreading. The multi-path arrivals that might lead to a lower propagation loss for more continuous signals, are more likely for these very short duration signals to lead to a lengthening of the signal (or even discrete pulses if surface/bottom bounces occur) rather than an increase in sound pressure level. This would leave the range at which the signal drops to a particular SPL (*e.g.,* 160 dB re 1uPa rms) unaltered from the spherical spreading model. Also critically important to consider is that these sources are highly directional, and most often pointed towards the bottom. When this acoustic energy hits the bottom at low angles of incidence or large grazing angle (*e.g.* on a path nearly perpendicular to the ocean floor), the much of this energy will be both absorbed and scattered, rather than reflected, leading to a very high loss of energy due to interaction with the bottom. As a result, the transmission loss would likely be much higher, rather than having a perfect reflection of all energy which could then lead to a less than 20LogR transmission loss overall.

Finally, there are also a number of very conservative assumptions used in the NEFSC's calculations (*e.g.,* highest source level and lowest frequency for range calculations) which leads to overestimates of the potential range where Level B harassment might occur, since operationally, parameters like the source level are likely to be lower in shallow water where a large range detection is unnecessary.

Description of NEFSC's Active Acoustic Devices

NEFSC's fisheries surveys may use a wide range of active acoustic devices 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. The NEFSC may also use passive listening sensors (*i.e.,* remotely and passively detecting sound rather than producing it), which do not have the potential to impact marine mammals. NEFSC active acoustic sources 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.,* acoustic Doppler current profilers).

Mid- and high-frequency underwater acoustic sources typically used for scientific purposes operate by creating an oscillatory overpressure through rapid vibration of a surface, using either electromagnetic forces or the piezoelectric effect of some materials. A vibratory source based on the piezoelectric effect is commonly referred to as a transducer. Transducers are usually designed to excite an acoustic wave of a specific frequency, often in a highly directive beam, with the directional capability increasing with operating frequency. The main parameter characterizing directivity is the beam width, defined as the angle subtended by diametrically opposite ''half power'' (−3 dB) points of the main lobe. For different transducers at a single operating frequency the beam width can vary from 180° (almost omnidirectional) to only a few degrees. Transducers are usually produced with either circular or rectangular active surfaces. For circular transducers, the beam width in the horizontal plane (assuming a downward pointing main beam) is equal in all directions, whereas rectangular transducers produce more complex beam patterns with variable beam width in the horizontal plane. Please see Zykov and Carr (2014) for further discussion of electromechanical sound sources.

The types of active sources employed in fisheries acoustic research and monitoring may be considered in two broad categories here, based largely on their respective operating frequency (*e.g.,* within or outside the known audible range of marine species) and other output characteristics (*e.g.,* signal duration, directivity). As described below, these operating characteristics result in differing potential for acoustic impacts on marine mammals.

Category 1 active fisheries acoustic sources include those with high output frequencies (greater than 180 kHz) that are outside the known functional hearing capability of any marine mammal. Sounds that are above the functional hearing range of marine animals may be audible if sufficiently loud (*e.g.,* Mohl, 1968) or may elicit some type of behavioral response (*e.g.,* Deng *et al.,* 2014; Hastie *et al.,* 2014). However, the relative output levels of these sources mean that they would potentially be detectable to marine mammals at maximum distances of only a few meters, and are highly unlikely to be of sufficient intensity to result in behavioral harassment. These sources also generally have short duration signals and highly directional beam patterns, meaning that any individual marine mammal would be unlikely to even receive a signal that would almost certainly be inaudible. Therefore, Category 1 sources are not expected to have any effect on marine mammals and are not considered further in this document.

Category 2 acoustic sources, which are present on most NEFSC fishery research vessels, 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 lower output frequencies than Category 1 sources. Category 2 active acoustic sources have moderate to high output frequencies (10 to 180 kHz) that are generally within the functional hearing range of marine mammals and therefore have the potential to cause behavioral harassment. However, while likely potentially audible to certain species, these sources have generally short ping durations and are typically focused (highly directional) to serve their intended purpose of mapping specific objects, depths, or environmental features. These characteristics reduce the likelihood of an animal receiving or perceiving the signal. A number of these sources, particularly those with relatively lower output frequencies coupled with higher output levels can be operated in different output modes (*e.g.,* energy can be distributed among multiple output beams) that may lessen the likelihood of perception by and potential impact on marine mammals.

We now describe specific acoustic sources used by the NEFSC. The acoustic system used during a particular survey is optimized for surveying under specific environmental conditions (*e.g.,* depth and bottom type). Lower frequencies of sound travel further in the water (*i.e.,* good range) but provide lower resolution (*i.e.,* are less precise). Pulse width and power may also be adjusted in the field to accommodate a variety of environmental conditions. Signals with a relatively long pulse width travel further and are received more clearly by the transducer (*i.e.,* good signal-to-noise ratio) but have a lower range resolution. Shorter pulses provide higher range resolution and can detect smaller and more closely spaced objects in the water. Similarly, higher power settings may decrease the utility of collected data. Power level is also adjusted according to bottom type, as some bottom types have a stronger return and require less power to produce data of sufficient quality. Power is typically set to the lowest level possible in order to receive a clear return with the best data. Survey vessels may be equipped with multiple acoustic systems; each system has different advantages that may be utilized depending on the specific survey area or purpose. In addition, many systems may be operated at one of two frequencies or at a range of frequencies. We summarize characteristics of these sources in Table 2.

1. *Multi-Frequency Narrow Beam Scientific Echosounders*—Echosounders and sonars work by transmitting acoustic pulses into the water that travel through the water column, reflect off the seafloor, and return to the receiver. Water depth is measured by multiplying the time elapsed by the speed of sound in water (assuming accurate sound speed measurement for the entire signal path), while the returning signal itself carries information allowing ''visualization'' of the seafloor. Multi-frequency split-beam sensors are deployed from NEFSC 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 operates Simrad EK60 system, which transmits and receives at six frequencies ranging from 18 to 333 kHz.

2. *Multibeam Echosounder and Sonar*—Multibeam echosounders and sonars operate similarly to the devices described above. However, 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 NEFSC operates the Simrad ME70 system, which is mounted to the hull of the research vessels and emits frequencies in the 70–120 kHz range.

3. *Single-Frequency Omnidirectional Sonar*—Low-frequency, high-resolution, long range fishery sonars operate with user selectable frequencies between 20–30 kHz, which provide longer range and prevent interference from other vessels. These sources provide omnidirectional imaging around the source with three different vertical beamwidths available (single or dual vertical view and 180° tiltable). At the 30-kHz operating frequency, the vertical beamwidth is less than 7° and can be electronically tilted from +10 to −80°, which results in differential transmitting beam patterns. The cylindrical multi-element transducer allows the omnidirectional sonar beam to be electronically tilted down to −60°, allowing automatic tracking of schools of fish within the entire water volume around the vessel. The NEFSC operates the Simrad SX90 system.

4. *Acoustic Doppler Current Profiler (ADCP)*—An ADCP is a type of sonar used for measuring water current velocities simultaneously at a range of depths. Whereas current depth profile measurements in the past required the use of long strings of current meters, the ADCP enables measurements of current velocities across an entire water column. 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. 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.

An ADCP anchored to the seafloor can measure current speed not just at the bottom, but at equal intervals to the surface. An ADCP instrument may be anchored to the seafloor or can be mounted to a mooring or to the bottom of a boat. ADCPs that are moored 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. ADCPs operate at frequencies between 75 and 300 kHz.

5. *Net Monitoring Systems*—During trawling operations, a range of sensors may be used to assist with controlling and monitoring gear. Net sounders give information about the concentration of fish around the opening to the trawl, as well as the clearances around the opening and the bottom of the trawl; catch sensors give information about the rate at which the codend is filling; symmetry sensors give information about the optimal geometry of the trawls; and tension sensors give information about how much tension is in the warps and sweeps. The NEFSC uses the NetMind System which measures door spread and monitors the door height off of the bottom and operates at 30 and 200 kHz. The NEFSC also uses a Simrad ITI Catch Monitoring System, which allows monitoring of the exact position of the gear and of what is happening in and around the trawl.

TABLE 2—OPERATING CHARACTERISTICS OF NEFSC ACTIVE ACOUSTIC SOURCES

Active acoustic system	Operating frequencies	Maximum source level (db)	Single ping duration (ms) and repetition rate (Hz)	Orientation/directionality	Nominal beamwidth (degrees)
Simrad EK60 (surrogate for ES60) narrow beam echosounder.	18, *38, 70, 120, 200,* 333 kHz; primary frequencies italicized.	224 dB	Variable; most common settings are 1 ms and 0.5 Hz.	Downward looking	7° at 38 kHz. 11° at 18 kHz.
Simrad ME70 multibeam echosounder.	70–120 kHz	205 dB	0.06–5 ms; 1–4 Hz	Primarily downward looking.	130°.
Simrad SX90 narrow beam sonar.	20–30 kHz	219 dB	Variable	Omnidirectional	4–5° (variable for tilt angles from 0–45° from horizontal).
Teledyne RD Instruments ADCP, Ocean Surveyor.	75 kHz	224 dB	0.2 Hz	Downward looking	30°.
Simrad ITI Catch Monitoring System.	27–33 kHz	214 dB	0.05–0.5 Hz	Downward looking	40°.
Raymarine SS260 transducer for DSM300 (surrogate for FCV–292).	50, 200 kHz	217 dB	Unknown	Downward looking	19° at 50 kHz. 6° at 200 kHz.
Simrad EQ50	50, 200 kHz	210 dB	Variable	Downward looking	16° at 50 kHz. 7° at 200 kHz.
NetMind	30, 200 kHz	190 dB	Unknown	Downward looking	50°.

Proposed Mitigation

In order to issue an incidental take authorization under section 101(a)(5)(A) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, ''and other means of effecting the least practicable adverse 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 subsistence uses.'' Note that taxonomic information for certain species mentioned in this section is provided in the following section (''Description of Marine Mammals in the Area of the Specified Activity'').

The NEFSC proposed to implement the following suite of mitigation measures during fisheries research. The Center bases these procedures on protocols used during previous research surveys and/or best practices developed for commercial fisheries using similar gear. In addition, the proposed rule's adaptive management framework would require the NEFSC to review its procedures and investigate options for incorporating new mitigation measures and equipment into its on-going survey programs. The NEFSC will initiate a process for its Chief Scientists and vessel captains to communicate with each other about their experiences with protected species interactions during research work with the goal of improving decision-making regarding avoidance of adverse interactions. Evaluations of new mitigation measures include assessments of their effectiveness in reducing risk to marine mammals. However, consideration of additionally proposed measures must also pass safety considerations and allow survey results to remain consistent with previous data sets.

General Measures

Coordination and communication—When NEFSC survey effort is conducted aboard NOAA-owned vessels, there are both vessel officers and crew and a scientific party. Vessel officers and crew are not composed of NEFSC staff, but are employees of NOAA's Office of Marine and Aviation Operations (OMAO), which is responsible for the management and operation of NOAA fleet ships and aircraft and is composed of uniformed officers of the NOAA Commissioned Corps as well as civilians. The ship's officers and crew provide mission support and assistance to embarked scientists, and the vessel's Commanding Officer (CO) has ultimate responsibility for vessel and passenger safety and, therefore, decision authority. When NEFSC survey effort is conducted aboard cooperative platforms (*i.e.,* non-NOAA vessels), ultimate responsibility, and decision authority again rests with non-NEFSC personnel (*i.e.,* vessel's master or captain). Decision authority includes the implementation of mitigation measures (*e.g.,* whether to stop deployment of trawl gear upon observation of marine mammals). The scientific party involved in any NEFSC survey effort is composed, in part or whole, of NEFSC staff led by a Chief Scientist (CS). Therefore, because the NEFSC—not OMAO or any other entity that may have authority over survey platforms used by the NEFSC—is the applicant to whom any incidental take authorization issued under the authority of these proposed regulations would be issued, we require that the NEFSC take all necessary measures to coordinate and communicate in advance of each specific survey with OMAO, or other relevant parties, to ensure that all mitigation measures and monitoring requirements described herein, as well as the specific manner of implementation and relevant event-contingent decision-making processes, are clearly understood and agreed-upon. This may involve description of all required measures when submitting cruise instructions to OMAO or when completing contracts with external entities. NEFSC will coordinate and conduct briefings at the outset of each survey and as necessary between ship's crew (CO/master or designee(s), as appropriate) and scientific party in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures. The CS will be responsible for coordination with the Officer on Deck (OOD; or equivalent on non-NOAA platforms) to ensure that requirements, procedures, and decision-making processes are understood and properly implemented.

Protected species training—In an effort to help standardize and further emphasize the importance of protected species information, the NEFSC will implement a formalized protected species training program for all crew members as part of its continuing research program that will be required for all NEFSC-affiliated research projects, including cooperative research partners. The NEFSC would conduct training programs on a regular basis which would include topics such as monitoring and sighting protocols, species identification, decision-making factors for avoiding take, procedures for handling and documenting protected species caught in research gear, and reporting requirements. Required training would occur through participation in protected species training programs developed by the regional commercial Fisheries Observer Program, which would typically be the Northeast Fisheries Observer Program (NEFOP).

All NEFSC research crew members that may be assigned to monitor for the presence of marine mammals and sea turtles during future surveys will be required to attend an initial training course and refresher courses annually or as necessary. The implementation of this new training program will formalize and standardize the information provided to all crew that might experience protected species interactions during research activities.

Vessel speed—Vessel speed during active sampling rarely exceeds 5 kt, with typical speeds being 2 to 4 kt. Transit speeds vary from 6 to 14 kt but average 10 kt. These low vessel speeds minimize the potential for ship strike (see ''Potential Effects of the Specified Activity on Marine Mammals and Their Habitat'' for an in-depth discussion of ship strike). At any time during a survey or in transit, if a crew member standing watch or dedicated marine mammal observer sights marine mammals that may intersect with the vessel course that individual will immediately communicate the presence of marine mammals to the bridge for appropriate course alteration or speed reduction, as possible, to avoid incidental collisions.

Other gears—The NEFSC deploys a wide variety of gear to sample the marine environment during all of their research cruises. Many of these types of gear (*e.g.,* plankton nets, video camera and ROV deployments) are not considered to pose any risk to marine mammals and are therefore not subject to specific mitigation measures. In addition, specific aspects of gear design, survey protocols (*e.g.,* number of hooks), and limited frequency of use indicate that certain types of gears that may otherwise be expected to have the potential to result in take of marine mammals do not pose significant risk to certain species of marine mammals (*e.g.,* large whales interactions with NEFSC longline gears) and are not subject to specific mitigation measures due to the low level of survey effort and small survey footprint relative to that of commercial fisheries. However, at all times when the NEFSC is conducting survey operations at sea, the OOD and/or CS and crew will monitor for any unusual circumstances that may arise at a sampling site and use best professional judgment to avoid any potential risks to marine mammals during use of all research equipment.

Handling procedures—The NEFSC will implement a number of handling protocols to minimize potential harm to marine mammals 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 incidental take of marine mammals in fishing gear is similar for commercial fisheries and research surveys, NEFSC proposes to adopt these protocols, which are expected to increase post-release survival. In general, following a ''common sense'' approach to handling captured or entangled marine mammals will present the best chance of minimizing injury to the animal and of decreasing risks to scientists and vessel crew. Handling or disentangling marine mammals carries inherent safety risks, and using best professional judgment and ensuring human safety is paramount. The NEFSC protected species training programs would include procedures for handling and documenting protected species caught in research gear, and reporting requirements. The CS and appropriate members of the research crews would also be trained using the same monitoring, data collection, and reporting protocols for protected species as is required by the NEFOP.

Written protocols—For all NEFSC-affiliated research projects and vessels, the vessel coordinator and center director reviews cruise instructions and protocols for avoiding adverse interactions with protected species. If the research is conducted on a NOAA vessel, the Commanding Officer finalizes these instructions. If any inconsistencies or deficiencies are found, the written instructions will be made fully consistent with the NEFOP training materials and any guidance on decision-making that arises out of the training opportunities described earlier. In addition, the NEFSC would review informational placards and reporting procedures and update them as necessary for consistency and accuracy. Many research cruises already include pre-sail review of protected species protocols. The NEFSC will require pre-sail briefings before all research cruises, including those conducted by cooperating partners, as part of its continuing research program.

Trawl Survey Visual Monitoring and Operational Protocols

The mitigation requirements described here are applicable to all beam, mid-water, and bottom trawl operations conducted by the NEFSC.

Visual monitoring—The OOD, CS (or other designated member of the Scientific Party), and crew standing watch on the bridge visually scan for marine mammals (and other protected species) during all daytime operations. Marine mammal watches will be conducted by scanning the surrounding waters with bridge binoculars to survey the area upon arrival at the station, during visual and sonar reconnaissance of the trawl line to look for potential hazards (*e.g.,* commercial fishing gear, unsuitable bottom for trawling, *etc.*), and while the gear is deployed. During nighttime operations, visual observation will be conducted using the naked eye and available vessel lighting.

The NEFSC considered a modification of the move-on rule to monitor for marine mammals for a 30-minute period while on station before deploying trawl gear. However, the NEFSC deemed this as not practicable because the measure would result in substantial delays to complete the surveys, increased costs and days at sea, and reductions in the number of stations and amount of fish sampled annually. The reduction in effort would adversely affect the scientific integrity of its research programs and quality of data used to inform NEFSC stock assessments by compromising the statistical continuity of long-term time-series data sets which could affect future fisheries management decisions.

Operational procedures—The primary purpose of conducting visual monitoring period is to implement the ''move-on rule.'' If marine mammals are sighted around the vessel before setting the gear, the OOD may decide to move the vessel away from the marine mammal to a different section of the sampling area if the animal appears to be at risk of interaction with the gear. During daytime trawl operations), 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 night time trawl operations or other periods of limited visibility. However, operational lighting from the vessel illuminates the water in the immediate vicinity of the vessel during gear setting and retrieval.

After moving on, if marine mammals are still visible from the vessel and appear to be at risk, the OOD may decide to move the vessel again or skip the sampling station. The OOD will consult with the CS or other designated scientist (identified prior to the voyage and noted on the cruise plan) and other experienced crew as necessary to determine the best strategy to avoid potential 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. If trawling operations have been delayed because of the presence of marine mammals, the vessel resumes trawl operations (when practical) only when the animals have not been sighted near the vessel or otherwise determined to no longer be at risk. This decision is at the discretion of the OOD and is situationally dependent.

In general, trawl operations will be conducted immediately upon arrival on station in order to minimize the time during which marine mammals may become attracted to the vessel. However, in some cases it will be necessary to conduct small net tows (*e.g.,* bongo net) prior to deploying trawl gear in order to avoid trawling through extremely high densities of gelatinous zooplankton that can damage trawl gear.

Once the trawl net is in the water, the OOD, CS, and/or crew standing watch will continue to visually monitor the surrounding waters and will maintain a lookout for marine mammal presence as far away as environmental conditions allow.

If marine mammals are sighted before the gear is fully retrieved, the most appropriate response to avoid marine mammal interaction will be determined by the professional judgment of the CS, watch leader, OOD and other experienced crew as necessary. This judgment will be based on past experience operating trawl gears around marine mammals (*i.e.,* best professional judgment) and on NEFSC training sessions that will facilitate dissemination of expertise operating in these situations (*e.g.,* factors that contribute to marine mammal gear interactions and those that aid in successfully avoiding such events). Best professional judgment takes into consideration the species, numbers, and behavior of the animals, the status of the trawl net operation (*e.g.,* 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. We recognize that it is not possible to dictate in advance the exact course of action that the OOD or CS should take in any given event involving the presence of marine mammals in proximity to an ongoing trawl tow, given the sheer number of potential variables, combinations of variables that may determine the appropriate course of action, and the need to consider human safety in the operation of fishing gear at sea. Nevertheless, we require a full accounting of factors that shape both successful and unsuccessful decisions and these details will be fed back into NEFSC training efforts and ultimately help to refine the best professional judgment that determines the course of action taken in any given scenario (see further discussion in ''Proposed Monitoring and Reporting'').

The efficacy of the ''move-on'' rule is limited during night time 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.

Tow duration and direction—Standard survey protocols that are expected to lessen the likelihood of marine mammal interactions include standardized tow durations and distances. Standard tow durations of not more than thirty minutes at the target depth will be implemented, excluding deployment and retrieval time (which may require an additional thirty minutes, depending on target depth), to reduce the likelihood of attracting and incidentally taking marine mammals. Short tow durations decrease the opportunity for marine mammals to find the vessel and investigate. The exceptions to the 30-min tow duration are the Atlantic Herring Acoustic Pelagic Trawl Survey (AHAPTS) and the deep-water biodiversity survey where the total time in the water (deployment, fishing, haulback) are 40 to 60 min and 180 min, respectively.

Trawl tow distances will be less than 3 nm—typically 1–2 nm, depending on the specific survey and trawl speed—which is also expected to reduce the likelihood of attracting and incidentally taking marine mammals.

The NEFSC will tow the bottom trawl in either straight lines or following depth contours, whereas the AHAPTS tows would target fish aggregations and deep-water biodiversity tows along oceanographic or bathymetric features. Sharp course changes will be avoided in all surveys.

Gear maintenance—The crew will be careful when emptying the trawl to avoid damage to 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 are present. The vessel's crew will clean trawl nets prior to deployment to remove prey items that might attract marine mammals. Catch volumes are typically small with every attempt made to collect all organisms caught in the trawl.

Speed and course alterations—The vessel's speed during active sampling with trawl nets will not exceed 5 kt. Typical towing speeds are 2–4 kt. Transit speed between active sampling stations will range from 10–12 kt, except in areas where vessel speeds are regulated to lower speeds. When operating in North Atlantic right whale 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 kt. Further, vessels will reduce speed and change course in the vicinity of resting groups of large whales.

As noted earlier, 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. Also, 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.

Dredge Survey Visual Monitoring and Operational Protocols

The mitigation requirements described here are applicable to all hydraulic, New Bedford-type, commercial, and Naturalist dredge operations conducted by the NEFSC.

Visual monitoring—Visual monitoring requirements for all dredge gears are the same as those described above for trawl surveys. Please see that section for full details of the visual monitoring and ''move-on'' protocols. The small size of the scallop dredge (eight feet wide) and clam dredge (13 feet wide) and the fishing orientation of the opening during most of the dredge haul (downward against the seabed) minimize the need for marine mammal excluding devices. However, care will be taken when emptying the dredge to avoid damage to protected species 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 protected species are present.

Tow duration and direction—Standard dredge durations are 15 min or less, excluding deployment and retrieval time, to reduce the likelihood of attracting and incidentally taking protected species.

Longline Gear Visual Monitoring and Operational Protocols

Visual monitoring—Visual monitoring requirements for pelagic or demersal longline surveys are the same as those described above for trawl surveys. Please see that section for full details.

Operational procedures—The precautions for setting longline gear apply to the following NEFSC surveys: Apex Predators Bottom Longline Coastal Shark, Apex Predators Pelagic Nursery Grounds Shark, COASTSPAN Longline Surveys, and the NEFOP Observer Bottom Longline Training Trips. Prior to setting the gear, the OOD, CS, and crew visually scan the waters surrounding the vessel for protected species at least 30 minutes before deploying the longline gear. This typically occurs during transit through the setting area and then returning back to the starting point. Longline sets may be delayed if marine mammals have been detected near the vessel in the 30 minutes prior to setting the gear.

For the Apex Predators Bottom Longline Coastal Shark Survey, the OOD, CS, and crew uses a one nautical mile radius around the vessel as to guide the decision on whether marine mammals are at risk of interactions before deploying the gear). 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 to look for hooked 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. The NEFSC has established standard soak times of three hours for bottom longline and two to five hours for pelagic longline surveys. The CS will ensure that soak times do not exceed five hours, except in cases where weather or mechanical difficulty delay gear retrieval.

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 min. When visibility allows, the OOD, CS, and crew standing watch will conduct set checks every 15 min to look for hooked, 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. The NEFSC would take extra caution during gear retrieval.

Gill Net Visual Monitoring and Operational Protocols

Visual monitoring—The monitoring procedures for gill nets are similar to those described for trawl gear. The NEFSC does not propose to use pelagic gillnets in any survey.

Operational procedures—Gill nets are not deployed if marine mammals have been sighted on arrival at the sample site. 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.

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. Also, in the unexpected case of a bottlenose dolphin 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.

On the NEFOP Observer Training cruises, acoustic pingers and weak links are used on all gill nets consistent with the Harbor Porpoise Take Reduction Plan regulations at (50 CFR 229.33) for commercial fisheries to reduce marine mammal bycatch. Under the Harbor Porpoise Take Reduction Plan, gillnet gear used in specific areas during specific times are required to be equipped with pingers. We discuss the use of pingers and their acoustic characteristics later within the subsection titled ''Cooperative Research

Visual Monitoring and Operational Protocols, Acoustic Deterrent Devices.''

All NEFOP protocols concerning monitoring and reporting protected species interactions are followed as per the current NEFOP Observer Manual (available on the Internet at *http://www.nefsc.noaa.gov/fsb/manuals/2013/NEFSC_Observer_Program_Manual.pdf*). The soak duration time is 12 to 24 hours. Communication with the NEFOP Training Lead and the vessel captain occurs within 24 to 48 hours prior to setting of gear. During these communications, the NEFOP Training Lead and Captain decide when to set the gear, specifically taking into account any possible weather delays to avoid a long soak period. They do not deploy the gear if a significant weather delay is expected that would increase the preferred soak duration to greater than 24 hours. In those situations, the gear set times will be delayed.

Fyke Net Visual Monitoring and Operational Protocols

Visual monitoring—Fyke nets are normally set inshore by small boat crews, who will visually survey areas prior to deploying the nets. Monitoring is done prior to setting and during net retrieval which is is conducted every 12 to 24-. If marine mammals are in close proximity (approximately 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 interact with the gear during the setting, the crew will lift and remove the gear from the water.

Operational procedures—A 2-m fyke net will be deployed with a marine mammal excluder device that reduces the effective mouth opening to less than 15 cm. 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.

Beach Seine Visual Monitoring and Operational Protocols

Visual monitoring—Prior to setting the seine nets, researchers would visually survey the area for marine mammals. They would also observe for marine mammals continuously during sampling.

Operational procedures—Seines are deployed with one end held on shore by a crew member and the net slowly deployed by boat in an arc and then retrieved by pulling both ends onto shore. Typical seine hauls are less than 15 min with the resulting catch sampled and released. Scientists would look as far as field of view permits from the beach in the general sampling area before the net is fished and would not deploy if marine mammals are present. If marine mammals are observed to be interacting with the gear, it will be lifted and removed from the water.

Rotary Screw Trap Visual Monitoring and Operational Protocols

Visual monitoring—Sites are visually surveyed for marine mammals prior to submerging the gear in the water channel. The traps remain in the water for an extended period of time and sampling crews tend the traps on a daily basis. The researchers would modify, delay, or conclude the sampling period 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.

Operational procedures—Under most conditions the live car (*i.e.,* catch holding pen) is about 75 percent full of water, which would allow any trapped mammals to breath until release from the trap. 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). If capture occurs, animal is temporarily retained in live tank and released as soon as possible.

Cooperative Research Visual Monitoring and Operational Protocols

The mitigation requirements described earlier are applicable to commercial fishing vessels engaged in NEFSC cooperative research using trawls, dredges, longline, and gillnet gears.

These commercial fishing vessels are significantly smaller than the NOAA vessels and depending on their size and configuration, marine mammal sighting may be difficult to make during all aspects of fishing operations. Further, scientific personnel are normally restricted from the deck during gear setting and haulback operations. For all vessel size classes, it is unlikely that the individual(s) searching for marine mammals will have unrestricted 360 degree visibility around the vessel. However, observations during approach to a fishing station and during gear setting and haulback may be feasible and practicable from the wheelhouse.

These projects will also comply with the TRP mitigation measures and gear requirements specified for their respective fisheries and areas (*e.g.,* pingers, sinking groundlines, and weak links on gillnet gear).

The NEFSC will review all NEFSC-affiliated research instructions and protocols for avoiding adverse interactions with protected species. If those instructions/protocols are not fully consistent with NEFOP training materials and guidance on decision-making that arises from NEFSC protected species training, the NEFSC will incorporate specific language into its contracts and agreements with NEFSC-affiliated research partners requiring adherence to all required training requirements, operating procedures, and reporting requirements for protected species.

Visual monitoring—Commercial fishing vessels are significantly smaller than the NOAA white boats, and depending on their size and configuration, marine mammal sighting may be difficult to make during all aspects of fishing operations. Also, scientific personnel are normally restricted from the deck during gear setting and haulback operations. However, observations during approach to a fishing station, and during gear setting and haulback may be feasible from the wheelhouse.

Operational procedures—For the Apex Predators Bottom Longline Coastal Shark and COASTSPAN longline and gillnet surveys, NEFSC partners would implement the Move-on-Rule. During the soak, the line is run and if any marine mammals are sighted the line is pulled immediately. On COASTSPAN gillnet surveys, gillnets are continuously monitored during the 3-hour soak time by under-running it, pulling it across the boat while leaving the net ends anchored. All animals, algae and other objects are removed with each pass as the net is reset into the water to minimize bycatch mortality.

Acoustic deterrent devices—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 micropascal at 1 m, lasting 300 milliseconds (±15 milliseconds), and repeating every 4 seconds (±.2 seconds).

Acoustic deterrent devices (pingers) are underwater sound-emitting devices that have been shown to decrease the probability of interactions with certain species of marine mammals when fishing gear is fitted with the devices. Multiple studies have reported large decreases in harbor porpoise mortality (approximately eighty to ninety percent) in bottom-set gillnets (nets composed of vertical panes of netting, typically set in a straight line and either anchored to the bottom or drifting) during controlled experiments (*e.g.,* Kraus *et al.,* 1997; Trippel *et al.,* 1999; Gearin *et al.,* 2000). Using commercial fisheries data rather than a controlled experiment, Palka *et al.* (2008) reported that harbor porpoise bycatch rates in the northeast U.S gillnet fishery when fishing without pingers was about two to three times higher compared to when pingers were used. After conducting a controlled experiment in a California drift gillnet fishery during 1996–97, Barlow and Cameron (2003) reported significantly lower bycatch rates when pingers were used for all cetacean species combined, all pinniped species combined, and specifically for short-beaked common dolphins (85 percent reduction) and California sea lions (69 percent reduction). While not a statistically significant result, catches of Pacific white-sided dolphins were reduced by seventy percent. Carretta *et al.* (2008) subsequently examined nine years of observer data from the same drift gillnet fishery and found that pinger use had eliminated beaked whale bycatch. Carretta and Barlow (2011) assessed the long-term effectiveness of pingers in reducing marine mammal bycatch in the California drift gillnet fishery by evaluating fishery data from 1990–2009 (with pingers in use beginning in 1996), finding that bycatch rates of cetaceans were reduced nearly fifty percent in sets using a sufficient number of pingers. However, in contrast to the findings of Barlow and Cameron (2003), they report no significant difference in pinniped bycatch.

To be effective, a pinger must emit a signal that is sufficiently aversive to deter the species of concern, which requires that the signal is perceived while also deterring investigation. In rare cases, aversion may be learned as a warning when an animal has survived interaction with gear fitted with pingers (Dawson, 1994). The mechanisms by which pingers work in operational settings are not fully understood, but field trials and captive studies have shown that sounds produced by pingers are aversive to harbor porpoises (*e.g.,* Laake *et al.,* 1998; Kastelein *et al.,* 2000; Culik *et al.,* 2001), and it is assumed that when marine mammals are deterred from interacting with gear fitted with pingers that it is because the sounds produced by the devices are aversive. Two primary concerns expressed with regard to pinger effectiveness in reducing marine mammal bycatch relate to habituation (*i.e.,* marine mammals may become habituated to the sounds made by the pingers, resulting in increasing bycatch rates over time; Dawson, 1994; Cox *et al.,* 2001; Carlstrom *et al.,* 2009) and the ''dinner bell effect'' (Dawson, 1994; Richardson *et al.,* 1995), which implies that certain predatory marine mammal species (*e.g.,* sea lions) may come to associate pingers with a food source (*e.g.,* fish caught in nets) with the result that bycatch rates may be higher in nets with pingers than in those without.

Palka *et al.* (2008) report that habituation has not occurred on a level that affects the bycatch estimate for the northeast U.S. gillnet fishery, while cautioning that the data studied do not provide a direct method to study habituation. Similarly, Carretta and Barlow (2011) report that habituation is not apparent in the California drift gillnet fishery, with the proportion of pinger-fitted sets with bycatch not significantly different for either cetaceans or pinnipeds between the periods 1996–2001 and 2001–09; in fact, bycatch rates for both taxa overall were lower in the latter period. We are not aware of any long-term behavioral studies investigating habituation. Bycatch rates of California sea lions, specifically, did increase during the latter period. However, the authors do not attribute the increase to pinger use (*i.e.,* the ''dinner bell effect''); rather, they believe that continuing increases in population abundance for the species (Carretta *et al.,* 2014) coincident with a decline in fishery effort are responsible for the increased rate of capture. Despite these potential limitations on the effectiveness of pingers, and while effectiveness has not been tested on trawl gear, we believe that the available evidence supports an assumption that use of pingers is likely to reduce the potential for marine mammal interactions with NEFSC gear.

If one assumes that use of a pinger is effective in deterring marine mammals from interacting with fishing gear, one must therefore assume that receipt of the acoustic signal has a disturbance effect on those marine mammals (*i.e.,* Level B harassment). However, Level B harassment that may be incurred as a result of NEFSC's use of pingers does not constitute take that must be authorized under the MMPA. The MMPA prohibits the taking of marine mammals by U.S. citizens or within the U.S. EEZ unless such taking is appropriately permitted or authorized. However, the MMPA provides several narrowly defined exemptions from this requirement (*e.g.,* for Alaskan natives; for defense of self or others; for Good Samaritans [16 U.S.C. 1371(b)–(d)]). Section 109(h) of the MMPA (16 U.S.C. 1379(h)) allows for the taking of marine mammals in a humane manner by federal, state, or local government officials or employees in the course of their official duties if the taking is necessary for ''the protection or welfare of the mammal,'' ''the protection of the public health and welfare,'' or ''the non-lethal removal of nuisance animals.'' Section 101(a)(4)(A) of the MMPA (16 U.S.C. 1371) allows for the owner of fishing gear or catch, or an employee or agent of such owner, to deter a marine mammal from damaging the gear or catch if the deterrence does not result in mortality or serious injury.

The NEFSC's use of pingers as a deterrent device, which may cause Level B harassment of marine mammals, is intended solely for the avoidance of potential marine mammal interactions with NEFSC and cooperative research gear (*i.e.,* avoidance of Level A harassment, serious injury, or mortality). Therefore, use of such deterrent devices, and the taking that may result, is for the protection and welfare of the mammal and is covered explicitly under MMPA section 109(h)(1)(A) or section 101(a)(4)(A). Potential taking of marine mammals resulting from NEFSC's use of pingers is not discussed further in this document.

Acoustic Telemetry Gear Visual Monitoring and Operational Protocols

The NEFSC deploys passive acoustic telemetry receivers in many of Maine's rivers, estuaries, bays and into the Gulf of Maine. These receivers are used to monitor tagged Atlantic salmon, as well as other tagged animals of collaborators along the east coast.

Visual monitoring—The receivers are set by small boat crews that visually survey the area for marine mammals prior to setting. Interactions with the gear or boats are not expected.

Operational Procedures—Receivers are anchored using a 24 pound mushroom anchor or a 79 pound cement mooring and attached to a surface float by 11/16 inch sinking pot warp with a weight rating of 1,200 pounds. Units in the estuary and bay are equipped with whale-safe weak links with a weight rating of 600 pounds. Other receivers are deployed on coastal commercial lobstermen's fishing gears which comply with fishing regulations for nearshore operations. The receivers are recovered twice annually, but the traps are tended according to required fishing schedules of the fishery.

We have carefully evaluated the NEFSC's proposed mitigation measures and considered a range of other measures in the context of ensuring that we prescribed the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another: (1) The manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals, (2) the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and (3) the practicability of the measure for applicant implementation.

Any mitigation measure(s) we prescribe should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(1) Avoidance or minimization of injury or death of marine mammals wherever possible (goals 2, 3, and 4 may contribute to this goal).

(2) A reduction in the number (total number or number at biologically important time or location) of individual marine mammals exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only).

(3) A reduction in the number (total number or number at biologically important time or location) of times any individual marine mammal would be exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only).

(4) A reduction in the intensity of exposure to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing the severity of behavioral harassment only).

(5) Avoidance or minimization of adverse effects to marine mammal habitat, paying particular attention to the prey base, blockage or limitation of passage to or from biologically important areas, permanent destruction of habitat, or temporary disturbance of habitat during a biologically important time.

(6) For monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Based on our evaluation of the NEFSC's proposed measures, we have preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Description of Marine Mammals in the Area of the Specified Activity

We have reviewed NEFSC' species descriptions—which summarize available information regarding status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of the potentially affected species—for accuracy and completeness and refer the reader to Sections 3 and 4 of the NEFSC's application, as well as to NMFS' Stock Assessment Reports (SARs; *www.nmfs.noaa.gov/pr/sars/*), instead of reprinting the information here. Table 3 lists all species with expected potential for occurrence in the Atlantic coast region where the NEFSC proposes to conduct the specified activity and summarize information related to the population or stock, including potential biological removal (PBR). For taxonomy, we follow Committee on Taxonomy (2014).

PBR, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population, is discussed in greater detail later in this document (see ''Negligible Impact Analyses'').

Species that could potentially occur in the proposed research areas but are not expected to have the potential for interaction with NEFSC research gear or that are not likely to be harassed by NEFSC's use of active acoustic devices are described briefly in the NEFSC's application and in this document but omitted from further analysis. These include extralimital species (*e.g.,* beluga (*Delphinapterus leucas*), Bryde's (*Balaenoptera edeni*), and false killer (*Pseudorca crassidens*) whales, which are species that do not normally occur in a given area but for which there are one or more occurrence records that are considered beyond the normal range of the species.

For status of species, we provide information regarding U.S. regulatory status under the MMPA and ESA. Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. Survey abundance (as compared to stock or species abundance) is the total number of individuals estimated within the survey area, which may or may not align completely with a stock's geographic range as defined in the SARs. These surveys may also extend beyond U.S. waters.

TABLE 3—MARINE MAMMALS POTENTIALLY PRESENT IN THE VICINITY OF NEFSC RESEARCH ACTIVITIES IN THE ATLANTIC COAST REGION

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR [3]	Annual M/SI [3]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Balaenidae (right whales)						
North Atlantic right whale.	*Eubalaena glacialis*	Western Atlantic	E/D; Y	465 (n/a, 465, 2010)	0.9	4.75
Family Balaenopteridae (rorquals)						
Minke whale	*Balaenoptera acutorostrata acutorostrata*.	Canadian East Coast	–; N	20,741 (0.30, 16,199, 2007).	162	[6] 9.45

TABLE 3—MARINE MAMMALS POTENTIALLY PRESENT IN THE VICINITY OF NEFSC RESEARCH ACTIVITIES IN THE ATLANTIC COAST REGION—Continued

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR [3]	Annual M/SI [3]
Sei whale	*B. borealis borealis*	Nova Scotia	E/D; Y	357 (0.52, 236, 2011)	0.5	0.8
Blue whale	*B. musculus musculus*.	Western North Atlantic.	E/D; Y	Unk (n/a, 440, 2009) [4].	0.9	Unk
Fin whale	*B. physalus physalus*	Western North Atlantic.	E/D; Y	1,618 (0.33, 1,234, 2011).	2.5	3.35
Humpback whale	*Megaptera novaeangliae novaeangliae*.	Gulf of Maine	E/D; Y	823 (0, 823, 2008)	2.7	[7] 10.15
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae						
Sperm whale	*Physeter macrocephalus*.	Western North Atlantic.	E/D; Y	2,288 (0.28, 1,815, 2011).	3.6	0.8
Family Kogiidae						
Pygmy sperm whale	*Kogia breviceps*	Western North Atlantic.	–; N	3,785 (0.47, 2,598, 2011).	26	3.4
Dwarf sperm whale	*K. sima*	Western North Atlantic.	–; N	3,785 (0.47, 2,598, 2011).	26	3.4
Family Ziphiidae (beaked whales)						
Northern bottlenose whale.	*Hyperoodon ampullatus*.	Western North Atlantic.	–; N	Unk	Unk	0
Blainville's beaked whale.	*Mesplodon densirostris*.	Western North Atlantic.	–; N	7,092 (0.54, 4,632, 2011) [5].	46	0.2
Sowerby's beaked whale.	*M. bidens*	Western North Atlantic.	–; N	7,092 (0.54, 4,632, 2011) [5].	46	0
Gervais' beaked whale.	*M. europaeus*					
True's beaked whale	*M. mirus*					
Cuvier's beaked whale.	*Ziphius cavirostris*	Western North Atlantic.	–; N	6,532 (0.32, 5,021, 2011).	50	0.4
Family Delphinidae						
Short-beaked common dolphin.	*Delphinus delphis delphis*.	Western North Atlantic.	–; N	173,486 (0.55, 112,531, 2007).	1,125	[6] 289
Pygmy killer whale	*Feresa attenuata*	Western North Atlantic.	–; N	Unk	Unk	Unk
Short-finned pilot whale.	*Globicephala macrorhynchus*.	Western North Atlantic.	–; N	21,515 (0.37, 15,913, 2011).	159	140
Long-finned pilot whale.	*G. melas*	Western North Atlantic.	–; N	26,535 (0.35, 19,930, 2006).	199	35
Risso's dolphin	*Grampus griseus*	Western North Atlantic.	–; N	18,250 (0.46, 12,619, 2011).	126	51
Fraser's dolphin	*Lagenodelphis hosei*	Western North Atlantic.	–; N	Unk	0	0
Atlantic white-sided dolphin.	*Lagenorhynchus acutus*.	Western North Atlantic.	–; N	48,819 (0.61, 30,403, 2011).	304	116
White-beaked dolphin	*L. albirostris*	Western North Atlantic.	–; N	3,003 (0.94, 1,023, 2006).	10	0
Killer whale	*Orcinus orca*	Western North Atlantic.	–; N	Unk	Unk	Unk
Melon-headed whale	*Peponocephala electra*.	Western North Atlantic.	–; N	Unk	Unk	0
Pantropical spotted dolphin.	*Stenella attenuata*	Western North Atlantic.	–; N	3,333 (0.91, 1,733, 2011).	17	0
Clymene dolphin	*S. clymene*	Western North Atlantic.	–; N	Unk	Unk	Unk
Striped dolphin	*S. coeruleoalba*	Western North Atlantic.	–; N	54,807 (0.3, 42,804, 2011).	428	0
Atlantic spotted dolphin.	*S. frontalis*	Western North Atlantic.	–; N	44,715 (0.43, 31,610, 2011).	316	0

TABLE 3—MARINE MAMMALS POTENTIALLY PRESENT IN THE VICINITY OF NEFSC RESEARCH ACTIVITIES IN THE ATLANTIC COAST REGION—Continued

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR [3]	Annual M/SI [3]
Spinner dolphin	*S. longirostris*	Western North Atlantic.	–; N	Unk	Unk	Unk
Rough-toothed dolphin.	*Steno bredanensis*	Western North Atlantic.	–; N	271 (1.0, 134, 2011)	1.3	0
Common bottlenose dolphin.	*Tursiops truncatus truncatus*.	Western North Atlantic (WNA) Offshore.	–; N	77,532 (0.40, 56,053, 2011).	561	45.1
		WNA Northern Migratory Coastal.	–/D; Y	11,548 (0.36, 8,620, 2011).	86	[8] 3.8–5.8
		WNA Southern Migratory Coastal.	–/D; Y	9,173 (0.46, 6,326, 2011).	63	[8] 2.6–16.5
		WNA S. Carolina/Georgia Coastal.	–/D; Y	4,377 (0.43, 3,097, 2011).	31	Unk
		WNA Northern Florida Coastal.	–/D; Y	1,219 (0.67, 730, 2011).	7	Unk
		WNA Central Florida Coastal.	–/D; Y	4,895 (0.71, 2,851, 2011).	29	Unk
		Northern North Carolina Estuarine System.	–; Y	950 (0.23, 785, 2006)	7.9	[8] 1.9–9.1
		Southern North Carolina Estuarine System.	–; Y	188 (0.19, 160, 2006)	1.6	[8] 0.2–0.8
		Northern South Carolina Estuarine System.	–; Y	Unk	Unk	[6] Unk
		Charleston Estuarine System.	–; Y	289 (0.03, 281, 2006)	2.8	Unk
		Northern Georgia/Southern South Carolina Estuarine System.	–; Y	Unk	Unk	Unk
		Southern Georgia Estuarine System.	–; Y	194 (0.05, 185, 2009)	1.9	Unk
		Jacksonville Estuarine System.	–; Y	Unk	Unk	Unk
		Indian River Lagoon Estuarine System.	–; Y	Unk	Unk	Unk
Family Phocoenidae (porpoises)						
Harbor porpoise	*Phocoena phocoena phocoena*.	Gulf of Maine/Bay of Fundy Stock.	–; N	79,883 (0.32, 61,415, 2011).	706	[6] 683
Order Carnivora—Superfamily Pinnipedia						
Family Phocidae (earless seals)						
Hooded seal	*Cystophora cristata*	Western North Atlantic.	–; N	Unk	Unk	[9] 5,199
Gray seal	*Halichoerus grypus grypus*.	Western North Atlantic.	–; N	331,000 (n/a, n/a, 2012).	Unk	[6 10] 4,959
Harp seal	*Pagophilus groenlandicus*.	Western North Atlantic.	–; N	Unk	Unk	306,082
Harbor seal	*Phoca vitulina vitulina*	Western North Atlantic.	–; N	75,834 (0.15, 66,884, 2012).	2,006	[6] 441

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (–) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. NMFS automatically designates any species or stock listed under the ESA as depleted and as a strategic stock under the MMPA.

[2] NMFS marine mammal stock assessment reports at: *www.nmfs.noaa.gov/pr/sars/.* CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, abundance and PBR is unknown (Unk) and the CV is not applicable.

[3] These values, found in NMFS' SARs, represent PBR and annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, subsistence hunting, and ship strike). In some cases PBR is unknown (Unk) because the minimum population size cannot be determined. Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or as unknown (Unk).

[4] Given the small proportion of the distribution range that has been sampled and considering the low number of blue whales encountered and photographed, the current data, based on photo-identification, do not allow for an estimate of abundance of this species in the Northwest Atlantic with a minimum degree of certainty (Sears *et al.* 1987; Hammond et al. 1990; Sears *et al.* 1990; Sears and Calambokidis 2002; Fisheries and Oceans Canada 2009).

[5] The total number of this species of beaked whale off the eastern U.S. and Canadian Atlantic coast is unknown, and seasonal abundance estimates are not available for this stock. However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon spp.*) from selected regions are available for select time periods (Barlow *et al.* 2006) as well as two estimates of *Mesoplodon spp.* beaked whales alone (Waring *et al.,* 2015).

[6] The NEFSC has historically taken this species in a NEFSC research survey (2004–2015) (see Tables 4, 5, and 6).

[7] This average includes humpback mortalities and serious injuries that occurred in the southeastern and mid-Atlantic states that could not be confirmed as involving members of the Gulf of Maine stock. This average includes Canadian records from the southern side of Nova Scotia within the mortality and serious injury rates, to reflect the effective range of this stock.

[8] The range for the total estimated average annual fishery mortality (minimum-maximum) reflects the uncertainty in assigning observed or reported mortalities to a particular stock.

[9] The average consists of three components: 1) 5,173 from 2001–2005 (2001 = 3,960; 2002 = 7,341; 2003 = 5,446, 2004 = 5,270; and 2005 = 3,846) average catches of Northwest Atlantic population of hooded seals by Canada and Greenland; 2) 25 hooded seals (CV = 0.82) from the observed U.S. fisheries; and 3) one hooded seal from average 2001–2005 stranding mortalities resulting from non-fishery human interactions (Waring *et al.,* 2015).

[10] The average consists of five components: 1) 1,100 (CV = 0.11) (Table 3) from the 2007–2011 U.S. observed fishery; 2) 9 from average 2007–2011 non-fishery related, human interaction stranding mortalities (NMFS unpublished data); 3) 750 from average 2007–2011 kill in the Canadian hunt (DFO, 2013); 4) 81 from average 2007–2011 DFO scientific collections (DFO, 2013); and 5) 3,019 from average 2007–2011 removals of nuisance animals in Canada (DFO, 2013; Waring *et al.,* 2015).

Take reduction planning—Take reduction plans help recover and prevent the depletion of strategic marine mammal stocks that interact with certain U.S. commercial fisheries, as required by Section 118 of the MMPA. The immediate goal of a take reduction plan is to reduce, within six months of its implementation, the M/SI of marine mammals incidental to commercial fishing to less than the PBR level. The long-term goal is to reduce, within five years of its implementation, the M/SI of marine mammals incidental to commercial fishing to insignificant levels, approaching a zero serious injury and mortality rate, taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans. NMFS convenes Take Reduction Teams to develop these plans.

For marine mammals in specified geographic region of NEFSC research programs, there are currently four take reduction plans in effect (the Atlantic Large Whale Take Reduction Plan, the Bottlenose Dolphin Take Reduction Plan, the Harbor Porpoise Take Reduction Plan, and the Pelagic Longline Take Reduction Plan). As discussed earlier in the ''Proposed Mitigation'' section, the NEFSC and NEFSC cooperative research projects comply with applicable TRP mitigation measures and gear requirements specified for their respective fisheries and areas.

The Atlantic Large Whale Take Reduction Plan (ALWTRP)—The goal of this plan is to reduce mortality/serious injury (M/SI) of North Atlantic right, humpback, fin, and minke whales in several northeast fisheries that use lobster trap/pots and gillnets. Gear modification requirements and restrictions vary by location, date, and gear type but may include the use of weak links, and gear marking and configuration specifications. Detailed requirements may be found in the regional guides to gillnet and pot/trap gear fisheries available at: *http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/.*

Of the species/stocks of concern, the NEFSC has requested the authorization of incidental M/SI + Level A harassment for the minke whale only (see ''Estimated Take by Incidental Harassment'' later in this document).

The Bottlenose Dolphin Take Reduction Plan—The goal of this plan is to reduce M/SI of coastal bottlenose dolphins incidental to the North Carolina inshore gillnet, Southeast Atlantic gillnet, Southeastern U.S. shark gillnet, U.S. Mid-Atlantic coastal gillnet, Atlantic blue crab trap/pot, Mid-Atlantic haul/beach seine, North Carolina long haul seine, North Carolina roe mullet stop net, and Virginia pound net fisheries (71 FR 24776, April 26, 2006). The following general requirements were implemented: Spatial/temporal gillnet restrictions, gear proximity (fishermen must stay within a set distance of gear), gear modifications, non-regulatory conservation measures, and a revision to the large mesh gillnet size restriction. Detailed requirements may be found at: *http://www.nmfs.noaa.gov/pr/interactions/trt/bdtrp.htm.*

Of the species/stocks of concern, the NEFSC has requested the authorization of incidental M/SI + Level A harassment for 3 stocks of bottlenose dolphins (see ''Estimated Take by Incidental Harassment'' later in this document).

The Harbor Porpoise Take Reduction Plan—The goal of this plan is to reduce interactions between harbor porpoises and commercial gillnet gear fisheries in the New England and the Mid-Atlantic areas. Management includes seasonal time and area closures that correspond with peak seasonal abundances of harbor porpoises and gear modification requirements such as the use of pingers, floatline length, twine size, tie downs, net size, net number, and numbers of nets per string. Detailed requirements may be found at: *http://www.greateratlantic.fisheries.noaa.gov/protected/porptrp/.*

The NEFSC has requested the authorization of incidental M/SI + Level A harassment for harbor porpoises (see ''Estimated Take by Incidental Harassment'' later in this document).

The Pelagic Longline Take Reduction Plan—The plan addresses M/SI of long-finned and short-finned pilot whales as well as Risso's, common, and Atlantic white-sided dolphins in commercial pelagic longline fishing gear in the Atlantic. Regulatory measures include limiting mainline length to 20 nautical miles or less within the Mid-Atlantic Bight and posting an informational placard on careful handling and release of marine mammals in the wheelhouse and on working decks of the vessel. Detailed requirements are on the internet at: *http://www.greateratlantic.fisheries.noaa.gov/Protected/mmp/atgtrp/.*

Of the species/stocks of concern, the NEFSC has requested the authorization of incidental M/SI + Level A harassment for Risso's, common, and Atlantic white-sided dolphins (see ''Estimated Take by Incidental Harassment'' later in this document).

Unusual Mortality Events (UME)—the MMPA defines a UME as ''a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response.'' From 1991 to the present, there have been 22 formally recognized UMEs in the Atlantic coast region involving species under NMFS' jurisdiction. Bottlenose dolphins have been stranding at elevated rates since July 2013 along the Atlantic coast from New York to Florida (through Brevard County). All ages of bottlenose dolphins are stranding. A few live animals have stranded, but most were found dead, many times very decomposed. Many dolphins have lesions on their skin, mouth, joints, or lungs. The causes and mechanisms of this UME remain under investigation. For more information on UMEs, please visit: *www.nmfs.noaa.gov/pr/health/mmume/*.

Of the species/stocks of concern, the NEFSC has requested the authorization of incidental M/SI + Level A harassment for 3 stocks of bottlenose dolphins (see ''Estimated Take by Incidental Harassment'' later in this document).

Potential Effects of the Specified Activity on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity (*e.g.,* gear deployment, use of active acoustic sources, visual disturbance) may impact marine mammals and their habitat. The ''Estimated Take by Incidental Harassment'' section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The ''Negligible Impact Analysis'' section will include an analysis of how this specific activity will impact marine mammals and will consider the content of this section, the ''Estimated Take by Incidental Harassment'' section, and the ''Proposed Mitigation'' section, to draw conclusions regarding the likely impacts of this activity on the reproductive success or survivorship of individuals, and from that, on the affected marine mammal populations or stocks. In the following discussion, we consider potential effects to marine mammals from ship strike, physical interaction with the gear types described previously, use of active acoustic sources, and visual disturbance of pinnipeds.

Ship Strike

Vessel collisions with marine mammals, or ship strikes, can result in death or serious injury of the animal. Wounds resulting from ship strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus, 2001). An animal at the surface may be struck directly by a vessel, a surfacing animal may hit the bottom of a vessel, or an animal just below the surface may be cut by a vessel's propeller. More superficial strikes may not kill or result in the death of the animal. These interactions are typically associated with large whales (*e.g.,* fin whales), which are occasionally found draped across the bulbous bow of large commercial ships upon arrival in port. Although smaller cetaceans or pinnipeds are more maneuverable in relation to large vessels than are large whales, they may also be susceptible to strike. The severity of injuries typically depends on the size and speed of the vessel, with the probability of death or serious injury increasing as vessel speed increases (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Vanderlaan and Taggart, 2007; Conn and Silber, 2013). Impact forces increase with speed, as does the probability of a strike at a given distance (Silber *et al.,* 2010; Gende *et al.,* 2011).

Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 kn, and exceeded ninety percent at 17 kn. Higher speeds during collisions result in greater force of impact, but higher speeds also appear to increase the chance of severe injuries or death through increased likelihood of collision by pulling whales toward the vessel (Clyne, 1999; Knowlton *et al.,* 1995). In a separate study, Vanderlaan and Taggart (2007) analyzed the probability of lethal mortality of large whales at a given speed, showing that the greatest rate of change in the probability of a lethal injury to a large whale as a function of vessel speed occurs between 8.6 and 15 kt. The chances of a lethal injury decline from approximately eighty percent at 15 kt to approximately twenty percent at 8.6 kt. At speeds below 11.8 kt, the chances of lethal injury drop below fifty percent, while the probability asymptotically increases toward one hundred percent above 15 kt.

In an effort to reduce the number and severity of strikes of the endangered North Atlantic right whale, NMFS implemented speed restrictions in 2008 (73 FR 60173; October 10, 2008). These restrictions require that vessels greater than or equal to 65 ft (19.8 m) in length travel at less than or equal to 10 kn near key port entrances and in certain areas of right whale aggregation along the U.S. eastern seaboard. Conn and Silber (2013) estimated that these restrictions reduced total ship strike mortality risk levels by eighty to ninety percent.

For vessels used in NEFSC research activities, transit speeds average 10 kt (but vary from 6–14 kt), while vessel speed during active sampling is typically only 2 to 4 kt. At sampling speeds, both the possibility of striking a marine mammal and the possibility of a strike resulting in serious injury or mortality are discountable. At average transit speed, the probability of serious injury or mortality resulting from a strike, if one occurred, is less than fifty percent. However, the likelihood of a strike actually happening is again discountable. Ship strikes, as analyzed in the studies cited above, generally involve commercial shipping, which is much more common in both space and time than is research activity. Jensen and Silber (2004) summarized ship strikes of large whales worldwide from 1975–2003 and found that most collisions occurred in the open ocean and involved large vessels (*e.g.,* commercial shipping). Commercial fishing vessels were responsible for three percent of recorded collisions, while only one such incident (0.75 percent) was reported for a research vessel during that time period.

It is possible for ship strikes to occur while traveling at slow speeds. For example, a NOAA-chartered survey vessel traveling at low speed (5.5 kt) while conducting multi-beam mapping surveys off the central California coast struck and killed a blue whale in 2009. The State of California determined that the whale had suddenly and unexpectedly surfaced beneath the hull, with the result that the propeller severed the whale's vertebrae, and that this was an unavoidable event. This strike represents the only such incident in approximately 540,000 hours of similar coastal mapping activity ($p = 1.9 \times 10^{-6}$; 95% CI = $0–5.5 \times 10^{-6}$; NMFS, 2013). In addition, a research vessel reported a fatal strike in 2011 of a dolphin in the Atlantic, demonstrating that it is possible for strikes involving smaller cetaceans or pinnipeds to occur. In that case, the incident report indicated that an animal apparently was struck by the vessel's propeller as it was intentionally swimming near the vessel. While indicative of the type of unusual events that cannot be ruled out, neither of these instances represents a circumstance that would be considered reasonably foreseeable or that would be considered preventable.

In summary, we anticipate that vessel collisions involving NEFSC research vessels, while not impossible, represent unlikely, unpredictable events. However, there are several preventive measures to minimize the risk of vessel collisions with right whales and other species of marine mammals. The compliance guide for the North Atlantic right whale ship strike reduction rule (NMFS, 2008) states that all vessels 65 feet in overall length or greater must slow to speeds of 10 knots or less in seasonal management areas. The Northeast U.S. Seasonal Right Whale Management Areas include: Cape Cod Bay (January 1 to May 15), Off Race Point (March 1 to April 30) and Great South Channel (April 1 to July 31). Mid-Atlantic Seasonal Management Areas include several port or bay entrances from November 1 to April 30. When research vessels are actively sampling, cruise speeds are less than five knots, a speed at which the probability of collision and serious injury or mortality of large whales is low. When transiting between sampling stations, research vessels can travel at speeds of up to 14 knots. However, when NEFSC vessels are operating in right whale Seasonal Management Areas, Dynamic Management Areas, or at times and locations when whales are otherwise known to be present, they operate at speeds no greater than 10 knots.

NEFSC research vessel captains and crew watch for marine mammals while underway during daylight hours and take necessary actions to avoid them. NEFSC surveys using large NOAA vessels (*e.g.,* R/V *Henry B. Bigelow*) include one bridge crew dedicated to watching for obstacles at all times, including marine mammals. At any time during a survey or in transit, any bridge personnel that sights protected species that may intersect with the vessel course immediately communicates their presence to the helm for appropriate course alteration or speed reduction as possible to avoid incidental collisions, particularly with large whales (*e.g.,* North Atlantic right whales).

Finally, the Right Whale Sighting Advisory System (RWSAS) is a NMFS program designed to reduce collisions between ships and the critically endangered North Atlantic right whale by alerting mariners to the presence of the right whales. All NOAA research vessels operating in North Atlantic right whale habitat participate in the RWSAS.

No ship strikes have been reported from any fisheries research activities conducted or funded by the NEFSC in the Atlantic coast region. Given the relatively slow speeds of research vessels, the presence of bridge crew watching for obstacles at all times (including marine mammals), the presence of marine mammal observers on some surveys, and the small number of research cruises, we believe that the possibility of ship strike is discountable and, further, that were a strike of a large whale to occur, it would be unlikely to result in serious injury or mortality. No incidental take resulting from ship strike is anticipated, and this potential effect of research will not be discussed further in the following analysis.

Research Gear

The types of research gear used by the NEFSC were described previously under ''Detailed Description of Activity.'' Here, we broadly categorize these gears into those whose use we consider to have extremely unlikely potential to result in marine mammal interaction and those whose use we believe may result in marine mammal interaction. Gears in the latter category are carried forward for further analysis. Gears with likely potential for marine mammal interaction include high-speed midwater, pelagic, and bottom trawl nets, anchored sinking gillnets, fyke nets, and longline gear.

Trawl nets, gillnets, fyke nets, and longline gears deployed by the NEFSC are similar to gear used in various commercial fisheries, and the potential for and history of marine mammal interaction with these gears through physical contact (*i.e.,* capture or entanglement) is well-documented. Read *et al.* (2006) estimated marine mammal bycatch in U.S. fisheries from 1990–99 and derived an estimate of global marine mammal bycatch by expanding U.S. bycatch estimates using data on fleet composition from the United Nations Food and Agriculture Organization (FAO). Although most U.S. bycatch for both cetaceans (84 percent) and pinnipeds (98 percent) occurred in gillnets, global marine mammal bycatch in trawl nets and longlines is likely substantial given that total global bycatch is thought to number in the hundreds of thousands of individuals (Read *et al.,* 2006). In addition, global bycatch via longline has likely increased, as longlines have become the most common method of capturing swordfish and tuna since the U.N. banned the use of high seas driftnets over 2.5 km long in 1991 (high seas driftnets were previously often 40–60 km long) (Read, 2008; FAO, 2001).

Marine mammals are widely regarded as being quite intelligent and inquisitive, and when their pursuit of prey coincides with human pursuit of the same resources, it should be expected that physical interaction with fishing gear may occur (*e.g.,* Beverton, 1985). Fishermen and marine mammals are both drawn to areas of high prey density, and certain fishing activities may further attract marine mammals by providing food (*e.g.,* bait, captured fish, bycatch discards) or by otherwise making it easier for animals to feed on a concentrated food source. Provision of foraging opportunities near the surface may present an advantage by negating the need for energetically expensive deep foraging dives (Hamer and Goldsworthy, 2006). Trawling, for example, can make available previously unexploited food resources by gathering prey that may otherwise be too fast or deep for normal predation, or may concentrate calories in an otherwise patchy landscape (Fertl and Leatherwood, 1997). Pilot whales, which are generally considered to be teuthophagous (*i.e.,* feeding primarily on squid), were commonly observed in association with Atlantic mackerel (*Scomber scombrus*) trawl fisheries from 1977–88 in the northeast U.S. EEZ (Waring *et al.,* 1990). Not surprisingly, stomach contents of captured whales were observed to have high proportions of mackerel (68 percent of non-trace food items), indicating that the ready availability of a novel, concentrated, high-calorie prey item resulted in changed dietary composition (Read, 1994).

These interactions can result in injury or death for the animal(s) involved and/or damage to fishing gear. Coastal animals, including various pinnipeds, bottlenose dolphins, and harbor porpoises, are perhaps the most vulnerable to these interactions. They are most likely to interact with set or passive fishing gear such as gillnets, traps (Beverton, 1985; Barlow *et al.*, 1994; Read *et al.*, 2006; Byrd *et al.*, 2014; Lewison *et al.*, 2014). Although interactions are less common for use of trawl nets and longlines, they do occur with sufficient frequency to necessitate the establishment of required mitigation measures for multiple U.S. fisheries using both types of gear (NMFS, 2014). It is likely that no species of marine mammal can be definitively excluded from the potential for interaction with fishing gear (*e.g.,* Northridge, 1984); however, the extent of interactions is likely dependent on the biology, ecology, and behavior of the species involved and the type, location, and nature of the fishery.

Trawl nets—As described previously, trawl nets are towed nets (*i.e.,* active fishing) consisting of a cone-shaped net with a codend or bag for collecting the fish and can be designed to fish at the bottom, surface, or any other depth in the water column. Here we refer to bottom trawls and midwater trawls (*i.e.,* any net not designed to tend the bottom while fishing). Trawl nets in general have the potential to capture or entangle marine mammals, which have been known to be caught in bottom trawls, presumably when feeding on fish caught therein, and in midwater trawls, which may or may not be coincident with their feeding (Northridge, 1984).

Capture or entanglement may occur whenever marine mammals are swimming near the gear, intentionally (*e.g.,* foraging) or unintentionally (*e.g.,* migrating), and any animal captured in a net is at significant risk of drowning unless quickly freed. Animals can also be captured or entangled in netting or tow lines (also called lazy lines) other than the main body of the net; animals may become entangled around the head, body, flukes, pectoral fins, or dorsal fin. Interaction that does not result in the immediate death of the animal by drowning can cause injury (*i.e.,* Level A harassment) or serious injury. Constricting lines wrapped around the animal can immobilize the animal or injure it by cutting into or through blubber, muscles and bone (*i.e.,* penetrating injuries) or constricting blood flow to or severing appendages. Immobilization of the animal, if it does not result in immediate drowning, can cause internal injuries from prolonged stress and/or severe struggling and/or impede the animal's ability to feed (resulting in starvation or reduced fitness) (Andersen *et al.,* 2008).

Marine mammal interactions with trawl nets, through capture or entanglement, are well-documented. Dolphins are known to attend operating nets to either benefit from disturbance of the bottom or to prey on discards or fish within the net. For example, Leatherwood (1975) reported that the most frequently observed feeding pattern for bottlenose dolphins in the Gulf of Mexico involved herds following working shrimp trawlers, apparently feeding on organisms stirred up from the benthos. Bearzi and di Sciara (1997) opportunistically investigated working trawlers in the Adriatic Sea from 1990–94 and found that ten percent were accompanied by foraging bottlenose dolphins. However, midwater trawls have greater potential to capture cetaceans, because the nets may be towed at faster speeds, these trawls are more likely to target species that are important prey for marine mammals (*e.g.,* squid, mackerel), and the likelihood of working in deeper waters means that a more diverse assemblage of species could potentially be present (Hall *et al.,* 2000).

Globally, at least seventeen cetacean species are known to feed in association with trawlers and individuals of at least 25 species are documented to have been killed by trawl nets, including several large whales, porpoises, and a variety of delphinids (Karpouzli and Leaper, 2004; Hall *et al.,* 2000; Fertl and Leatherwood, 1997; Northridge, 1991). At least eighteen species of seals and sea lions are known to have been killed in trawl nets (Wickens, 1995). Generally, direct interaction between trawl nets and marine mammals (both cetaceans and pinnipeds) has been recorded wherever trawling and animals co-occur. Tables 8, 9, and 10 (later in this document) display more recent information regarding interactions specifically in U.S. fisheries and are more relevant to the development of take estimates for this proposed rule. In evaluating risk relative to a specific fishery (or comparable research survey), one must consider the size of the net as well as frequency, timing, and location of deployment. These considerations inform determinations of whether interaction with marine mammals is likely.

Of the net types described previously under ''Trawl Nets,'' NEFSC has recorded marine mammal interactions with the Gourock high-speed midwater rope trawl net and a 4-seam, 3-bridle bottom trawl net.

Longlines—Longlines are basically strings of baited hooks that are either anchored to the bottom, for targeting groundfish, or are free-floating, for targeting pelagic species and represent a passive fishing technique. Pelagic longlines, which notionally fish near the surface with the use of floats, may be deployed in such a way as to fish at different depths in the water column. For example, deep-set longlines targeting tuna may have a target depth of 400 m, while a shallow-set longline targeting swordfish is set at 30–90 m depth. We refer here to bottom and pelagic longlines. Any longline generally consists of a mainline from which leader lines (gangions) with baited hooks branch off at a specified interval, and is left to passively fish, or soak, for a set period of time before the vessel returns to retrieve the gear. Longlines are marked by two or more floats that act as visual markers and may also carry radio beacons; aids to detection are of particular importance for pelagic longlines, which may drift a significant distance from the deployment location. Pelagic longlines are generally composed of various diameter monofilament line and are generally much longer, and with more hooks, than are bottom longlines. Bottom longlines may be of monofilament or multifilament natural or synthetic lines.

Marine mammals may be hooked or entangled in longline gear, with interactions potentially resulting in death due to drowning, strangulation, severing of carotid arteries or the esophagus, infection, an inability to evade predators, or starvation due to an inability to catch prey (Hofmeyr *et al.,* 2002), although it is more likely that animals will survive being hooked if they are able to reach the surface to breathe. Injuries, which may include serious injury, include lacerations and puncture wounds. Animals may attempt to depredate either bait or catch, with subsequent hooking, or may become accidentally entangled. As described for trawls, entanglement can lead to constricting lines wrapped around the animals and/or immobilization, and even if entangling materials are removed the wounds caused may continue to weaken the animal or allow further infection (Hofmeyr *et al.,* 2002). Large whales may become entangled in a longline and then break free with a portion of gear trailing, resulting in alteration of swimming energetics due to drag and ultimate loss of fitness and potential mortality (Andersen *et al.,* 2008). Weight of the gear can cause entangling lines to further constrict and further injure the animal. Hooking injuries and ingested gear are most common in small cetaceans and pinnipeds but have been observed in large cetaceans (*e.g.,* sperm whales). The severity of the injury depends on the species, whether ingested gear includes hooks, whether the gear works its way into the gastrointestinal (GI) tract, whether the gear penetrates the GI lining, and the location of the hooking (*e.g.,* embedded in the animal's stomach or other internal body parts) (Andersen *et al.,* 2008). Bottom longlines pose less of a threat to marine mammals due to their deployment on the ocean bottom, but can still result in entanglement in buoy lines or hooking as the line is either deployed or retrieved. The rate of interaction between longline fisheries and marine mammals depends on the degree of overlap between longline effort and species distribution, hook style and size, type of bait and target catch, and fishing practices (such as setting/hauling during the day or at night).

The NEFSC plans to use pelagic and bottom longline gear in three programs: The Apex Predators Bottom Longline Coastal Shark, Apex Predators Pelagic Nursery Grounds Shark, and Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Longline surveys. The NEFSC has no recorded marine mammal interactions during the conduct of its pelagic and bottom longline surveys in the Atlantic coast region. While the NEFSC has not historically interacted with large whales or other cetaceans in its longline gear, documentation exists that some of these species are taken in commercial longline fisheries.

Gillnets and Fyke Nets—Marine mammal interactions with gillnets, through entanglement, are well-documented (Reeves *et al.,* 2013). At least 75 percent of odontocete species, 64 percent of mysticetes, 66 percent of pinnipeds, all sirenians, and marine mustelids have been recorded as gillnet bycatch over the past 20-plus years (Reeves *et al.*, 2013). Reeves *et al.*, (2013) note that numbers of marine mammals killed in gillnets tend to be greatest for species that are widely distributed in coastal and shelf waters. Common dolphins and striped dolphins, for example, have continued to be taken in large numbers globally despite the fact that large-scale driftnet fishing on the high seas has been illegal since 1993, eliminating one source of very large bycatches of northern right whale dolphins and common dolphins (Reeves *et al.*, 2013).

Minke whales are probably especially vulnerable to gillnet entanglement for several reasons, including their near-shore and shelf occurrence, their proclivity for preying on fish species that are also targeted by net fisheries, and their small size and consequently greater difficulty (compared to the larger mysticetes) of extricating themselves once caught (Reeves *et al.,* 2013).

Entanglement in fishing gear and bycatch in commercial fisheries occur with regularity in the Northeast and Mid-Atlantic regions and are the primary known causes of mortality and serious injury for pinnipeds in these areas. Gillnets are responsible for most observed and reported bycatch for marine mammals (Lewison *et al.,* 2014; Zollett, 2009). From 2006 to 2010, the average annual mortality of harbor seals incidental to commercial fisheries was 332; 280 incidents in the Northeast sink gillnet fishery and 50 incidents reported in the Mid-Atlantic sink gillnet fishery (Waring *et al.,* 2014). Gray seal incidental mortality from 2006 to 2010 was greater, with an annual average of 853 seals, 794 of which were in the Northeast sink gillnet and 53 in the Mid-Atlantic sink gillnet fisheries (Waring *et al.*, 2014).

Although bycatch is well known and well studied in marine fisheries, there are few studies on bycatch in freshwater fisheries using fyke nets (Larocque *et al.,* 2011). Fyke nets are passive fishing gear that have limited species selectivity and are set for long durations (Hubert, 1996; Larocque *et al.,* 2011). Thus, this gear has the potential to capture non-targeted fauna that use the same habitat as targeted species, even without the use of bait (Larocque *et al.,* 2011). Mortality in fyke nets can arise from stress and injury associated with anoxia, abrasion, confinement, and starvation (Larocque *et al.,* 2011).

Of the gear types described previously under ''Gillnets and Fyke Nets'' NEFSC has recorded marine mammal interactions with anchored sinking gillnets and fyke nets.

Other research gear—We discussed the potential for interactions with research gear in the previous sections. All other gears used in NEFSC fisheries research (*e.g.,* a variety of plankton nets, CTDs, ROVs) do not have the expected potential for marine mammal interactions, and are not known to have been involved in any marine mammal interaction anywhere. Specifically, we consider CTDs, XBTs, CUFES, ROVs, small trawls (Oozeki, IKMT, MOCNESS, and Tucker trawls), plankton nets (Bongo, Pairovet, and Manta nets), and vertically deployed or towed imaging systems to be no-impact gear types.

Unlike trawl nets and longline gear, which are used in both scientific research and commercial fishing applications, these other gears are not considered similar or analogous to any commercial fishing gear and are not designed to capture any commercially salable species, or to collect any sort of sample in large quantities. They are not considered to have the potential to take marine mammals primarily because of their design and how they are deployed. For example, CTDs are typically deployed in a vertical cast on a cable and have no loose lines or other entanglement hazards. A Bongo net is typically deployed on a cable, whereas neuston nets (these may be plankton nets or small trawls) are often deployed in the upper one meter of the water column; either net type has very small size (*e.g.,* two bongo nets of 0.5 m^2 each or a neuston net of approximately 2 m^2) and no trailing lines to present an entanglement risk. These other gear types are not considered further in this document.

Acoustic Effects

We previously provided general background information on sound and the specific sources used by the NEFSC (see ''Description of Active Acoustic Sound Sources''). Here, we first provide background information on marine mammal hearing before discussing the potential effects of NEFSC use of active acoustic sources on marine mammals.

Marine mammal hearing—Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for low-frequency cetaceans. The functional groups and the associated frequencies are indicated below (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group):

- Low-frequency cetaceans (mysticetes): Functional hearing is estimated to occur between approximately 7 Hz and 25 kHz (up to 30 kHz in some species), with best hearing estimated to be from 100 Hz to 8 kHz (Watkins, 1986; Ketten, 1998; Houser *et al.,* 2001; Au *et al.,* 2006; Lucifredi and Stein, 2007; Ketten *et al.,* 2007; Parks *et al.,* 2007a; Ketten and Mountain, 2009; Tubelli *et al.,* 2012);
- Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids): Functional hearing is estimated to occur between approximately 150 Hz and 160 kHz, with best hearing from 10 to less than 100 kHz (Johnson, 1967; White, 1977; Richardson *et al.,* 1995; Szymanski *et al.,* 1999; Kastelein *et al.,* 2003; Finneran *et al.,* 2005a, 2009; Nachtigall *et al.,* 2005, 2008; Yuen *et al.,* 2005; Popov *et al.,* 2007; Au and Hastings, 2008; Houser *et al.,* 2008; Pacini *et al.,* 2010, 2011; Schlundt *et al.,* 2011);
- High-frequency cetaceans (porpoises, river dolphins, and members of the genera *Kogia* and *Cephalorhynchus;* including two members of the genus *Lagenorhynchus,* including the hourglass dolphin, on the basis of recent echolocation data and genetic data [May-Collado and Agnarsson, 2006; Kyhn *et al.,* 2009, 2010; Tougaard *et al.,* 2010]): Functional hearing is estimated to occur between approximately 200 Hz and 180 kHz (Popov and Supin, 1990a, b; Kastelein *et al.,* 2002; Popov *et al.,* 2005); and
- Pinnipeds in water; Phocidae (true seals): Functional hearing is estimated to occur between approximately 75 Hz to 100 kHz, with best hearing between 1–50 kHz (Mohl, 1968; Terhune and Ronald, 1971, 1972; Richardson *et al.,* 1995; Kastak and Schusterman, 1999; Reichmuth, 2008; Kastelein *et al.,* 2009);
- Pinnipeds in water; Otariidae (eared seals): Functional hearing is estimated to occur between 100 Hz and 40 kHz for Otariidae, with best hearing between 2–48 kHz (Schusterman *et al.,* 1972; Moore and Schusterman, 1987; Babushina *et al.,* 1991; Richardson *et al.,* 1995; Kastak and Schusterman, 1998; Kastelein *et al.,*

2005a; Mulsow and Reichmuth, 2007; Mulsow *et al.,* 2011a, b).

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemila *et al.,* 2006; Kastelein *et al.,* 2009; Reichmuth *et al.,* 2013).

Within the Atlantic coast region, 37 marine mammal species (33 cetacean and 4 pinniped [0 otariid and 4 phocid] species) have the potential to co-occur with NEFSC research activities. Please refer to Table 3. Of the 37 cetacean species that may be present, six are classified within the low-frequency functional hearing group (*i.e.,* all mysticete species), 24 are classified within the mid-frequency functional hearing group (*i.e.,* all delphinidae and ziphiidae species and the sperm whale), three are classified within the high-frequency functional hearing group (*i.e.,* habor porpoise and *Kogia* spp.); and four are classified within the pinnipeds in water functional hearing group

Potential effects of underwater sound—Please refer to the information given previously (''Description of Active Acoustic Sources'') regarding sound, characteristics of sound types, and metrics used in this document. Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following: Temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al.,* 1995; Gordon *et al.,* 2004; Nowacek *et al.,* 2007; Southall *et al.,* 2007; Gotz *et al.,* 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range. We first describe specific manifestations of acoustic effects before providing discussion specific to the NEFSC's use of active acoustic sources (*e.g.,* echosounders).

Richardson *et al.* (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal, but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.,* when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (*i.e.,* permanent hearing impairment, certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that the NEFSC's use of active acoustic sources may result in such effects (see below for further discussion). Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak *et al.,* 1999; Schlundt *et al.,* 2000; Finneran *et al.,* 2002, 2005b). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al.,* 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e.,* tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al.,* 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.,* Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals—PTS data exists only for a single harbor seal (Kastak *et al.,* 2008)—but are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several decibels above (a 40-dB threshold shift approximates PTS onset; *e.g.,* Kryter *et al.,* 1966; Miller, 1974) that inducing mild TTS (a 6-dB threshold shift approximates TTS onset; *e.g.,* Southall *et al.* 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as impact pile driving pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall *et al.,* 2007). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g.,* change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.,* 2006; Southall *et al.,* 2007; Zimmer and Tyack, 2007). NEFSC activities do not involve the use of devices such as explosives or mid-frequency active sonar that are associated with these types of effects.

When a live or dead marine mammal swims or floats onto shore and is incapable of returning to sea, the event is termed a ''stranding'' (16 U.S.C. 1421h(3)). Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series (*e.g.,* Geraci *et al.,* 1999). However, the cause or causes of most strandings are unknown (*e.g.,* Best, 1982). Combinations of dissimilar stressors may combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other would not be expected to produce the same outcome (*e.g.,* Sih *et al.,* 2004). For further description of stranding events see, *e.g.,* Southall *et al.,* 2006; Jepson *et al.,* 2013; Wright *et al.,* 2013.

1. *Temporary threshold shift*—TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 1985). While experiencing TTS,

the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the data published at the time of this writing concern TTS elicited by exposure to multiple pulses of sound.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower, and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale [*Delphinapterus leucas*], harbor porpoise, and Yangtze finless porpoise [*Neophocoena asiaeorientalis*]) and three species of pinnipeds (northern elephant seal, harbor seal, and California sea lion) exposed to a limited number of sound sources (*i.e.,* mostly tones and octave-band noise) in laboratory settings (*e.g.,* Finneran *et al.,* 2002; Nachtigall *et al.,* 2004; Kastak *et al.,* 2005; Lucke *et al.,* 2009; Popov *et al.,* 2011). In general, harbor seals (Kastak *et al.,* 2005; Kastelein *et al.,* 2012a) and harbor porpoises (Lucke *et al.,* 2009; Kastelein *et al.,* 2012b) have a lower TTS onset than other measured pinniped or cetacean species. Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al.* (2007) and Finneran and Jenkins (2012).

2. *Behavioral effects*—Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.,* minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.,* species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.,* Richardson *et al.,* 1995; Wartzok *et al.,* 2003; Southall *et al.,* 2007; Weilgart, 2007; Archer *et al.,* 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.,* 2012), and can vary depending on characteristics associated with the sound source (*e.g.,* whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B–C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a ''progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,'' rather than as, more generally, moderation in response to human disturbance (Bejder *et al.,* 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; NRC, 2003; Wartzok *et al.,* 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.,* 1997; Finneran *et al.,* 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson *et al.,* 1995; Nowacek *et al.,* 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.,* Lusseau and Bejder, 2007; Weilgart, 2007; NRC, 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.,* Frankel and Clark, 2000; Costa *et al.,* 2003; Ng and Leung, 2003; Nowacek *et al.;* 2004). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.,* 2001; Nowacek *et al.;* 2004; Madsen *et al.,* 2006; Yazvenko *et al.,* 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.,* Kastelein *et al.,* 2001, 2005b, 2006; Gailey *et al.,* 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.,* 2000; Fristrup *et al.,* 2003; Foote *et al.,* 2004), while right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007b). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.,* 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.,* 1995). For example, gray whales are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme *et al.,* 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.,* Bowles *et al.,* 1994; Goold, 1996; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.,* Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.,* directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England, 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.,* when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.,* Beauchamp and Livoreil, 1997; Fritz *et al.,* 2002; Purser and Radford, 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.,* decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.,* Harrington and Veitch, 1992; Daan *et al.,* 1996; Bradshaw *et al.,* 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

3. *Stress responses*—An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.,* Seyle, 1950; Moberg, 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.,* Moberg, 1987; Blecha, 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.,* 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and ''distress'' is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.,* Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano *et al.,* 2002b) and, more rarely, studied in wild populations (*e.g.,* Romano *et al.,* 2002a). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as ''distress.'' In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

4. *Auditory masking*—Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.,* those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al.,* 1995). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g.,* snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.,* shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.,* signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.,* sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is man-made, it may be considered harassment when disrupting or altering behavioral patterns. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.,* Clark *et al.,* 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.,* Miller *et al.,* 2000; Foote *et al.,* 2004; Parks *et al.,* 2007b; Di Iorio and Clark, 2009; Holt *et al.,* 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.,* 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore, 2014). Masking can be tested directly in captive species (*e.g.,* Erbe, 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.,* Branstetter *et al.,* 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand, 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.,* from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Potential effects of NEFSC activity—As described previously (see ''Description of Active Acoustic Sound Sources''), the NEFSC proposes to use various active acoustic sources, including 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). These acoustic sources, which are present on most NEFSC fishery research vessels, 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.

Many typically investigated acoustic sources (*e.g.,* seismic airguns, low- and mid-frequency active sonar used for military purposes, pile driving, vessel noise)—sources for which certain of the potential acoustic effects described above have been observed or inferred—produce signals that are either much lower frequency and/or higher total energy (considering output sound levels and signal duration) than the high-frequency mapping and fish-finding systems used by the NEFSC. There has been relatively little attention given to the potential impacts of high-frequency sonar systems on marine life, largely because their combination of high output frequency and relatively low output power means that such systems are less likely to impact many marine species. However, some marine mammals do hear and produce sounds within the frequency range used by these sources and ambient noise is much lower at high frequencies, increasing the probability of signal detection relative to other sounds in the environment.

As noted above, relatively high levels of sound are likely required to cause TTS in most pinnipeds and odontocete cetaceans. While dependent on sound exposure frequency, level, and duration, NMFS' acoustics experts believe that existing studies indicate that for the kinds of relatively brief exposures potentially associated with transient sounds such as those produced by the active acoustic sources used by the NEFSC, SPLs in the range of approximately 180–220 dB rms might be required to induce onset TTS levels for most species (NEFSC, 2014). However, it should be noted that there may be increased sensitivity to TTS for certain species generally (harbor porpoise; Lucke *et al.,* 2009) or specifically at higher sound exposure frequencies, which correspond to a species' best hearing range (20 kHz vs. 3 kHz for bottlenose dolphins; Finneran and Schlundt, 2010). However, for these animals, which are better able to hear higher frequencies and may be more sensitive to higher frequencies, exposures on the order of approximately 170 dB rms or higher for brief transient signals are likely required for even temporary (recoverable) changes in hearing sensitivity that would likely not be categorized as physiologically damaging (NEFSC, 2014). The corresponding estimates for PTS would be at very high received levels that would rarely be experienced in practice.

Based on discussion provided by Southall *et al.* (2007), Lurton and DeRuiter (2011) modeled the potential impacts of conventional echosounders on marine mammals, estimating PTS onset at typical distances of 10–100 m for the kinds of sources considered here. Kremser *et al.* (2005) modeled the potential for TTS in blue, sperm, and beaked whales (please see Kremser *et al.* [2005] for discussion of assumptions regarding TTS onset in these species) from a multibeam echosounder, finding similarly that TTS would likely only occur at very close ranges to the hull of the vessel. The authors estimated ship movement at 12 kn (faster than NEFSC vessels would typically move), which would result in an underestimate of the potential for TTS to occur, but the modeled system (Hydrosweep) operates at lower frequencies and with a wider beam pattern than do typical NEFSC systems, which would result in a likely more significant overestimate of TTS potential. The results of both studies emphasize that these effects would very likely only occur in the cone ensonified below the ship and that animal responses to the vessel (sound or physical presence) at these extremely close ranges would very likely influence their probability of being exposed to these levels. At the same distances, but to the side of the vessel, animals would not be exposed to these levels, greatly decreasing the potential for an animal to be exposed to the most intense signals. For example, Kremser *et al.* (2005) note that SPLs outside the vertical lobe, or beam, decrease rapidly with distance, such that SPLs within the horizontal lobes are about 20 dB less than the value found in the center of the beam. For certain species (*i.e.,* odontocete cetaceans and especially harbor porpoises), these ranges may be somewhat greater based on more recent data (Lucke *et al.,* 2009; Finneran and Schlundt, 2010) but are likely still on the order of hundreds of meters. In addition, potential behavioral responses further reduce the already low likelihood that an animal may approach close enough for any type of hearing loss to occur.

Various other studies have evaluated the environmental risk posed by use of specific scientific sonar systems. Burkhardt *et al.* (2007) considered both the Hydrosweep system evaluated by Kremser *et al.* (2005) and the Simrad EK60, which is used by the NEFSC, and concluded that direct injury (*i.e.,* sound energy causes direct tissue damage) and indirect injury (*i.e.,* self-damaging behavior as response to acoustic exposure) would be unlikely given source and operational use (*i.e.,* vessel movement) characteristics, and that any behavioral responses would be unlikely to be significant. Similarly, Boebel *et al.* (2006) considered the Hydrosweep system in relation to the risk for direct or indirect injury, concluding that (1) risk of TTS (please see Boebel *et al.* [2006] for assumptions regarding TTS onset) would be less than two percent of the risk of ship strike and (2) risk of behaviorally-induced damage would be essentially nil due to differences in source characteristics between scientific sonars and sources typically associated with stranding events (*e.g.,* mid-frequency active sonar, but see discussion of Madagascar stranding event below). It should be noted that the risk of direct injury may be greater when a vessel operates sources while on station (*i.e.,* stationary), as there is a greater chance for an animal to receive the signal when the vessel is not moving.

Boebel *et al.* (2005) report the results of a workshop in which a structured, qualitative risk analysis of a range of acoustic technology was undertaken, specific to use of such technology in the Antarctic. The authors assessed a single-beam echosounder commonly used for collecting bathymetric data (12 kHz, 232 dB, 10° beam width), an array of single-beam echosounders used for mapping krill (38, 70, 120, and 200 kHz; 230 dB; 7° beam width), and a multibeam echosounder (30 kHz, 236 dB, 150° x 1° swath width). For each source, the authors produced a matrix displaying the severity of potential consequences (on a six-point scale) against the likelihood of occurrence for a given degree of severity. For the former two systems, the authors determined on the basis of the volume of water potentially affected by the system and comparisons between its output and available TTS data that the chance of TTS is only in a small volume immediately under the transducers, and that consequences of level four and above were inconceivable, whereas level one consequences (''Individuals show no response, or only a temporary (minutes) behavior change'') would be expected in almost all instances. Some minor displacement of animals in the immediate vicinity of the ship may occur. Boebel *et al.* (2005) note an increase in the likelihood of animal displacement because of the high output and broad width of the swath (abeam of the vessel) of the multibeam echosounder. However, the fore and aft beam width is small and the pulse length very short, so the risk of ensonification above TTS levels is still considered quite small and the likelihood of auditory or other injuries low. In general, the authors reached the same conclusions described for the single-beam systems, but note that more severe impacts—including fatalities resulting from herding of sensitive species in narrow sea ways—are at least possible (*i.e.,* may occur in exceptional circumstances). However, the probability of herding remains low not just because of the rarity of the necessary confluence of species, bathymetry, and likely other factors, but because the restricted beam shape makes it unlikely that an animal would be exposed more than briefly during the passage of the vessel (Boebel *et al.,* 2005).

We have, however, considered the potential for severe behavioral responses such as stranding and associated indirect injury or mortality from the NEFSC use of the multibeam echosounder, on the basis of a 2008 mass stranding of approximately one hundred melon-headed whales in a Madagascar lagoon system. An investigation of the event indicated that use of a high-frequency mapping system (12-kHz multibeam echosounder; it is important to note that all NEFSC sources operate at higher frequencies [see Table 2]) was the most plausible and likely initial behavioral trigger of the event, while providing the caveat that there is no unequivocal and easily identifiable single cause (Southall *et al.,* 2013). The panel's conclusion was based on (1) very close temporal and spatial association and directed movement of the survey with the stranding event; (2) the unusual nature of such an event coupled with previously documented apparent behavioral sensitivity of the species to other sound types (Southall *et al.,* 2006; Brownell *et al.,* 2009); and (3) the fact that all other possible factors considered were determined to be unlikely causes. Specifically, regarding survey patterns prior to the event and in relation to bathymetry, the vessel transited in a north-south direction on the shelf break parallel to the shore, ensonifying large areas of deep-water habitat prior to operating intermittently in a concentrated area offshore from the stranding site; this may have trapped the animals between the sound source and the shore, thus driving them towards the lagoon system.

The investigatory panel systematically excluded or deemed highly unlikely nearly all potential reasons for these animals leaving their typical pelagic habitat for an area extremely atypical for the species (*i.e.,* a shallow lagoon system). Notably, this was the first time that such a system has been associated with a stranding event.

The panel also noted several site- and situation-specific secondary factors that may have contributed to the avoidance responses that led to the eventual entrapment and mortality of the whales. Specifically, shoreward-directed surface currents and elevated chlorophyll levels in the area preceding the event may have played a role (Southall *et al.,* 2013). The report also notes that prior use of a similar system in the general area may have sensitized the animals and also concluded that, for odontocete cetaceans that hear well in higher frequency ranges where ambient noise is typically quite low, high-power active sonars operating in this range may be more easily audible and have potential effects over larger areas than low frequency systems that have more typically been considered in terms of anthropogenic noise impacts. It is, however, important to note that the relatively lower output frequency, higher output power, and complex nature of the system implicated in this event, in context of the other factors noted here, likely produced a fairly unusual set of circumstances that indicate that such events would likely remain rare and are not necessarily relevant to use of lower-power, higher-frequency systems more commonly used for scientific applications. The risk of similar events recurring may be very low, given the extensive use of active acoustic systems used for scientific and navigational purposes worldwide on a daily basis and the lack of direct evidence of such responses previously reported.

Characteristics of the sound sources predominantly used by the NEFSC further reduce the likelihood of effects to marine mammals, as well as the intensity of effect assuming that an animal perceives the signal. Intermittent exposures—as would occur due to the brief, transient signals produced by these sources—require a higher cumulative SEL to induce TTS than would continuous exposures of the same duration (*i.e.,* intermittent exposure results in lower levels of TTS) (Mooney *et al.,* 2009a; Finneran *et al.,* 2010). In addition, intermittent exposures recover faster in comparison with continuous exposures of the same duration (Finneran *et al.,* 2010). Although echosounder pulses are, in general, emitted rapidly, they are not dissimilar to odontocete echolocation click trains. Research indicates that marine mammals generally have extremely fine auditory temporal resolution and can detect each signal separately (*e.g.,* Au *et al.,* 1988; Dolphin *et al.,* 1995; Supin and Popov, 1995; Mooney *et al.,* 2009b), especially for species with echolocation capabilities. Therefore, it is likely that marine mammals would indeed perceive echosounder signals as being intermittent.

We conclude here that, on the basis of available information on hearing and potential auditory effects in marine mammals, high-frequency cetacean species would be the most likely to potentially incur temporary hearing loss from a vessel operating high-frequency sonar sources, and the potential for PTS to occur for any species is so unlikely as to be discountable. Even for high-frequency cetacean species, individuals would have to make a very close approach and also remain very close to vessels operating these sources in order to receive multiple exposures at relatively high levels, as would be necessary to cause TTS. Additionally, given that behavioral responses typically include the temporary avoidance that might be expected (see below), the potential for auditory effects considered physiological damage (injury) is considered extremely low in relation to realistic operations of these devices. Given the fact that fisheries research survey vessels are moving, the likelihood that animals may avoid the vessel to some extent based on either its physical presence or due to aversive sound (vessel 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.

Based on the source operating characteristics, most of these sources may be detected by odontocete cetaceans (and particularly high-frequency specialists such as porpoises) but are unlikely to be audible to mysticetes (*i.e.,* low-frequency cetaceans) and most pinnipeds. While low-frequency cetaceans and pinnipeds have been observed to respond behaviorally to low- and mid-frequency sounds (*e.g.,* Frankel, 2005), there is little evidence of behavioral responses in these species to high-frequency sound exposure (*e.g.,* Jacobs and Terhune, 2002; Kastelein *et al.,* 2006). If a marine mammal does perceive a signal from a NEFSC active acoustic source, it is likely that the response would be, at most, behavioral in nature. Behavioral reactions of free-ranging marine mammals to scientific sonars are likely to vary by species and circumstance. For example, Watkins *et al.* (1985) note that sperm whales did not appear to be disturbed by or even aware of signals from scientific sonars and pingers (36–60 kHz) despite being very close to the transducers, but Gerrodette and Pettis (2005) report that, when a 38-kHz echosounder and ADCP were on (1) the average size of detected schools of spotted dolphins and pilot whales was decreased; (2) perpendicular sighting distances increased for spotted and spinner dolphins; and (3) sighting rates decreased for beaked whales. As described above, behavioral responses of marine mammals are extremely variable, depending on multiple exposure factors, with the most common type of observed response being behavioral avoidance of areas around aversive sound sources. Certain odontocete cetaceans (particularly harbor porpoises and beaked whales) are known to avoid high-frequency sound sources in both field and laboratory settings (*e.g.,* Kastelein *et al.,* 2000, 2005b, 2008a, b; Culik *et al.,* 2001; Johnston, 2002; Olesiuk *et al.,* 2002; Carretta *et al.,* 2008). There is some additional, low probability for masking to occur for high-frequency specialists, but similar factors (directional beam pattern, transient signal, moving vessel) mean that the significance of any potential masking is probably inconsequential.

Potential Effects of Visual Disturbance

The NEFSC anticipates that some trawl, fyke net, and beach seine surveys may disturb a small number of pinnipeds during the conduct of these activities in upper Penobscot Bay above Fort Point Ledge, ME. Pinnipeds are expected to be hauled out on tidal ledges and at times may experience incidental close approaches by the survey vessel and/or researchers during the course of its fisheries research activities. The NEFSC expects that some of these animals will exhibit a behavioral response to the visual stimuli (*e.g.,* including alert behavior, movement, vocalizing, or flushing). NMFS does not consider the lesser reactions (*e.g.,* alert behavior) to constitute harassment. These events are expected to be infrequent and cause only a temporary disturbance on the order of minutes. Monitoring results from other activities involving the disturbance of pinnipeds and relevant studies of pinniped populations that experience more regular vessel disturbance indicate that individually significant or population level impacts are unlikely to occur.

In areas where disturbance of haul-outs due to periodic human activity (*e.g.,* researchers approaching on foot, passage of small vessels, maintenance activity) occurs, monitoring results have generally indicated that pinnipeds typically move or flush from the haul-out in response to human presence or visual disturbance, although some individuals typically remain hauled-out (*e.g.,* SCWA, 2012). The nature of response is generally dependent on species. For example, California sea lions and northern elephant seals have been observed as less sensitive to stimulus than harbor seals during monitoring at numerous sites. Monitoring of pinniped disturbance as a result of abalone research in the Channel Islands showed that while harbor seals flushed at a rate of 69 percent, California sea lions flushed at a rate of only 21 percent. The rate for elephant seals declined to 0.1 percent (VanBlaricom, 2010).

Upon the occurrence of low-severity disturbance (*i.e.,* the approach of a vessel or person as opposed to an explosion or sonic boom), pinnipeds typically exhibit a continuum of responses, beginning with alert movements (*e.g.,* raising the head), which may then escalate to movement away from the stimulus and possible flushing into the water. Flushed pinnipeds typically re-occupy the haul-out within minutes to hours of the stimulus.

In a popular tourism area of the Pacific Northwest where human disturbances occurred frequently, past studies observed stable populations of seals over a twenty-year period (Calambokidis *et al.,* 1991). Despite high levels of seasonal disturbance by tourists using both motorized and non-motorized vessels, Calambokidis *et al.* (1991) observed an increase in site use (pup rearing) and classified this area as one of the most important pupping sites for seals in the region. Another study observed an increase in seal vigilance when vessels passed the haul-out site, but then vigilance relaxed within ten minutes of the vessels' passing (Fox, 2008). If vessels passed frequently within a short time period (*e.g.,* 24 hours), a reduction in the total number of seals present was also observed (Fox, 2008).

Level A harassment, serious injury, or mortality could likely only occur as a result of trampling in a stampede (a potentially dangerous occurrence in which large numbers of animals succumb to mass panic and rush away from a stimulus) or abandonment of pups. However, given the nature of potential disturbance—which would entail the gradual and highly visible approach of a small vessel and small research crew—we would expect that pinnipeds would exhibit a gradual response escalation, and that stampeding or abandonment of pups would likely not be an issue.

Disturbance of pinnipeds caused by NEFSC survey activities—which are sparsely distributed in space and time—would be expected to last for only short periods of time, separated by significant amounts of time in which no disturbance occurred. Because such disturbance is sporadic, rather than chronic, and of low intensity, individual marine mammals are unlikely to incur any detrimental impacts to vital rates or ability to forage and, thus, loss of fitness. Correspondingly, even local populations, much less the overall stocks of animals, are extremely unlikely to accrue any significantly detrimental impacts.

Anticipated Effects on Marine Mammal Habitat

Effects to prey—In addition to direct, or operational, interactions between fishing gear and marine mammals, indirect (*i.e.,* biological or ecological) interactions occur as well, in which marine mammals and fisheries both utilize the same resource, potentially resulting in competition that may be mutually disadvantageous (*e.g.,* Northridge, 1984; Beddington *et al.,* 1985; Wickens, 1995). Marine mammal prey varies by species, season, and location and, for some, is not well documented. NEFSC fisheries research removals of species commonly utilized by marine mammals are relatively low. Prey of right whales, sei whales, and blue whales are primarily zooplankton, which are not directly targeted by NEFSC fisheries research, thus the likelihood of research activities changing prey availability is unlikely. There is some overlap in prey of humpback and fin whales (*e.g.,* Atlantic herring and sandeels) and possibly sperm whales (squid).

The removal by NEFSC fisheries research, regardless of season and location is, however, insignificant relative to that taken through commercial fisheries (See Section 4.2.3 of the NEFSC EA for more information on fish catch during research surveys). For example, the 2009 research catch of Atlantic herring in the GOM/GB represented 0.009% of the 2010 Allowable Biological Catch (ABC) for commercial harvest. Similarly, research catch of Atlantic mackerel in 2009 equaled 0.001% of the 2010 ABC and research catch for longfin squid was 0.021% of ABC.

The total prey removal by all NEFSC fisheries research surveys and projects, regardless of season and location across the Atlantic Coast region, totals a few hundreds of tons of fish per year (Table 4.2–8), which is a negligible percentage of the estimated fish consumed by cetaceans. The NEFSC research catch of invertebrate prey is also small; the average annual NEFSC research catch of long-finned squid was less than 12 tons (See Table 4.2–19 of the NEFSC EA for more information).

In addition to the small total biomass taken, some of the size classes of fish targeted in research surveys are smaller than that generally targeted by marine mammals. Research catches are also distributed over a wide area because of the random sampling design covering large sample areas. Fish removals by research are therefore highly localized and unlikely to affect the spatial concentrations and availability of prey for any marine mammal species. This is especially true for pinnipeds in the Atlantic coast region, which are opportunistic predators that consume a wide assortment of fish and squid. With pinniped populations increasing and ranges expanding in New England, food availability does not appear to be a limiting factor (Baraff and Loughlin, 2000).

In the southern portion of the Atlantic coast region, NEFSC-affiliated fisheries research is primarily related to catch, tag, and release studies of sharks, with minimal numbers of finfish collected for lab analysis. This level of effort would have no impact on prey sources for marine mammals in southern portion of the Atlantic coast region.

Acoustic habitat—Acoustic habitat is the soundscape—which encompasses all of the sound present in a particular location and time, as a whole—when considered from the perspective of the animals experiencing it. Animals produce sound for, or listen for sounds produced by, conspecifics (communication during feeding, mating, and other social activities), other animals (finding prey or avoiding predators), and the physical environment (finding suitable habitats, navigating). Together, sounds made by animals and the geophysical environment (*e.g.,* produced by earthquakes, lightning, wind, rain, waves) make up the natural contributions to the total acoustics of a place. These acoustic conditions, termed acoustic habitat, are one attribute of an animal's total habitat.

Soundscapes are also defined by, and acoustic habitat influenced by, the total contribution of anthropogenic sound. This may include incidental emissions from sources such as vessel traffic, or may be intentionally introduced to the marine environment for data acquisition purposes (as in the NEFSC's use of active acoustic sources). Anthropogenic noise varies widely in its frequency content, duration, and loudness and these characteristics greatly influence the potential habitat-mediated effects to marine mammals (please see also the previous discussion on masking under ''Acoustic Effects''), which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). For more detail on these concepts see, *e.g.,* Barber *et al.,* 2010; Pijanowski *et al.,* 2011; Francis and Barber, 2013; Lillis *et al.,* 2014.

Problems arising from a failure to detect cues are more likely to occur when noise stimuli are chronic and overlap with biologically relevant cues used for communication, orientation, and predator/prey detection (Francis and Barber, 2013). As described above (''Acoustic Effects''), the signals emitted by NEFSC active acoustic sources are generally high frequency, of short duration, and transient. These factors mean that the signals will attenuate rapidly (not travel over great distances), may not be perceived or affect perception even when animals are in the vicinity, and would not be considered chronic in any given location. The NEFSC's use of these sources is widely dispersed in both space and time. In conjunction with the prior factors, this means that it is highly unlikely that the NEFSC's use of these sources would, on their own, have any appreciable effect on acoustic habitat. Sounds emitted by NEFSC vessels would be of lower frequency and continuous, but would also be widely dispersed in both space and time. NEFSC vessel traffic—including both sound from the vessel itself and from the active acoustic sources—is of very low density compared to commercial shipping traffic or commercial fishing vessels and would therefore be expected to represent an insignificant incremental increase in the total amount of anthropogenic sound input to the marine environment.

Physical habitat—Fishing gear that contacts the seafloor can alter and/or physically damage seafloor habitat. Physical damage includes furrowing and smoothing of the seafloor as well as the displacement of rocks and boulders as fishing gear is towed across the bottom (Morgan and Chuenpagdee, 2003). Physical damage to the seafloor can increase with multiple tows in the same area (Stevenson *et al.,* 2004). Bottom contact fishing gear historically used in NEFSC fishery research activities includes bottom trawls, otter trawls, sea scallop dredges, and hydraulic surfclam dredges. Short-term cooperative research projects have also used pot gear for research on scup and sea bass as well as lobsters. The NEFSC has historically conducted bottom trawls in the Gulf of Maine, Georges Bank, Mid-Atlantic Bight, and southern New England subareas of the Atlantic coast region during each season. However, bottom trawl effort is generally lower in the winter relative to other seasons. The NEFSC has also used dredges in each of the Atlantic coast region subareas previously identified; however, dredging is restricted to spring, summer, and fall seasons. The geographic extent of any physical contact with benthic habitats caused by NEFSC fisheries research activities would be much less than two percent of the NEFSC research area. Physical damage to the seafloor typically recovers within 18 months through the action of water currents and natural sedimentation, with the exception of rock and boulder displacement (Stevenson *et al.,* 2004).

The seafloor in the specified geographic region is comprised primarily of silt, sand, clay, gravel, and boulders. Any physical damage caused by NEFSC fisheries research survey activities in these substrates would be expected to recover within 18 months (Stevenson *et al.,* 2004). The geographic area directly affected by NEFSC bottom trawl and dredge surveys in 2008 was estimated to be about 70 square miles, an unusually high amount due to the need for extra calibration trials with a new vessel. More typical coverage is estimated to be about 50 square miles per year (NEFSC, 2014). The area affected by research each year is a very small fraction of the total area of each of the Atlantic coast subregions (see Table 4.2–2 in the NEFSC's draft EA). The GOM covers an area of approximately 35,000 mi^2, the GB covers more than 16,000 square miles, the SNE subregion covers approximately 30,500 square miles, and the MAB covers approximately 32,000 square miles. Bottom disturbance resulting from annual NEFSC fisheries research activity with trawl and dredge gear would affect less than 0.05 percent of the total area of each Atlantic coast subregion (See Table 4.2–2 of the NEFSC EA for more information).

The geographical area directly affected by NEFSC bottom trawl and dredge surveys every year is estimated to be about 181 km^2. In addition, cooperative research activities not contributable to commercial fishing is likely to affect 150 to 250 km^2 each year. The area affected by research each year is a very small fraction of the total area involved in survey efforts.

Soft bottom habitats are typically less affected by pot gear than vegetated or hard bottom habitats (Barnette, 2001). Weights and anchors associated with fishing pots may physically damage fragile species such as coarls, which are more common in rocky substrates (Macdonald *et al.,* 1996, Eno *et al.,* 2001). Although pot gear may be deployed in some hard bottom habitats that are not suitable for trawling or dredging, its use is not limited to rocky substrates and data on the substrate for each pot used in past research is not available for quantitative estimates by habitat type. Overall, the effect of pot gear used for NEFSC fisheries research on benthic habitats is expected to be very small, especially compared to the number of pots used for commercial fisheries in the Northeast.

As described in the preceding section, the potential for NEFSC research to affect the availability of prey to marine mammals or to meaningfully impact the quality of acoustic habitat is considered to be insignificant for all species, in the specified geographical region. Effects to habitat will not be discussed further in this document.

Estimated Take by Incidental Harassment, Serious Injury, or Mortality

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment]. Serious injury means any injury that will likely result in mortality (50 CFR 216.3).

Take of marine mammals incidental to NEFSC research activities could occur as a result of: (1) Injury or mortality due to gear interaction; (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).

Estimated Take Due to Gear Interaction

Historical Interactions—In order to estimate the number of potential incidents of take that could occur by M/SI + Level A through gear interaction, we first consider the NEFSC's past record of such incidents, and then consider in addition other species that may have similar vulnerabilities to the NEFSC's trawl, gillnet, and fyke net gear for which we have historical interaction records. We describe historical interactions with NEFSC research gear in Tables 4, 5, and 6. Available records are for the years 2004 through the present. Please see Figure 4.2–2 in the NEFSC EA for specific locations of these incidents.

TABLE 4—HISTORICAL INTERACTIONS WITH TRAWL GEAR

Gear	Survey	Date	Species	Number killed	Number released alive	Total
Gourock high speed midwater rope trawl.	Atlantic Herring Survey	10/8/2004	Short-beaked common dolphin (Western NA stock).	2	0	2
Bottom trawl (4-seam, 3 bridle).	NEFSC Standard Bottom Trawl Survey.	11/11/2007	Short-beaked common dolphin (Western NA stock).	1	0	1
Gourock high speed midwater rope trawl.	Atlantic Herring Survey	10/11/2009	Minke whale	0	[1] 1	1
Bottom trawl (4-seam, 3 bridle).	Spring Bottom Trawl Survey.	4/4/15	Gray seal	[2] 1	0	1
Total individuals captured (total number of interactions given in parentheses)			Short-beaked common dolphin (3).	3	0	3
			Minke whale (1)	0	1	1
			Gray seal (1)	1	0	1

[1] According to the incident report, "The net's cod end and whale were brought aboard just enough to undo the cod end and free the whale. It was on deck for about five minutes. While on deck, it was vocalizing and moving its tail up and down. The whale swam away upon release and appeared to be fine. Estimated length was 19 feet." The NEFSC later classified this incidental take as a serious injury using NMFS criteria for such determinations published in January 2012 (Cole and Henry, 2013).

[2] The NEFSC filed an incident report for this incidental take on April 4, 2015.

TABLE 5—HISTORICAL INTERACTIONS WITH GILLNET GEAR

Gear	Survey	Date	Species	Number killed	Number released alive	Total
Gillnet	COASTSPAN	11/29/2008	Common Bottlenose dolphin (Northern South Carolina Estuarine System stock) [1].	1	0	1
Gillnet	NEFOP Observer Gillnet Training Trips.	5/4/2009	Gray seal	1	0	1
Gillnet	NEFOP Observer Gillnet Training Trips.	5/4/2009	Harbor porpoise	1	0	1
Total individuals captured (total number of interactions given in parentheses)			Bottlenose dolphin (1)	1	0	1
			Gray seal (1)	1	0	1
			Harbor porpoise (1)	1	0	1

[1] In 2008, the COASTSPAN gillnet survey caught and killed one common bottlenose dolphin in 2008 while a cooperating institution was conducting the survey in South Carolina. This was the only occurrence of incidental take in these surveys. 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 *et al.,* 2014).

TABLE 6—HISTORICAL INTERACTIONS WITH FYKE NET GEAR

Gear	Survey	Date	Species	Number killed	Number released alive	Total
Fyke Net	Maine Estuaries Diadromous Survey.	10/25/2010	Harbor seal	1	0	1
Total				1	0	1

The NEFSC has no recorded interactions with any gear other than midwater and bottom trawl, gillnet, and fyke net gears. As noted previously in "Potential Effects of the Specified Activity on Marine Mammals," we anticipate future interactions with the same gear types.

In order to use these historical interaction records in a precautionary manner as the basis for the take estimation process, and because we have no specific information to indicate whether any given future interaction might result in M/SI versus Level A harassment, we conservatively assume that all interactions equate to mortality.

During trawl surveys, the NEFSC has recorded interactions with short-beaked common dolphins (Western North Atlantic stock; two total interactions with three individual animals); minke whale (one total interaction with one animal); and gray seal (one total interaction with one animal). Common dolphins are the species most likely to interact with NEFSC trawl gear with an average of 1.5 dolphins captured per interaction.

During gillnet surveys, the NEFSC has recorded interactions with short-beaked common dolphins (Northern South Carolina Estuarine System stock; one total interaction with one animal); gray seal (one total interaction with one animal); and harbor porpoise (one total interaction with one animal).

During one fyke net survey in 2010, the NEFSC recorded one interaction with one harbor seal. Since this recorded interaction, the NEFSC now requires the use of marine mammal excluder devices as a mitigation measure for this gear type.

In order to produce the most precautionary take estimates possible, we use here the most recent 11 years of data (*e.g.,* 2004–15).

In order to estimate the potential number of incidents of M/SI + Level A that could occur incidental to the NEFSC's use of midwater and bottom trawl, gillnet, fyke net, and longline gear in the Atlantic coast region over the five-year period from 2015–20, we first look at the six species described that have been taken historically and then evaluate the potential vulnerability of additional species to these gears.

Table 7 shows the 11-year annual average captures of these six species and the projected five-year totals for this proposed rule, for trawl, gillnet, and fyke net gear. In order to produce precautionary estimates, we calculate the annual average for the 11-year period (2004–2015) and round up the annual to the nearest whole number. Because the NEFSC requests take for a five-year period, we multiply the annual average by five and assume that this number may be taken within the effective five-year period of the proposed authorization.

To date, infrequent interactions of trawl nets, gillnets, pelagic and bottom longline, and fyke net gears with marine mammals have occurred in the Atlantic coast region during NEFSC research activities. The NEFSC interaction rates have exhibited some inter-annual variation in numbers, possibly due to changing marine mammal densities and distributions and dynamic oceanographic conditions. This approach is precautionary. Estimating takes of species captured historically will produce an estimate higher than the historic average take for each species taken incidentally during past NEFSC research. We use this methodology to ensure accounting for the maximum amount of potential take in the future as well as accounting for the fluctuations in inter-annual variability observed during the 11-year time period. Moreover, these estimates are based on the assumption that annual effort over the proposed five-year authorization period will not exceed the annual effort during the period 2004–2015.

TABLE 7—ANNUAL AVERAGE CAPTURES (2004–15) AND PROJECTED FIVE-YEAR TOTAL FOR HISTORICALLY-CAPTURED SPECIES

Gear	Species	2004	05	06	07	08	09	10	11	12	13	14	15	Avg. per year	Projected 5-year total [1]
Trawl	Short-beaked common dolphin.	2	0	0	1	0	0	0	0	0	0	0	0	0.27	5
	Minke whale	0	0	0	0	0	1	0	0	0	0	0	0	0.09	5
	Gray seal	0	0	0	0	0	0	0	0	0	0	0	1	0.09	5
Gillnet	Common bottlenose dolphin.	0	0	0	0	1	0	0	0	0	0	0	0	0.09	[2] 5
	Harbor porpoise	0	0	0	0	0	1	0	0	0	0	0	0	0.09	5
	Gray seal	0	0	0	0	0	1	0	0	0	0	0	0	0.09	5
Fyke net	Harbor seal	0	0	0	0	0	0	1	0	0	0	0	0	0.09	5

[1] The estimated total is the product of the 2004–2015 annual average rounded up to the nearest whole number and multiplied by the five-year timespan of the proposed rule.

[2] The projected 5-year total includes an estimate of 5 each for the Western North Atlantic offshore, the Western North Atlantic Northern Migratory Coastal, and the Western North Atlantic Southern Migratory Coastal stocks of common bottlenose dolphins. The NEFSC is not requesting take for the estuarine stocks of bottlenose dolphins for the COASTPAN longline and gillnet surveys. In 2008, the COASTSPAN gillnet survey caught and killed one common bottlenose dolphin in 2008 while a cooperating institution was conducting the survey in South Carolina. This was the only occurrence of incidental take in these surveys. 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 *et al.,* 2014).

As background to the process of determining which species not historically taken may have sufficient vulnerability to capture in NEFSC gear to justify inclusion in the take authorization request, we note that the NEFSC is NMFS' research arm in the Greater Atlantic region which we consider as a leading source of expert knowledge regarding marine mammals (*e.g.,* behavior, abundance, density) in the areas where the NEFSC operates. The NEFSC formulated the take requests for species selected by NEFSC subject matter experts who based their selections on the best available information. We have concurred with these decisions.

In order to evaluate the potential vulnerability of additional species to trawl, gillnet, fyke net, and longline gear, we first consulted NMFS' List of Fisheries (LOF), which classifies U.S. commercial fisheries into one of three categories according to the level of incidental marine mammal M/SI that is known to occur on an annual basis over the most recent five-year period (generally) for which data has been analyzed: Category I, frequent incidental M/SI; Category II, occasional incidental M/SI; and Category III, remote likelihood of or no known incidental M/SI. We provide this information, as presented in the 2015 LOF (79 FR 77919; January 28, 2015), in Tables 8, 9, and 10. In order to simplify information presented, and to encompass information related to other similar species from different locations, we group marine mammals by genus (where there is more than one member of the genus found in U.S. waters). For confirmed and documented incidents of M/SI incidental to relevant commercial fisheries, we note whether we believe those incidents provide sufficient basis upon which to infer vulnerability to capture in NEFSC research gear. More information is available on the Internet at: *www.nmfs.noaa.gov/pr/interactions/lof/.*

TABLE 8—U.S. COMMERCIAL FISHERIES INTERACTIONS FOR PELAGIC AND BOTTOM TRAWL GEAR FOR RELEVANT SPECIES

Species [1]	Pelagic trawl [2]	Location/Fishery [3]	Vulnerability inferred? [4]	Bottom trawl [2]	Location/fishery [3]	Vulnerability inferred? [4]
Humpback whale	Y	AK BSAI pollock trawl (1).	N	N	AK/BSAI flatfish trawl (0.2), BSAI pollock trawl (0.2).	N.
North Atlantic right whale	N	n/a	N	N	n/a	N.
Minke whale [5]	N	n/a	N	Y	NE bottom trawl (1.8)	Y.
Sei whale	N	n/a	N	N	n/a	N.
Blue whale	N	n/a	N	N	n/a	N.
Fin whale	N	n/a	N	N	n/a	N.
Sperm whale	N	n/a	n/a	N	n/a	n/a.
Kogia spp.	N	n/a	n/a	N	n/a	n/a.
Cuvier's beaked whale	N	n/a	n/a	N	n/a	n/a.
Mesoplodon spp.	N	n/a	n/a	N	n/a	n/a.
Delphinis spp.	Y	MA midwater trawl (3.2), NE mid-water trawl (0).	Y	Y	MA bottom trawl (19)	Y.
Common bottlenose dolphin	N	MA mid-water trawl (0).	N	Y	MA bottom trawl (20) NE bottom trawl (20)	Y.
Pygmy killer whale	N	n/a	n/a	N	n/a	n/a.
Short-finned pilot whale	Y	MA mid-water trawl (2.4) NE mid-water trawl (4).	N	Y	NE bottom trawl (29)	N.
Long-finned pilot whale	Y	MA mid-water trawl (2.4) NE mid-water trawl (4).	N	N	n/a	n/a.
Risso's dolphin	Y	MA mid-water trawl (0.2).	Y	Y	NE bottom trawl (2.5) MA bottom trawl (42)	Y.
Pantropical spotted dolphin	N	n/a	n/a	N	n/a	n/a.
Fraser's dolphin	N	n/a	n/a	N	n/a	n/a.
Atlantic white-sided dolphin	Y	MA mid-water trawl (6).	Y	Y	NE bottom trawl (73) MA bottom trawl (4)	Y.
White-beaked dolphin	N	n/a	N	Y	n/a	N.
Killer whale	N	n/a	n/a	N	BSAI flatfish trawl (0.4), BSAI rockfish trawl (0.2).	N.
Melon-headed whale	N	n/a	n/a	N	n/a	n/a.
Pantropical spotted dolphin	N	n/a	n/a	N	n/a	n/a.
Atlantic spotted dolphin	N	n/a	Y	N	n/a	n/a.
All other *Stenella* spp	N	n/a	n/a	N	n/a	n/a.
Rough-toothed dolphin	N	n/a	n/a	N	n/a	n/a.
Melon-headed whale	N	n/a	n/a	N	n/a	n/a.
Harbor porpoise	N	n/a	N	Y	NE bottom trawl (4.5) AK/BSAI flatfish trawl (0.36)	Y.
Hooded seal	N	n/a	n/a	N	n/a	n/a.
Gray seal	Y	MA mid-water trawl (0.2).	Y	Y	NE bottom trawl (9.2)	Y.
Harbor seal	Y	AK BSAI pollock trawl (0.3), NE midwater trawl (0.7).	Y	Y	AK/BSAI flatfish trawl (0.36) MA bottom trawl (0.2) NE bottom trawl (0.8)	Y.
Harp seal	N	MA mid-water trawl (0).	N	Y	NE bottom trawl (0.4)	N.

[1] Please refer to Table 3 for taxonomic reference.

[2] Indicates whether any member of the genus has documented incidental M/SI in a U.S. fishery using that gear in the most recent five-year timespan for which data is available.

[3] Values in parentheses represent the mean annual estimate of M/SI for that fishery in the most recent five-year timespan for which data is available (2007–11 in most cases). An interaction may be prorated if it is documented as an injury but the severity of the injury is unknown (*e.g.,* one entanglement may be estimated as 0.75 M/SI). Where there is less than one hundred percent observer coverage, documented M/SI is extrapolated to produce whole-fishery estimates. Associated CVs are not presented here; please refer to relevant SARs for more information. Some species have zero M/SI for 2007–11, but remain listed on that fishery's current list of marine mammal species/stocks injured/killed due to older interactions.

[4] Where there are no documented incidents of M/SI incidental to relevant commercial fisheries, this is not applicable.

[5] One minke whale was captured in a midwater trawl and released alive by NMFS' Northeast Fisheries Science Center in 2009. It was later determined that this capture constituted a serious injury.

TABLE 9—U.S. COMMERCIAL FISHERIES INTERACTIONS FOR LONGLINE GEAR FOR RELEVANT SPECIES

Species [1]	Longlines [2]	Location/Fishery [3]	Vulnerability inferred? [4]
Humpback whale	Y	HI shallow-set longline (0.75)	N.
North Atlantic right whale	N	n/a	n/a.
Minke whale	N	n/a	n/a.
Sei whale	N	n/a	n/a.
Blue whale	N	n/a	n/a.
Fin whale	N	n/a	n/a.
Sperm whale	Y	HI deep-set longline (3), ATL large pelagics longline (0).	N.
Kogia spp.	Y	HI shallow-set longline (0)	N.
Cuvier's beaked whale	Y	American Samoa longline (0), ATL large pelagics longline (0).	N.
Mesoplodon spp.	Y	HI shallow-set longline (1), ATL large pelagics longline (0).	N.
Delphinis spp.	Y	ATL large pelagics longline (1.7)	Y.
Common bottlenose dolphin	Y	HI deep-set longline (9), HI shallow-set longline (7), ATL large pelagics longline-WNA offshore (1.7).	Y.
Pygmy killer whale	N	n/a	n/a.
Short-finned pilot whale	Y	Hawaii-based deep-set longline fishery (1.0 outside EEZ, 0.1 in HI EEZ), Hawaii-based shallow-set longline fishery (0.1 outside EEZ, 0 in HI EEZ), ATL large pelagics longline (119).	N.
Long-finned pilot whale	N	n/a	n/a.
Risso's dolphin	Y	CA shallow set longline fishery (0), CA deep set longline fishery (0), Hawaii-based deep-set longline fishery (0.9 outside EEZ, 0.6 in HI EEZ), Hawaii-based shallow-set longline fishery (3.6 outside EEZ, 0 in HI EEZ), ATL large pelagics longline (10).	Y.
Pantropical spotted dolphin	Y	HI deep-set longline (0.6), HI, ATL large pelagics longline (0).	N.
Fraser's dolphin	N	ATL large pelagics longline (0)	N.
Atlantic white-sided dolphin	N	ATL large pelagics longline (0)	N.
Atlantic spotted dolphin	N	ATL large pelagics longline (0)	N.
White-beaked dolphin	N	n/a	n/a.
Killer whale	Y	BSAI Greenland turbot longline (0.3)	N.
Melon-headed whale	N	n/a	n/a.
Atlantic spotted dolphin	N	ATL large pelagics longline (0)	N.
All other *Stenella* spp.	N	n/a	n/a.
Rough-toothed dolphin	N	n/a	n/a.
Harbor porpoise			
Hooded seal	N	n/a	n/a.
Gray seal	N	n/a	n/a.
Harbor seal	N	n/a	n/a.
Harp seal	N	n/a	n/a.

[1] Please refer to Table 3 for taxonomic reference.
[2] Indicates whether any member of the genus has documented incidental M/SI in a U.S. fishery using that gear in the most recent five-year timespan for which data is available.
[3] Values in parentheses represent the mean annual estimate of M/SI for that fishery in the most recent five-year timespan for which data is available (2007–11 in most cases). An interaction may be prorated if it is documented as an injury but the severity of the injury is unknown (*e.g.,* one entanglement may be estimated as 0.75 M/SI). Where there is less than one hundred percent observer coverage, documented M/SI is extrapolated to produce whole-fishery estimates. Associated CVs are not presented here; please refer to relevant SARs for more information. Some species have zero M/SI for 2007–11, but remain listed on that fishery's current list of marine mammal species/stocks injured/killed due to older interactions.
[4] Where there are no documented incidents of M/SI incidental to relevant commercial fisheries, this is not applicable.

TABLE 10—U.S. COMMERCIAL FISHERIES INTERACTIONS FOR GILLNET GEAR FOR RELEVANT SPECIES

Species [1]	Gillnets [2]	Location/fishery [3]	Vulnerability inferred? [4]
Humpback whale	N	n/a	n/a.
North Atlantic right whale	N	n/a	n/a.
Minke whale	N	n/a	n/a.
Sei whale	N	n/a	n/a.
Blue whale	N	n/a	n/a.
Fin whale	N	n/a	n/a.
Sperm whale	N	n/a	n/a.
Kogia spp.	N	n/a	n/a.
Cuvier's beaked whale	N	n/a	n/a.
Mesoplodon spp.	N	n/a	n/a.
Delphinis spp.	Y	Northeast Sink Gillnet (41), MA Gillnet (12)	Y.

TABLE 10—U.S. COMMERCIAL FISHERIES INTERACTIONS FOR GILLNET GEAR FOR RELEVANT SPECIES—Continued

Species [1]	Gillnets [2]	Location/fishery [3]	Vulnerability inferred? [4]
Common bottlenose dolphin	Y	Commercial mid-Atlantic gillnet fisheries post BDTRP (6.02), Southeast Atlantic inshore gillnet fishery (0.2),.	Y.
Pygmy killer whale	N	n/a	n/a.
Short-finned pilot whale	Y	CA/OR thresher shark/swordfish drift gillnet fishery (0), Northeast Sink Gillnet (1).	N.
Long-finned pilot whale	Y	Northeast Sink Gillnet (1)	N.
Risso's dolphin	Y	CA/OR thresher shark/swordfish drift gillnet fishery (7) CA/OR/WA, Mid-Atlantic Gillnet (6.8).	Y.
Pantropical spotted dolphin	N	n/a	N.
Fraser's dolphin	N	n/a	n/a.
Atlantic white-sided dolphin	Y	Northeast Sink Gillnet (33), MA Gillnet (0).	
White-beaked dolphin	N	n/a	N
Killer whale	N	n/a	N.
Melon-headed whale	N	n/a	n/a.
Atlantic spotted dolphin	N	n/a	n/a.
All other *Stenella* spp.	N	n/a	n/a.
Rough-toothed dolphin	N	n/a	n/a.
Harbor porpoise	Y	Northeast Sink Gillnet (462), Mid-Atlantic Gillnet (198), Yakutat salmon set gillnet (21.8), Kodiak Island set gillnet (35.8), Cook Inlet salmon set gillnet (0).	Y.
Hooded seal	Y	Northeast Sink Gillnet (25), Mid-Atlantic Gillnet (0)	Y.
Gray seal	Y	Northeast Sink Gillnet (1,043), Mid-Atlantic Gillnet (57).	Y.
Harbor seal	Y	Northeast Sink Gillnet (346), Mid-Atlantic Gillnet (49)	Y.
Harp seal	Y	Northeast Sink Gillnet (208), Mid-Atlantic Gillnet (63)	Y.

[1] Please refer to Table 3 for taxonomic reference.

[2] Indicates whether any member of the genus has documented incidental M/SI in a U.S. fishery using that gear in the most recent five-year timespan for which data is available.

[3] Values in parentheses represent the mean annual estimate of M/SI for that fishery in the most recent five-year timespan for which data is available (2007–11 in most cases). An interaction may be prorated if it is documented as an injury but the severity of the injury is unknown (*e.g.,* one entanglement may be estimated as 0.75 M/SI). Where there is less than one hundred percent observer coverage, documented M/SI is extrapolated to produce whole-fishery estimates. Associated CVs are not presented here; please refer to relevant SARs for more information. Some species have zero M/SI for 2007–11, but remain listed on that fishery's current list of marine mammal species/stocks injured/killed due to older interactions.

[4] Where there are no documented incidents of M/SI incidental to relevant commercial fisheries, this is not applicable.

Information related to incidental M/SI in relevant commercial fisheries is not, however, the sole determinant of whether it may be appropriate to authorize M/SI + Level A incidental to NEFSC survey operations. A number of factors (*e.g.,* species-specific knowledge regarding animal behavior, overall abundance in the geographic region, density relative to NEFSC survey effort, feeding ecology, propensity to travel in groups commonly associated with other species historically taken) were taken into account by the NEFSC to determine whether a species may have a similar vulnerability to certain types of gear as historically taken species. In some cases, we have determined that species without documented M/SI may nevertheless be vulnerable to capture in NEFSC research gear. Similarly, we have determined that some species groups with documented M/SI are not likely to be vulnerable to capture in NEFSC gear. In these instances, we provide further explanation later in this document. Those species with no records of historical interaction with NEFSC research gear and no documented M/SI in relevant commercial fisheries, and for which the NEFSC has not requested the authorization of incidental take, are not considered further in this section. The NEFSC believes generally that any sex or age class of those species for which take authorization is requested could be captured.

Non-historical interactions—In addition to those species the NEFSC has directly interacted with research fishing gear over the 11-year period (2004–2015), the NEFSC believes 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 ''reference'' species taken in the past. The NEFSC believes 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 11 years.

We note that prior takes in the cooperative research fishery are assigned to the respective fishery; therefore the NEFSC did not consider those types of take in formulating the requested authorization. The NEFSC only estimated takes for NEFSC gear that: (1) Had a prior take in the historical record, or (2) by analogy to commercial fishing gear. Further, given the rare events of M/SI in NEFSC fishery research, the NEFSC binned gear into categories (*e.g.,* trawls) rather than partitioning take by gear, as it would result in estimated takes that far exceed the recorded take history.

Vulnerability of analogous species to different gear types is informed by the record of interactions by the analogous and reference species with commercial fisheries using gear types similar to those used in research. Furthermore, when determining the amount of take requested, we make a distinction between analogous species thought to have the same vulnerability for incidental take as the reference species and those analogous species that may have a similar vulnerability. In those cases thought to have the same vulnerability, the request is for the same number per year as the reference species. In those cases thought to have similar vulnerability, the request is less than the reference species. For example, the NEFSC believes the vulnerability of harbor seals to be taken in gillnets is the same as for gray seals (one per year) and thus requests one harbor seal per year (total of 5 over the authorization period). Alternatively, the potential for take of Atlantic white-sided dolphins in gillnets is expected to be similar to harbor porpoise (one per year) and the reduced request relative to this reference species is one Atlantic white sided dolphin over the entire five-year authorization period.

The approach outlined here reflects: (1) Concern that some species with which we have not had historical interactions may interact with these gears, (2) acknowledgment of variation between sets, and (3) understanding that many marine mammals are not solitary so if a set results in take, the take could be greater than one animal. In these particular instances, the NEFSC estimates the take of these species to be equal to the maximum interactions per any given set of a reference species historically taken during 2004–2015.

Trawls—To estimate the requested taking of analogous species, the NEFSC identified several species in the western North Atlantic Ocean which may have similar vulnerability to research-based trawls as the short-beaked common dolphin. The maximum take of short-beaked common dolphin was two individuals in one trawl set in 2004. Therefore, on the basis of similar vulnerability, the NEFSC estimates two potential takes over the five year authorization period for each of the following species in trawls: Risso's dolphin, common bottlenose dolphin (offshore and both northern and southern coastal migratory stocks), Atlantic-white-sided dolphin, white-beaked dolphin, Atlantic spotted dolphin, and harbor porpoise. For these species, we propose to authorize a total taking by M/SI + Level A of two individuals over the five-year timespan (see Table 11).

Other dolphin species may have similar vulnerabilities as those listed above but because of the timing and location of NEFSC research activities, the NEFSC concluded that the likelihood for take of these species was low (see Tables 8, 9, and 10). Those species include: Pantropical spotted dolphin, striped dolphin, Fraser's dolphin, rough-toothed dolphin, Clymene dolphin, and spinner dolphin.

Two pinniped species may be taken in commercial fisheries analogous to NEFSC research trawl activities. In general, the NEFSC deems these species as less susceptible to incidental take in NEFSC trawl activities due to the seasonal timing and low frequency of this research as well as the higher distribution of the pinniped species near shore when compared to the more offshore distribution of NEFSC trawl activities. Therefore, NEFSC requests one potential take each of gray and harbor seals in trawls over the LOA authorization period. For these pinniped species, we propose to authorize a total taking by M/SI + Level A of one individual over the five-year timespan (see Table 11).

Gillnets—To estimate the requested take of analogous species for gillnets, the NEFSC identified several species in the western North Atlantic Ocean which may have similar vulnerability to research-based gillnet surveys as the short-beaked common dolphin—due to similar behaviors and distributions in the survey areas.

Gillnet surveys typically occur nearshore in bays and estuaries. One gray seal and one harbor porpoise were caught during a Northeast Fisheries Observer Program training gillnet survey. The NEFSC believes that harbor seals have the same vulnerability to be taken in gillnets as gray seals and therefore estimates five takes of harbor seals in gillnets over the five-year authorization period. For this species, we propose to authorize a total taking by M/SI + Level A of five individuals over the five-year timespan (see Table 11).

Likewise, the NEFSC believes that Atlantic white-sided dolphins and short-beaked common dolphins have a similar vulnerability to be taken in gillnets as harbor porpoise and bottlenose dolphins (Waring *et al.,* 2014) and estimates one take each of Atlantic white-sided dolphin and short-beaked common dolphin in gillnet gear over the five-year authorization period. For this species, we propose to authorize a total taking by M/SI + Level A of one individual over the five-year timespan (see Table 11).

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 in these surveys. The NEFSC is not requesting any bottlenose dolphin takes from the Northern South Carolina Estuarine System stock. Further, because of limited survey effort in estuarine waters, the NEFSC considers there to be a remote chance of incidentally taking a bottlenose dolphin from the estuarine stocks. Thus, the NEFSC is not requesting take for the estuarine stocks of bottlenose dolphins for the COASTPAN longline and gillnet surveys. However, in the future, if there is a bottlenose dolphin take from the estuarine stocks as confirmed by genetic sampling, the NEFSC will reconsider its take request in consultation and coordination with the NMFS Office of Protected Resources and the Atlantic Bottlenose Dolphin Take Reduction Team.

Fyke nets—For fyke nets, the NEFSC believes that gray seals have a similar vulnerability for incidental take as harbor seals which interacted once in a single fyke net set during the past 11 years. For the period of this authorization, the NEFSC estimates one take by fyke net for gray seals over the five-year authorization period. Thus, for gray seals, we propose to authorize a total taking by M/SI + Level A of one individual over the five-year timespan (see Table 11).

Longlines—While the NEFSC has not historically interacted with large whales or other cetaceans in its longline gear, it is well documented that some of these species are taken in commercial longline fisheries. The 2015 List of Fisheries classifies commercial fisheries based on prior interactions with marine mammals. Although the NEFSC used this information to help make an informed decision on the probability of specific cetacean and large whale interactions with longline gear, many other factors were also taken into account (*e.g.,* relative survey effort, survey location, similarity in gear type, animal behavior, prior history of NEFSC interactions with longline gear, *etc.*). Therefore, there are several species that have been shown to interact with commercial longline fisheries but for which the NEFSC is not requesting take. For example, the NEFSC is not requesting take of large whales, long-finned pilot whales, and short-finned pilot whales in longline gear. Although these species could become entangled in longline gear, the probability of interaction with NEFSC longline gear is extremely low considering a low level of survey effort relative to that of commercial fisheries, the short length of the mainline, and low numbers of hooks used. Based on the amount of fish caught by commercial fisheries versus NEFSC fisheries research, the "footprint" of research effort compared to commercial fisheries is very small. The NEFSC considered previously caught species (as outlined in the 2015 List of Fisheries, see Tables 8, 9, and 10) in analogous commercial fisheries to have a higher probability of take; however, all were not included for potential take by the NEFSC. Additionally, marine mammals have never been caught or entangled in NEFSC longline gear; if interactions occur marine mammals depredate caught fish from the gear but leave the hooks attached and unaltered. They have never been hooked nor had hooks taken off gear during depredation. However, such gear could be considered analogous to potential commercial longline surveys that may be conducted elsewhere (*e.g.,* Garrison, 2007; Roche *et al.* 2007; Straley *et al.,* 2014). Given the potential for interactions, NEFSC estimates one take over the five-year authorization period of the following cetaceans in longline gear: Risso's dolphin, common bottlenose dolphin (offshore and both northern and southern coastal migratory stocks), and short-beaked common dolphins. For these species, we propose to authorize a total taking by M/SI + Level A of one individual over the five-year timespan (see Table 11).

It is also possible that researchers may not be able to identify a captured animal to the species level with certainty. Certain pinnipeds and small cetaceans are difficult to differentiate at sea, especially in low-light situations or when a quick release is necessary. For example, a captured delphinid that is struggling in the net may escape or be freed before positive identification is made. Therefore, the NEFSC has requested the authorization of incidental M/SI + Level A for an unidentified delphinid by trawl (1 individual), gillnet (1 individual), and longline (1 individual) gears over the course of the five-year period of the proposed authorization. Similarly, the NEFSC has requested the authorization of incidental M/SI + Level A for an unidentified pinniped by fyke net (1 individual), gillnet (1 individual), and longline (1 individual) gears.

TABLE 11—TOTAL ESTIMATED M/SI + LEVEL A DUE TO GEAR INTERACTION IN THE ATLANTIC COAST REGION, 2015–2020

Species	Est. 5-year total, trawl [1]	Est. 5-year total, gillnet [1]	Est. 5-year total, longline [1]	Est. 5-year total, fyke net [1]	Total, all gears
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 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 (WNA offshore stock) [2]	2	5	1	0	8
Common bottlenose dolphin (WNA N. Migratory stock) [2]	2	5	1	0	8
Common bottlenose dolphin (WNA S. Migratory stock) [2]	2	5	1	0	8
Harbor porpoise	2	5	0	0	7
Unidentified delphinid	1	1	1	0	3
Harbor seal	1	5	0	5	11
Gray seal	1	5	0	1	7
Unidentified pinniped	0	1	1	1	3

[1] Please see preceding text for derivation of take estimates.
[2] The NEFSC is not requesting takes for the estuarine stocks of bottlenose dolphins for the COASTPAN longline and gillnet surveys.

Estimated Take Due to Acoustic Harassment

As described previously (''Potential Effects of the Specified Activity on Marine Mammals''), we believe that NEFSC's use of active acoustic sources has, at most, the potential to cause Level B harassment of marine mammals. In order to attempt to quantify the potential for Level B harassment to occur, NMFS (including the NEFSC and acoustics experts from other parts of NMFS) developed an analytical framework considering characteristics of the active acoustic systems described previously under ''Description of Active Acoustic Sound Sources,'' their expected patterns of use in the NEFSC operational areas in the Atlantic coast region, and characteristics of the marine mammal species that may interact with them. We believe that this quantitative assessment benefits from its simplicity and consistency with current NMFS acoustic guidance regarding Level B harassment but caution that, based on a number of deliberately precautionary assumptions, the resulting take estimates should be seen as a likely substantial overestimate of the potential for behavioral harassment to occur as a result of the operation of these systems. Additional details on the approach used and the assumptions made that result in conservative estimates are described later.

The assessment paradigm for active acoustic sources used in NEFSC fisheries research is relatively straightforward and has a number of key simplifying assumptions. NMFS' current acoustic guidance requires in most cases that we assume Level B harassment occurs when a marine mammal receives an acoustic signal at or above a simple step-function threshold. For use of these active acoustic systems, the current threshold is 160 dB re 1 μPa (rms) for Level B harassment. Estimating the number of exposures at the 160-dB received level requires several determinations, each of which is described sequentially here:

(1) A detailed characterization of the acoustic characteristics of the effective sound source or sources in operation;

(2) The operational areas exposed to levels at or above those associated with Level B harassment when these sources are in operation;

(3) A method for quantifying the resulting sound fields around these sources; and

(4) An estimate of the average density for marine mammal species in each area of operation.

Quantifying the spatial and temporal dimension of the sound exposure footprint (or ''swath width'') of the active acoustic devices in operation on moving vessels and their relationship to the average density of marine mammals enables a quantitative estimate of the number of individuals for which sound levels exceed the relevant threshold for each area. The number of potential incidents of Level B harassment is ultimately estimated as the product of the volume of water ensonified at 160 dB rms or higher and the volumetric density of animals determined from simple assumptions about their vertical stratification in the water column. Specifically, reasonable assumptions based on what is known about diving behavior across different marine mammal species were made to segregate those that predominately remain in the upper 200 m of the water column versus those that regularly dive deeper during foraging and transit. We describe the methods for estimating each of these calculations in greater detail in the following sections, along with the simplifying assumptions made, and followed by the take estimates for the proposed research surveys in the Atlantic coast region.

Sound source characteristics—The NEFSC conducted an initial characterization of the general source parameters for the primary active acoustic sources during survey operations, thus, enabling a full assessment of all sound sources used by the NEFSC and delineation of Category 1 and Category 2 sources (see Table 2) the latter of which are carried forward for additional analyses presented here. This auditing of the active acoustic sources also enabled a determination of the predominant sources that, when operated, would have sound footprints exceeding those from any other simultaneously used sources. These sources were effectively those used directly in acoustic propagation modeling to estimate the zones within which the 160 dB rms received level would occur.

Many of these sources can be operated in different modes and with different output parameters. In modeling their potential impact areas, those features among those given previously in Table 2 (*e.g.,* lowest operating frequency) that would lead to the most precautionary estimate of maximum received level ranges (*i.e.,* largest ensonified area) were used. The effective beam patterns took into account the normal modes in which these sources are typically operated. While these signals are brief and intermittent, a conservative assumption was taken in ignoring the temporal pattern of transmitted pulses in calculating Level B harassment events. Operating characteristics of each of the predominant sound sources were used in the calculation of effective line-kilometers and area of exposure for each source in each survey.

Among the eight Category 2 sources identified in Table 2, the NEFSC identified six predominant sources (Table 12) as having the largest potential impact zones during operations, based on their relatively lower output frequency, higher output power, and their operational pattern of use.

TABLE 12—EFFECTIVE EXPOSURE AREAS FOR PREDOMINANT ACOUSTIC SOURCES ACROSS TWO DEPTH STRATA

Active acoustic system	Effective exposure area: sea surface to 200 m depth (km²)	Effective exposure area: sea surface to depth at which 160-dB threshold is reached (km²)
Simrad EK60 (surrogate for ES60) narrow beam echosounder	0.0142	0.1411
Simrad ME70 multibeam echosounder	0.0201	0.0201
Teledyne RD Instruments ADCP, Ocean Surveyor	0.0144	0.0303
Raymarine SS260 transducer for DSM300 (surrogate for FCV–292)	0.0004	0.0004
Simrad EQ50	0.0142	0.1411
NetMind	0.0201	0.0201

The NEFSC estimated the effective cross-sectional areas of exposure for each of the six predominant sources using a commercial software package (MATLAB) and key input parameters including source-specific operational characteristics (*i.e.,* frequency, beamwidth, source level, tilt angle, and horizontal and vertical resolution; see Table 2) and environmental characteristics (*i.e.,* depth for attenuation coefficient, temperature, salinity, pH, and latitude). Where relevant, the NEFSC performed calculations for different notional operational scenarios, and the largest cross-sectional area used in estimating take. For example, the EK60 cross-sectional area was calculated for (a) a simple cone at 3 dB points; (b) a rectangle derived from strip width times depth; and (c) integration of the nominal beam pattern, which assumes side lobes of ensonification (and which is displayed in Figure 6–2 of the NEFSC's PEA).

Calculating effective line-kilometers—In determining the effective line-kilometers for each of these predominant sources, the operational patterns of use relative to one another were further applied to determine which source was the predominant one operating at any point in time for each survey. When multiple sound sources are used simultaneously, the one with the largest potential impact zone in each relevant depth strata is considered for use in estimating exposures. For example, when species (*e.g.,* sperm whales) regularly dive deeper than 200 m, the largest potential impact zone was calculated for both depth strata and in some cases resulted in a different source being predominant in one depth stratum or the other. This enabled a more comprehensive way of accounting for maximum exposures for animals diving in a complex sound field resulting from simultaneous sources with different spatial profiles. This overall process effectively resulted in three sound sources (*i.e.,* the EK60, ME70, and DSM300) comprising the total effective line-kilometers, their relative proportions depending on the nature of each survey in each region.

Based on the operating parameters for each source type, the NEFSC determined an estimated volume of water ensonified at or above the 160 dB rms threshold. In all cases where multiple sources are operated simultaneously, the one with the largest estimated acoustic footprint was considered to be the effective source. This was calculated for each depth stratum (0–200 m and > 200m), where appropriate (*i.e.* in the Atlantic coast 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, this resulted in different sources being 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). For each ecosystem area, the total number of line km that would be surveyed was determined, as was the relative percentage of surveyed linear km associated with each source type. The total line-kilometers for each vessel, the effective percentages associated with each of the resulting three predominant source types (EK60, ME70, and DSM300), and the effective total line-kilometers of operation for each source type follow in Tables 13, 14, and 15.

TABLE 13—ANNUAL LINEAR SURVEY km FOR EACH VESSEL TYPE AND ITS PREDOMINANT SOURCES WITHIN THE 0–200 m DEPTH STRATUM FOR THE ATLANTIC COAST REGION

Vessel	Survey(s)	Line km/ vessel	Source	Overall % source usage	% Time source dominant (0–200 m)	Line km/ dominant source (0–200 m)
R/V *H.B. Bigelow*	BTS, Spring ECOMon	27303	ES60	100	5	1365.15
			ME70	100		
			ADCP	95	95	25937.85
			Doppler Spd log	95		
			Doppler Spd log	25		
	Marine mammal Pop-up retrieval.	913 <200 m	EK60	2	2	18.26
	Marine mammal abundance	1700	EK60	50	50	850
R/V*G. Michelle*	Mass DMF Inshore Spring & Fall Bottom Trawl Survey.	8000	DSM300	100	100	8000
R/V *Pisces*	Gulf of Maine Northern Shrimp Survey.	6000	DSM300	100	100	6000
	Pelagics	4773	EK60	100	5	238.65
			ES60	100		
			ME70	95	95	4534.35
			ADCP	95		
			Doppler Spd log	25		
	Atlantic Herring	8300	EK60	100	25	2075
			ME70	75	75	6225
			ADCP	100		
R/V *G. Gunter*	LMRCSC	2880	EK60	100	100	2880
			Simrad EQ50	100		
	Pelagics	9500	EK60	100	100	9500
			Simrad EQ50	100		

TABLE 14—ANNUAL LINEAR SURVEY km FOR EACH VESSEL TYPE AND ITS PREDOMINANT SOURCES WITHIN THE TWO DEPTH STRATA FOR THE OFFSHORE (>200 m WATER DEPTH) HABITAT

Vessel	Survey(s)	Line km/ vessel	Source	Overall % source usage	% Time source dominant (0–200 m)	% Time source dominant (>200 m)	Line km/ dominant source (0–200 m)	Line km/ dominant source (>200 m)
R/V *H.B. Bigelow*	Deepwater corals/ habitat.	4808	EK60	100	5	100	240.4	4808
			ES60	100				
			ME70	95	95	0	4567.6	
			ADCP	95				
			Doppler Spd log.	25				
	Marine Mammal Abundance.	3359	EK60	50	50	50	1679.5	1679.5
R/V *Pisces*	Deepwater Biodiversity.	2328	EK60	100	75	100	1746	2328
			ES60	5				
			ME70	25	25	0	582	
			ADCP	100				
			Doppler Spd log.	100				

TABLE 15—EFFECTIVE TOTAL ANNUAL SURVEY KILOMETERS FOR WHICH EACH SOURCE TYPE IS THE PREDOMINANT ACOUSTIC SOURCE WITHIN TWO DEPTH STRATA

Source	Summed line km/ source (0–200 m)	Summed line km/ source (>200 m)	Summed dominant source % of total line km (0–200 m)	Summed dominant source % of total line km (>200 m)
Atlantic Coast Region				
EK60	16927	NA	25	NA
ME70	36697	NA	54	NA
DSM300	14000	NA	21	NA
Offshore Region				
EK60	3666	8816	42	100
ME70	5150	0	58	0

Calculating volume of water ensonified—The cross-sectional area of water ensonified at or above the 160 dB rms threshold was calculated using a simple model of sound propagation loss, which accounts for the loss of sound energy over increasing range. The NEFSC used a spherical spreading model (where propagation loss = 20 * log [range]; such that there would be 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), a reasonable approximation over the relatively short ranges involved, and accounted for the frequency-dependent absorption coefficient and beam pattern of these sound sources, which is generally highly directional. The lowest frequency was used for systems that are operated over a range of frequencies. The vertical extent of this area is calculated for two depth strata (0–200 m and surface to range at which the on-axis received level reaches 160 dB rms). A simple visualization of a two-dimensional slice of modeled sound propagation is shown in Figure 6–2 of NEFSC's application to illustrate the predicted area ensonified to the 160-dB threshold by an EK60 operated at 18 kHz. The NEFSC differentially applied these results based on the typical vertical stratification of marine mammals.

Following the determination of effective sound exposure area for transmissions considered in two dimensions, the next step was to determine the effective volume of water ensonified at or above 160 dB rms for the entirety of each survey in each region. For each of the three predominant sound sources, the volume of water ensonified is estimated as the athwartship cross-sectional area (in square kilometers) of sound at or above 160 dB rms (as illustrated in Figure 6–2 of the NEFSC's application) multiplied by the total distance traveled by the ship.

Where different sources operating simultaneously would be predominant in each different depth strata (*e.g.,* ME70 and EK60 operating simultaneously may be predominant in the shallow stratum and deep stratum, respectively), the resulting cross-sectional area calculated took this into account. Specifically, for shallow-diving species this cross-sectional area was determined for whichever was predominant in the shallow stratum, whereas for deeper-diving species this area was calculated from the combined effects of the predominant source in the shallow stratum and the (sometimes different) source predominating in the deep stratum. This creates an effective total volume characterizing the area ensonified when each predominant source is operated and accounts for the fact that deeper-diving species may encounter a complex sound field in different portions of the water column.

Marine mammal densities—One of the primary limitations to traditional estimates of behavioral harassment from acoustic exposure is the assumption that animals are uniformly distributed in time and space across very large geographical areas, such as those being considered here. There is ample evidence that this is in fact not the case and marine species are highly heterogeneous in terms of their spatial distribution, largely as a result of species-typical utilization of heterogeneous ecosystem features. Some more sophisticated modeling efforts have attempted to include species-typical behavioral patterns and diving parameters in movement models that more adequately assess the spatial and temporal aspects of distribution and thus exposure to sound (*e.g.,* Navy, 2013). While simulated movement models were not used to mimic individual diving or aggregation parameters in the determination of animal density in this estimation, the vertical stratification of marine mammals based on known or reasonably assumed diving behavior was integrated into the density estimates used.

First, typical two-dimensional marine mammal density estimates (animals/km^2) were obtained from various sources for each ecosystem area. These were estimated from marine mammal Stock Assessment Reports for the western North Atlantic (Waring *et al.,* 2011, 2012, 2013, 2014). However, there are a number of caveats associated with these estimates:

(1) They are often calculated using visual sighting data collected during one season rather than throughout the year. The time of year when data were collected and from which densities were estimated may not always overlap with the timing of NEFSC fisheries surveys (detailed previously in ''Detailed Description of Activities'').

(2) The densities used for purposes of estimating acoustic exposures do not take into account the patchy distributions of marine mammals in an ecosystem, at least on the moderate to fine scales over which they are known to occur. Instead, animals are considered evenly distributed throughout the assessed area and seasonal movement patterns are not taken into account.

In addition, and to account for at least some coarse differences in marine mammal diving behavior and the effect this has on their likely exposure to these kinds of often highly directional sound sources, a volumetric density of marine mammals of each species was determined. This value is estimated as the abundance averaged over the two-dimensional geographic area of the surveys and the vertical range of typical habitat for the population. Habitat ranges were categorized in two generalized depth strata (0–200 m and 0 to greater than 200 m) based on gross differences between known generally surface-associated and typically deep-diving marine mammals (*e.g.,* Reynolds and Rommel, 1999; Perrin *et al.,* 2009). Animals in the shallow-diving stratum were assumed, on the basis of empirical measurements of diving with monitoring tags and reasonable assumptions of behavior based on other indicators, to spend a large majority of their lives (*i.e.,* greater than 75 percent) at depths shallower than 200 m. Their volumetric density and thus exposure to sound is therefore limited by this depth boundary. In contrast, species in the deeper-diving stratum were assumed to regularly dive deeper than 200 m and spend significant time at these greater depths. Their volumetric density and thus potential exposure to sound at or above the 160 dB rms threshold is extended from the surface to the depth at which this received level condition occurs (*e.g.,* the Atlantic coast region was generally considered to be comprised of water no deeper than 200 m).

The volumetric densities are estimates of the three-dimensional distribution of animals in their typical depth strata. For shallow-diving species the volumetric density is the area density divided by 0.2 km (*i.e.,* 200 m). For deeper diving species, the volumetric density is the area density divided by a nominal value of 0.5 km (*i.e.,* 500 m), or the depth of the region of interest (*e.g.,* in the LME area density for deep diving species was divided by 0.2km to reflect the depth of the region). Table 17 shows the two-dimensional and resulting three-dimensional (volumetric) densities for each species in the Atlantic coast region and adjacent offshore waters.

TABLE 16—VOLUMETRIC DENSITIES FOR EACH SPECIES IN THE ATLANTIC COAST REGION AND ADJACENT OFFSHORE WATERS

Species	Typical depth strata		Atlantic coast region density (#/km^2)	Offshore area density (#/km^2)	Atlantic coast region volumetric density (#/km^3)	Offshore area volumetric density (#/km^3)
	0–200 m	>200 m (deep divers)				
Cetaceans						
North Atlantic right whale	X	....	0.0018	0	0.00900	0.00000
Humpback whale	X	....	0.0009	0.0006	0.00450	0.00300
Fin whale	X	....	0.0036	0.0007	0.01800	0.00350
Sei whale	X	....	0.0027	0.00004	0.01350	0.00020
Minke whale	X	....	0.0066	0	0.03300	0.00000
Blue whale	X	....	0	0.0026	0.00000	0.01300
Sperm whale	....	X	0.00001	0.0152	0.00005	0.03040
Dwarf sperm whale	....	X	0.00002	0.002	0.00010	0.00400
Pygmy sperm whale	....	X	0.00002	0.002	0.00010	0.00400
Killer Whale	X	....	....	....	....	....
Pygmy killer whale	X	....	....	....	....	....
Northern bottle-nose whale	....	X	0	0.0017	0.00000	0.00340
Cuvier's beaked whale	....	X	0.0021	0.0156	0.01050	0.03120
Mesoplodon beaked whales	....	X	0.0021	0.0156	0.01050	0.03120
Melon-headed whale	X	....	....	....	0.00000	0.00000
Risso's dolphin	X	....	0.0022	0.0844	0.01100	0.42200
Long-finned pilot whale	....	X	0.0345	0.0256	0.17250	0.05120
Short-finned pilot whale	....	X	0.0345	0.0256	0.17250	0.05120
Atlantic white-sided dolphin	X	....	0.0244	0	0.12200	0.00000
White-beaked dolphin	X	....	0.0081	0	0.04050	0.00000
Short-beaked common dolphin	X	....	0.2115	0.1875	1.05750	0.93750
Atlantic spotted dolphin	X	....	0	0.0208	0.00000	0.10400
Pantropical spotted dolphin	X	....	....	....	....	....
Striped dolphin	X	....	0	0.3028	0.00000	1.51400
Fraser's dolphin	X	....	....	....	....	....
Rough toothed dolphin	X	....	0	0.0016	0.00000	0.00800
Clymene dolphin	X	....	....	....	....	....
Spinner dolphin	....	X	....	....	....	....
Common bottle-nose dophin (offshore)	X	....	0.0060	0.0526	0.03000	0.26300
Common bottle-nose dolphin (coastal)	X	....	0.1033	0	0.51650	0.00000
Harbor Porpoise	X	....	0.0193	0	0.09650	0.00000
Pinnipeds						
Harbor Seal	X	....	0.2844	....	1.42200	0.00000
Gray Seal	X	....	....	....	....	....
Harp Seal	X	....	....	....	....	....
Hooded Seal	X	....	....	....	....	....

Using area of ensonification and volumetric density to estimate exposures—Estimates of potential incidents of Level B harassment (*i.e.,* potential exposure to levels of sound at or exceeding the 160 dB rms threshold) are then calculated for the Atlantic coast region and adjacent offshore areas by using: (1) The combined results from output characteristics of each source and identification of the predominant sources in terms of acoustic output (Tables 2 and 12); (2) their relative annual usage patterns for each depth stratum (Tables 13, 14, and 15); (3) a source-specific determination made of the area of water associated with received sounds at either the extent of a depth boundary or the 160 dB rms received sound level; and (4) determination of a biologically-relevant volumetric density of marine mammal species in each area (Table 16).

Estimates of Level B harassment by acoustic sources are the product of the volume of water ensonified at 160 dB rms or higher for the predominant sound source for each portion of the total line-kilometers for which it is used and the volumetric density of animals for each species. We will present the annual take estimates later in this document.

For each species and sound source, the cross sectional area for the relevant depth strata (Tables 13, 14, and 15) was multiplied by the effective line km for each respective depth strata for the relevant survey area and the volumetric density to estimate Level B harassment.

To illustrate the process, we focus on the EK60 and the North Atlantic right whale.

(1) EK60 ensonified volume; 0–200 m: 0.0142 km^2 * 16,927 km = 240.36 km^3

(2) Estimated exposures to sound ≥ 160 dB rms; North Atlantic right whale; EK60: (0.009 North Atlantic right whales/km^3 * 240.36 km^3 = 2.1 [rounded to 2]) = 2 estimated North Atlantic right whale exposures to SPLs ≥ 160 dB rms resulting from use of the EK60 in the 0–200 m depth stratum.

TABLE 17—DENSITIES AND ESTIMATED SOURCE-, STRATUM-, AND SPECIES-SPECIFIC ANNUAL ESTIMATES OF LEVEL B HARASSMENT IN THE ATLANTIC COAST REGION AND ADJACENT OFFSHORE WATERS

Species	Volumetric density (#/km^3)	Estimated Level B harassment (#s of animals) in 0–200m depth stratum			Estimated Level B harassment in >200m depth stratum	Total
		EK60	ME70	DSM300	EK60	
Atlantic Coast Region Cetaceans						
North Atlantic right whale	0.009	2	7	2	NA	11
Humpback whale	0.0045	1	3	1	NA	5
Fin whale	0.018	4	13	4	NA	21
Sei whale	0.0135	3	10	3	NA	16
Minke whale	0.033	8	24	7	NA	39
Blue whale	0	0	0	0	NA	[1] 10
Sperm whale	0.00005	0	0	0	NA	[1] 10
Dwarf sperm whale	0.0001	0	0	0	NA	[1] 10
Pygmy sperm whale	0.0001	0	0	0	NA	[1] 10
Killer Whale	0	0	0	0	NA	[1] 10
Pygmy killer whale	0	0	0	0	NA	[1] 10
Northern bottlenose whale	0	0	0	0	NA	[1] 10
Cuvier's beaked whale	0.0105	3	8	2	NA	13
Mesoplodon beaked whales	0.0105	3	8	2	NA	13
Melon-headed whale	0	0	0	0	NA	[1] 10
Risso's dolphin	0.011	3	8	2	NA	13
Long-finned pilot whale	0.1725	41	127	35	NA	203
Short-finned pilot whale	0.1725	41	127	35	NA	203
Atlantic white-sided dolphin	0.122	29	90	25	NA	144
White-beaked dolphin	0.0405	10	30	8	NA	48
Short-beaked common dolphin	1.0575	254	780	213	NA	1247
Atlantic spotted dolphin	0	0	0	0	NA	[1] 10
Pantropical spotted dolphin	0	0	0	0	NA	[1] 10
Striped dolphin	0	0	0	0	NA	[1] 10
Fraser's dolphin	0	0	0	0	NA	[1] 10
Rough toothed dolphin	0	0	0	0	NA	[1] 10
Clymene dolphin	0	0	0	0	NA	[1] 10
Spinner dolphin	0	0	0	0	NA	[1] 10
Common bottlenose dolphin (offshore)	0.0300	7	22	6	NA	35
Common bottlenose dolphin (coastal)	0.5165	124	381	104	NA	609
Harbor Porpoise	0.0965	23	71	19	NA	113
Atlantic Coast Region Pinnipeds						
Harbor Seal	1.422	342	1049	287	NA	1678
Gray Seal	0.00000	0	0	0	NA	[1] 10
Harp Seal	0.00000	0	0	0	NA	[1] 10
Hooded Seal	0.00000	0	0	0	NA	[1] 10
Offshore Area Cetaceans						
North Atlantic right whale	0	0	0	0	0	[1] 10
Humpback whale	0.003	0	0	0	0	[1] 10
Fin whale	0.004	0	0	0	0	[1] 10
Sei whale	0.0002	0	0	0	0	[1] 10
Minke whale	0	0	0	0	0	[1] 10
Blue whale	0.013	1	1	0	0	2
Sperm whale	0.0304	2	3	0	14	19
Dwarf sperm whale	0.004	0	0	0	2	2
Pygmy sperm whale	0.004	0	0	0	2	2
Killer Whale	0	0	0	0	0	[1] 10
Pygmy killer whale	0	0	0	0	0	[1] 10
Northern bottlenose whale	0.0034	0	0	0	2	2
Cuvier's beaked whale	0.0312	2	3	....	15	20
Mesoplodon beaked whales	0.0312	2	3	0	15	20
Melon-headed whale	0	0	0	0	0	[1] 10
Risso's dolphin	0.422	22	44	0	0	66
Long-finned pilot whale	0.0512	3	5	0	24	32
Short-finned pilot whale	0.0512	3	5	0	24	32
Atlantic white-sided dolphin	0	0	0	0	0	[1] 10
White-beaked dolphin	0	0	0	0	0	[1] 10
Short-beaked common dolphin	0.9375	49	97	0	0	146
Atlantic spotted dolphin	0.104	5	11	0	0	16
Pantropical spotted dolphin	0	0	0	0	0	[1] 10

TABLE 17—DENSITIES AND ESTIMATED SOURCE-, STRATUM-, AND SPECIES-SPECIFIC ANNUAL ESTIMATES OF LEVEL B HARASSMENT IN THE ATLANTIC COAST REGION AND ADJACENT OFFSHORE WATERS—Continued

Species	Volumetric density (#/km^3)	Estimated Level B harassment (#s of animals) in 0–200m depth stratum			Estimated Level B harassment in >200m depth stratum	Total
		EK60	ME70	DSM300	EK60	
Striped dolphin	1.514	79	157	0	0	236
Fraser's dolphin	0	0	0	0	0	[1] 10
Rough toothed dolphin	0.008	0	1	0	0	1
Clymene dolphin	0	0	0	0	0	[1] 10
Spinner dolphin	0	0	0	0	0	[1] 10
Common bottlenose dolphin (offshore)	0.2630	14	27	0	0	41

[1] For all species with unknown or very low volumetric density, *i.e.,* ≤0.004 animals per km3, or for species unlikely to be impacted by the predominant acoustic sources outlined above, the NEFSC requested a precautionary Level B Harassment take of 10 individuals. The number chosen is indicative of the very low probability of sighting or interaction with these species during most research cruises with the active acoustic instruments used in NEFSC research.

Estimated Take Due to Physical Disturbance

Estimated take due to physical disturbance could potentially occur in the Penobscot River Estuary as a result of the unintentional approach of NEFSC vessels to pinnipeds hauled out on ledges. This would result in no greater than Level B harassment.

The NEFSC uses four gear types (fyke nets, beach seine, rotary screw traps, and Mamou shrimp trawl) to monitor fish communities in the Penobscot River Estuary. The NEFSC conducts the annual surveys over specific sampling periods which could use any gear type: Mamou trawling is conducted year-round; fyke net and beach seine surveys are conducted April–November, and rotary screw trap surveys from April–June.

We anticipate that trawl, fyke net, and beach seine surveys may disturb harbor seals and gray seals hauled out on tidal ledges. The NEFSC conducts these surveys in upper Penobscot Bay above Fort Point Ledge where there is only one minor seal ledge (Odum Ledge) used by approximately 50 harbor seals (*i.e.,* based on a June 2001 survey). Although one cannot assume that the number of seals using this region is stable over the April–November survey period; it is likely lower in spring and autumn.

There were no observations of gray seals in the 2001 survey, but recent anecdotal information suggests that a few gray seals may share the haulout site. These fisheries research activities do not entail intentional approaches to seals on ledges (*i.e.,* boats avoid close approach to tidal ledges and no gear is deployed near the tidal ledges), only behavioral disturbance incidental to small boat activities is anticipated. It is likely that some pinnipeds on the ledges would move or flush from the haul-out into the water in response to the presence or sound of NEFSC survey vessels. Behavioral responses may be considered according to the scale shown in Table 18. We consider responses corresponding to Levels 2–3 to constitute Level B harassment.

TABLE 18—SEAL RESPONSE TO DISTURBANCE

Level	Type of response	Definition
1	Alert	Head orientation in response to disturbance. This may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, or changing from a lying to a sitting position.
2	Movement	Movements away from the source of disturbance, ranging from short withdrawals over short distances to hurried retreats many meters in length.
3	Flight	All retreats (flushes) to the water or another group of seals.

The NEFSC estimated potential incidents of Level B harassment due to physical disturbance (Table 19) using the following assumptions: (1) All hauled out seals may be disturbed by passing research skiffs, although researchers have estimated that only about 10 percent (5 animals in a group of 50) have been visibly disturbed in the past; and (2) approximately 50 harbor seals and 20 gray seals may be disturbed by the passage of researchers for each survey effort (100 fyke net sets, 100 beach seine sets, and 200 Mamou shrimp trawls per year).

The resulting estimate (Table 20) is that 50 harbor seals and 20 gray seals may be disturbed (Level B harassment) by the physical presence of researchers in skiffs annually. The estimated total number of instances of harassment is approximately 20,000 for harbor seals and 8,000 for gray seals. However, this level of periodic and temporary disturbance is unlikely to affect the use of the haulout by either species.

TABLE 19—ESTIMATED ANNUAL LEVEL B HARASSMENT TAKE OF PINNIPEDS ASSOCIATED WITH SURVEYS IN THE LOWER ESTUARY OF THE PENOBSCOT RIVER

Species	Estimated seals on ledge haulout	Survey gear	Number of sets	Survey season	Estimated instances of harassment
Harbor seal	50	Fyke net	100	April–November	5,000
Gray seal	20				2,000
Harbor seal	50	Beach seine	100	April–November	5,000
Gray seal	20				2,000
Harbor seal	50	Mamou shrimp trawl	200	Year-round	10,000
Gray seal	20				4,000

Summary of Estimated Incidental Take

Here we provide summary tables detailing the total proposed incidental take authorization on an annual basis for the NEFSC in the Atlantic coast region, as well as other information relevant to the negligible impact analyses.

TABLE 20—SUMMARY INFORMATION RELATED TO PROPOSED ANNUAL TAKE AUTHORIZATION IN THE ATLANTIC COAST REGION, 2015–2020

Species [1]	Proposed total annual Level B harassment authorization	Percent of estimated population	Proposed total M/SI + Level A authorization 2015–2020	Estimated maximum annual M/SI + Level A [2]	PBR [3]	% PBR [4]	Stock trend [5]
North Atlantic Right whale	21	4.52	0	0	n/a		↑
Humpback whale	15	1.82	0	0	n/a		↑
Minke whale	49	0.02	5	1	162	0.62	?
Sei whale	26	7.28	0	0	n/a		?
Fin whale	31	1.92	0	0	n/a		?
Blue whale	12	2.73	0	0	n/a		?
Sperm whale	29	1.27	0	0	n/a		?
Kogia spp.	12	0.32	0	0	n/a		?
Cuvier's beaked whale	33	0.51	0	0	n/a		?
Mesoplodont beaked whales	33	0.47	0	0	n/a		
Bottlenose dolphin (WNA Offshore) [6].	76	0.10	[6] 11	2.2	561	0.39	?
Bottlenose dolphin (WNA, Northern Migratory Coastal) [6].	609	5.27	[6] 11	2.2	86	2.56	?
Bottlenose dolphin (WNA, Southern Migratory Coastal) [6].	609	6.64	[6] 11	2.2	63	3.49	?
Pantropical spotted dolphin	20	0.60	0	0	n/a		?
Atlantic spotted dolphin	26	0.06	3	0.6	316	0.19	?
Spinner dolphin	20	undet.	0	0	n/a		?
Striped dolphin	246	0.45	0	0	n/a		?
Short-beaked common dolphin	1,393	0.80	10	2	170	1.18	?
White-beaked dolphin	58	2.90	3	0.6	10	6.00	?
Atlantic white-sided-dolphin	154	0.32	5	1	304	0.33	?
Risso's dolphin	79	0.43	5	1	126	0.79	?
Fraser's dolphin	20	undet.	0	0	n/a		?
Clymene dolphin	20	0.33	0	0	n/a		?
Melon-headed whale	20	undet.	0	0	n/a		?
Pygmy killer whale	20	undet.	0	0	n/a		?
Long-finned pilot whale	235	0.89	0	0	n/a		?
Short-finned pilot whale	235	1.09	0	0	n/a		?
Harbor porpoise	113	0.14	7	1.4	706	0.20	?
Gray seal	10; 20 [7]	2.42	10	1.6	1,469	0.14	↑
Harp seal	10	0.0001	0	0	n/a		→↑
Harbor seal	1,768; 50 [7].	0.001	14	2.8	1,662	0.17	?
Unidentified delphinid				n/a	n/a		n/a
Unidentified pinniped				n/a	n/a		n/a

Please see preceding text for details.

[1] For species with multiple stocks in the Atlantic coast regions or for species groups (*Kogia spp.* and Mesoplodont beaked whales), indicated level of take could occur to individuals from any stock or species (not including coastal and estuarine stocks of bottlenose dolphins).

[2] This column represents the total number of incidents of M/SI + Level A that could potentially accrue to the specified species or stock and is the number carried forward for evaluation in the negligible impact analysis (later in this document). To reach this total, we add one to the total for each pinniped or delphinid that may be captured in longline or gillnet gear, one to the total for each delphinid that may be captured in trawl gear, and one pinniped that may be captured in fyke net gear. This represents the potential that the take of an unidentified pinniped or delphinid could accrue to any given stock captured in that gear. The proposed take authorization is formulated as a five-year total; the annual average is used only for purposes of negligible impact analysis. We recognize that portions of an animal may not be taken in a given year.

[3] See Table 3 and following discussion for more detail regarding PBR.

[4] Estimated maximum annual M/SI + Level A expressed as a percentage of PBR.

[5] See relevant SARs for more information regarding stock status and trends. Interannual increases may not be interpreted as evidence of a trend.

[6] For these stocks of bottlenose dolphins, the estimated annual maximum numbers of M/SI + Level A reflect the stock-specific trawl estimate (2), plus five for gillnet take, plus one for longline take, plus three for the potential take of one unidentified delphinid by trawl, gillnet, and longline.

[7] The first number represents estimated annual Level B take by acoustic sources. The second number represents estimated annual Level B take by the physical disturbance during surveys in Penobscot Bay.

Analyses and Preliminary Determinations

Here we provide negligible impact analyses and small numbers analyses for the Atlantic coast region for which we propose rulemaking. Unless otherwise specified, the discussion below is intended to apply to all of the species for which take is authorized, *i.e.,* those discussed previously and indicated in Table 20 given that the anticipated effects of these activities are expected to be similar in nature, and there is no information about the size, status, or structure of any species or stock that would lead to a different analysis. In some cases we add species-specific factors.

Negligible Impact Analyses

NMFS has defined ''negligible impact'' in 50 CFR 216.103 as ''. . . an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.'' A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' by mortality, serious injury, and Level A or Level B harassment, we consider other factors, such as the likely nature of any behavioral responses (*e.g.,* intensity, duration), the context of any such responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat. We also evaluate the number, intensity, and context of estimated takes by evaluating this information relative to population status. The impacts from other past and ongoing anthropogenic activities are incorporated into these analyses via their impacts on the environmental baseline (*e.g.,* as reflected in the density/distribution and status of the species, population size and growth rate).

In 1988, Congress amended the MMPA, with provisions for the incidental take of marine mammals in commercial fishing operations. Congress directed NMFS to develop and recommend a new long-term regime to govern such incidental taking (see MMC, 1994). The need to set allowable take levels incidental to commercial fishing operations led NMFS to suggest a new and simpler conceptual means for assuring that incidental take does not cause any marine mammal species or stock to be reduced or to be maintained below the lower limit of its Optimum Sustainable Population (OSP) level. That concept (PBR) was incorporated in the 1994 amendments to the MMPA, wherein Congress enacted MMPA sections 117 and 118, establishing a new regime governing the incidental taking of marine mammals in commercial fishing operations and stock assessments.

PBR, which is defined by the MMPA (16 U.S.C. 1362(20)) as ''the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population,'' is one tool that can be used to help evaluate the effects of M/SI on a marine mammal stock. OSP is defined by the MMPA (16 U.S.C. 1362(9)) as ''the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element.'' A primary goal of the MMPA is to ensure that each stock of marine mammal either does not have a level of human-caused M/SI that is likely to cause the stock to be reduced below its OSP level or, if the stock is depleted (*i.e.,* below its OSP level), does not have a level of human-caused mortality and serious injury that is likely to delay restoration of the stock to OSP level by more than ten percent in comparison with recovery time in the absence of human-caused M/SI.

PBR appears within the MMPA only in section 117 (relating to periodic stock assessments) and in portions of section 118 describing requirements for take reduction plans for reducing marine mammal bycatch in commercial fisheries. PBR was not designed as an absolute threshold limiting human activities, but as a means to evaluate the relative impacts of those activities on marine mammal stocks. Specifically, assessing M/SI relative to a stock's PBR may signal to NMFS the need to establish take reduction teams in commercial fisheries and may assist NMFS and existing take reduction teams in the identification of measures to reduce and/or minimize the taking of marine mammals by commercial fisheries to a level below a stock's PBR. That is, where the total annual human-caused M/SI exceeds PBR, NMFS is not required to halt fishing activities contributing to total M/SI but rather may prioritize working with a take reduction team to further mitigate the effects of fishery activities via additional bycatch reduction measures.

Since the introduction of PBR, NMFS has used the concept almost entirely within the context of implementing sections 117 and 118 and other commercial fisheries management-related provisions of the MMPA, including those within section 101(a)(5)(E) related to the taking of ESA-listed marine mammals incidental to commercial fisheries (64 FR 28800; May 27, 1999). The MMPA requires that PBR be estimated in stock assessment reports and that it be used in applications related to the management of take incidental to commercial fisheries (*i.e.,* the take reduction planning process described in section 118 of the MMPA. Although NMFS has not historically applied PBR outside the context of sections 117 and 118, NMFS recognizes that as a quantitative tool, PBR may be useful in certain instances for evaluating the impacts of other human-caused activities on marine mammal stocks. In this analysis, we consider incidental M/

SI relative to PBR for each affected stock, in addition to considering the interaction of those removals with incidental taking of that stock by harassment, within our evaluation of the likely impacts of the proposed activities on marine mammal stocks and in determining whether those impacts are likely to be negligible. Our use of PBR in this case does not make up the entirety of our impact assessment, but rather is utilized as a known, quantitative metric for evaluating whether the proposed activities are likely to have a population-level effect on the affected marine mammal stocks. For the purposes of analyzing this specified activity, NMFS acknowledges that some of the fisheries research activities use similar gear and may have similar effects, but on a smaller scale, as marine mammal take by commercial fisheries.

Species/Group Specific Analysis—To avoid repetition, the majority of our preliminary applies to all the species listed in Table 20, given that the anticipated effects of the NEFSC research activities are expected to be relatively similar in nature. Where there are meaningful differences between species or stocks, or groups of species, in anticipated individual responses to activities, impact of expected take on the population due to differences in population status, or impacts on habitat, we describe them within the section or within a separate sub-section. See the Brief Background on Sound section earlier in this proposed rule for a description of marine mammal functional hearing groups as originally designated by Southall *et al.* (2007).

Acoustic Effects—Please refer to Table 20 for information relating to this analysis. As described in greater depth previously (see ''Acoustic Effects''), we do not believe that the NEFSC's use of active acoustic sources has the likely potential to cause any effect exceeding Level B harassment of marine mammals. In addition, for the majority of species, the proposed annual take by Level B harassment is very low in relation to the population abundance estimate (less than 7.5 percent) for each stock.

We have produced what we believe to be conservative estimates of potential incidents of Level B harassment. The procedure for producing these estimates, described in detail in ''Estimated Take Due to Acoustic Harassment,'' represents NMFS' best effort towards balancing the need to quantify the potential for occurrence of Level B harassment due to production of underwater sound with a general lack of information related to the specific way that these acoustic signals, which are generally highly directional and transient, interact with the physical environment and to a meaningful understanding of marine mammal perception of these signals and occurrence in the areas where the NEFSC operates. The sources considered here have moderate to 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. In addition, some of these sources can be operated in different output modes (*e.g.,* energy can be distributed among multiple output beams) that may lessen the likelihood of perception by and potential impacts on marine mammals in comparison with the quantitative estimates that guide our proposed take authorization.

In particular, low-frequency hearing specialists (*i.e.,* mysticetes) and certain pinnipeds (*i.e.,* otariids) are less likely to perceive or, given perception, to react to these signals than the quantitative estimates indicate. These groups have reduced functional hearing at the higher frequencies produced by active acoustic sources considered here (*e.g.,* primary operating frequencies of 40–180 kHz) and, based purely on their auditory capabilities, the potential impacts are likely much less (or non-existent) than we have calculated as these relevant factors are not taken into account.

However, for purposes of this analysis, we assume that the take levels proposed for authorization will occur. As described previously, there is some minimal potential for temporary effects to hearing for certain marine mammals (*i.e.,* odontocete cetaceans), but most effects would likely be limited to temporary behavioral disturbance. Effects on individuals that are taken by Level B harassment will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring), reactions that are considered to be of low severity (*e.g.,* Southall *et al.,* 2007). There is the potential for behavioral reactions of greater severity, including displacement, but because of the directional nature of the sources considered here and because the source is itself moving, these outcomes are unlikely and would be of short duration if they did occur. Although there is no information on which to base any distinction between incidents of harassment and individuals harassed, the same factors, in conjunction with the fact that NEFSC survey effort is widely dispersed in space and time, indicate that repeated exposures of the same individuals would be very unlikely.

Take by M/SI + Level A—We now consider the level of taking by M/SI + Level A proposed for authorization. First, it is likely that required injury determinations will show some undetermined number of gear interactions to result in Level A harassment rather than serious injury; therefore, our authorized take numbers are overestimates with regard solely to M/SI. In addition, we note that these proposed take levels are likely precautionary overall when considering that: (1) Estimates for historically taken species were developed assuming that the annual average number of takes from 2004–2015, would occur in each year from 2015–20; and that (2) the majority of species for which take authorization is proposed have never been taken in NEFSC surveys.

However, assuming that all of the takes proposed for authorization actually occur, we assess these quantitatively by comparing to the calculated PBR for each stock. Estimated M/SI for all stocks is significantly less than PBR and the annual average take by M/SI + Level A for these stocks well below the PBR (less than four percent for each stock, with the exception of white beaked dolphins at six percent).

Large whales (North Atlantic right, blue, fin, sei, humpback, and sperm whales)—Due to their very low numbers within the NEFSC research area and a tendency to occur primarily in waters outside of the NEFSC research area, blue, sperm, and sei whales rarely coincide with NEFSC fisheries research vessels. Thus, we anticipate that any potential gear interactions are unlikely. There have been no entanglements or takes of blue, sperm, or sei whales or any ESA-listed marine mammals in NEFSC fisheries research. Thus, there are no requested take by M/SI + Level A of these species during the next five years. Given the mitigation measures in place and the lack of historical takes, the NEFSC does not expect to have any adverse gear interactions with ESA-listed cetaceans in research surveys.

Long- and short-finned pilot whales—Due to the low levels of survey effort in hotspot areas for pilot whales, adherence to gear requirements for longline surveys, low numbers of hooks and sets used in longline surveys, and short soak times with continuous monitoring during gillnet surveys, we anticipate that any potential gear interactions are unlikely. There have been no entanglements or takes of long- or short-finned pilot whales in NEFSC fisheries research. Thus, there are no requested take by M/SI + Level A of these species during the next five years.

Pinnipeds—Given the low historic number of seal interactions with research gear and the implementation of mitigation measures, future mortalities of pinnipeds would be considered rare or infrequent.

Take by Physical Disturbance—We note that the NEFSC conducts one set of research activities where the physical presence of researchers may result in Level B incidental harassment of pinnipeds on haulouts. Several research efforts to monitor fish communities in the Penobscot River Estuary require researchers in small skiffs to pass seals on one tidal ledge (Odum Ledge) where approximately 50 harbor seals and perhaps a few gray seals are periodically hauled out. These surveys do not entail intentional approaches to seals on haulouts (*i.e.,* the boats avoid close approach to tidal ledges), and no research gear is deployed near the tidal ledge; only behavioral disturbance incidental to small boat activities is anticipated. NEFSC conservatively estimated that all hauled out seals may be disturbed by passing research skiffs. However, researchers estimate that approximately 10 percent (5 animals in a group of 50) have been visibly disturbed in the past. This level of periodic incidental harassment would have temporary effects, would not be expected to alter the continued use of the tidal ledge by seals.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the planned mitigation measures, we preliminarily find that the total marine mammal take from NEFSC fisheries research activities will have a negligible impact on the affected marine mammal species or stocks in the Atlantic coast region. In summary, this finding of negligible impact is founded on the following factors: (1) The possibility of injury, serious injury, or mortality from the use of active acoustic devices may reasonably be considered discountable; (2) the anticipated incidents of Level B harassment from the use of active acoustic devices consist of, at worst, temporary and relatively minor modifications in behavior; (3) the predicted number of incidents of combined Level A harassment, serious injury, and mortality are at insignificant levels relative to all affected stocks; and (4) the presumed efficacy of the planned mitigation measures in reducing the effects of the specified activity to the level of least practicable adverse impact. In addition, no M/SI is proposed for authorization for any species or stock that is listed under the ESA. In combination, we believe that these factors demonstrate that the specified activity will have only short-term effects on individuals (resulting from Level B harassment) and that the total level of taking will not impact rates of recruitment or survival sufficiently to result in population-level impacts.

Small Numbers Analyses

Please see Table 20 for information relating to this small numbers analysis. The total amount of taking proposed for authorization is less than 7.5 percent for all stocks.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed mitigation measures, we preliminarily find that small numbers of marine mammals will be taken relative to the populations of the affected species or stocks in the Atlantic coast region.

Proposed Monitoring and Reporting

In order to issue an incidental take authorization for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking.'' The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for incidental take authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area.

Any monitoring requirement we prescribe should improve our understanding of one or more of the following:

- Occurrence of marine mammal species in action area (*e.g.,* presence, abundance, distribution, density).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving, or feeding areas).
- Individual responses to acute stressors, or impacts of chronic exposures (behavioral or physiological).
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of an individual; or (2) population, species, or stock.
- Effects on marine mammal habitat and resultant impacts to marine mammals.
- Mitigation and monitoring effectiveness.

The NEFSC plans to make more systematic its training, operations, data collection, animal handling and sampling protocols, etc. in order to improve its ability to understand how mitigation measures influence interaction rates and ensure its research operations are conducted in an informed manner and consistent with lessons learned from those with experience operating these gears in close proximity to marine mammals. It is in this spirit that we propose the monitoring requirements described below.

Visual Monitoring

Marine mammal watches are a standard part of conducting fisheries research activities, and are implemented as described previously in ''Proposed Mitigation.'' Marine mammal watches and monitoring occur prior to deployment of gear, and they continue until gear is brought back on board. If marine mammals are sighted in the area then the sampling station is either moved or canceled. When dedicated marine mammal observers are on board they will record the estimated species and number of animals present and their behavior. If marine mammal observers are not on board or available (due to vessel size limits and bunk space) then NEFSC would develop the protocols, provide training as practical, and evaluate the reports. This information can be valuable in understanding whether some species may be attracted to vessels or gears. NOAA vessels are required to monitor interactions with protected species (and report interactions to the NEFSC Director) but in reality are limited to direct interactions and reporting dead or entangled marine mammals. Similarly, there is a condition of grant and contract awards for monitoring of protected species takes.

In the Penobscot Bay only, the NEFSC will monitor any potential disturbance of pinnipeds on ledges, paying particular attention to the distance at which different species of pinniped are disturbed. Disturbance will be recorded according to the three-point scale, representing increasing seal response to disturbance, shown in Table 19.

Training

The NEFSC anticipates that additional information on practices to avoid marine mammal interactions can be gleaned from training sessions and more systematic data collection standards. The NEFSC will conduct annual trainings for all chief scientists and other personnel who may be responsible for conducting dedicated marine mammal visual observations to explain mitigation measures and monitoring and reporting requirements, mitigation and monitoring protocols, marine mammal identification, recording of count and disturbance observations (relevant to Penobscot Bay surveys), completion of datasheets, and use of equipment. Some of these topics may be familiar to NEFSC staff, who may be professional biologists; the NEFSC shall determine the agenda for these trainings and ensure that all relevant staff have necessary familiarity with these topics.

The NEFSC will also dedicate a portion of training to discussion of best professional judgment (which is recognized as an integral component of mitigation implementation; see ''Proposed Mitigation''), including use in any incidents of marine mammal interaction and instructive examples where use of best professional judgment was determined to be successful or unsuccessful. We recognize that many factors come into play regarding decision-making at sea and that it is not practicable to simplify what are inherently variable and complex situational decisions into rules that may be defined on paper. However, it is our intent that use of best professional judgment be an iterative process from year to year, in which any at-sea decision-maker (*i.e.,* responsible for decisions regarding the avoidance of marine mammal interactions with survey gear through the application of best professional judgment) learns from the prior experience of all relevant NEFSC personnel (rather than from solely their own experience). The outcome should be increased transparency in decision-making processes where best professional judgment is appropriate and, to the extent possible, some degree of standardization across common situations, with an ultimate goal of reducing marine mammal interactions. It is the responsibility of the NEFSC to facilitate such exchange.

Handling Procedures and Data Collection

Improved standardization of handling procedures were discussed previously in ''Proposed Mitigation.'' In addition to the benefits implementing these protocols are believed to have on the animals through increased post-release survival, NEFSC believes adopting these protocols for data collection will also increase the information on which ''serious injury'' determinations (NMFS, 2012a, b) are based and improve scientific knowledge about marine mammals that interact with fisheries research gears and the factors that contribute to these interactions. NEFSC personnel will be provided standard guidance and training regarding handling of marine mammals, including 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.

NEFSC will record interaction information on either existing data forms created by other NMFS programs or will develop their own standardized forms. To aid in serious injury determinations and comply with the current NMFS Serious Injury Guidelines (NMFS, 2012a, b), researchers will also answer a series of supplemental questions on the details of marine mammal interactions.

Reporting

As is normally the case, NEFSC will coordinate with the relevant stranding coordinators for any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that are encountered during field research activities. The NEFSC will follow a phased approach with regard to the cessation of its activities and/or reporting of such events, as described in the proposed regulatory texts following this preamble. In addition, Chief Scientists (or cruise leader, CS) will provide reports to NEFSC leadership and to the Office of Protected Resources (OPR) by event, survey leg, and cruise. As a result, when marine mammals interact with survey gear, whether killed or released alive, a report provided by the CS will fully describe any observations of the animals, the context (vessel and conditions), decisions made and rationale for decisions made in vessel and gear handling. The circumstances of these events are critical in enabling the NEFSC and OPR to better evaluate the conditions under which takes are most likely occur. We believe in the long term this will allow the avoidance of these types of events in the future.

The NEFSC will submit annual summary reports to OPR including: (1) Annual line-kilometers surveyed during which the EK60, ME70, SX90 (or equivalent sources) were predominant (see ''Estimated Take by Acoustic Harassment'' for further discussion), specific to each region; (2) summary information regarding use of all longline (including bottom and vertical lines) and trawl (including bottom trawl) gear, including number of sets, hook hours, tows, etc., specific to each region and gear; (3) accounts of all incidents of marine mammal interactions, including circumstances of the event and descriptions of any mitigation procedures implemented or not implemented and why; (4) summary information related to any disturbance of pinnipeds during the Penobscot Bay surveys, including event-specific total counts of animals present, counts of reactions according to the three-point scale shown in Table 19, and distance of closest approach; and (5) a written evaluation of the effectiveness of NEFSC mitigation strategies in reducing the number of marine mammal interactions with survey gear, including best professional judgment and suggestions for changes to the mitigation strategies, if any. The period of reporting will be a calendar year and the report must be submitted not less than ninety days following the end of a calendar year. Submission of this information is in service of an adaptive management framework allowing NMFS to make appropriate modifications to mitigation and/or monitoring strategies, as necessary, during the proposed five-year period of validity for these regulations.

NMFS has established a formal incidental take reporting system, the Protected Species Incidental Take (PSIT) database, requiring that incidental takes of protected species be reported within 48 hours of the occurrence. The PSIT generates automated messages to NMFS staff, alerting them to the event and to the fact that updated information describing the circumstances of the event has been entered into the database. The PSIT and CS reports represent not only valuable real-time reporting and information dissemination tools but also serve as an archive of information that may be mined in the future to study why takes occur by species, gear, region, etc.

The NEFSC will also collect and report all necessary data, to the extent practicable given the primacy of human safety and the well-being of captured or entangled marine mammals, to facilitate serious injury (SI) determinations for marine mammals that are released alive. NEFSC will require that the CS 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. NEFSC understands the critical need to provide as much relevant information as possible about marine mammal interactions to inform decisions regarding SI determinations. In addition, the NEFSC will perform all necessary reporting to ensure that any incidental M/SI is incorporated as appropriate into relevant SARs.

Adaptive Management

The final regulations governing the take of marine mammals incidental to NEFSC fisheries research survey operations in three specified geographical regions would contain an adaptive management component. The inclusion of an adaptive management component will be both valuable and necessary within the context of five-year regulations for activities that have been associated with marine mammal mortality.

The reporting requirements associated with these proposed rules are designed to provide OPR with monitoring data from the previous year to allow consideration of whether any changes are appropriate. OPR and the NEFSC will meet annually to discuss the monitoring reports and current science and whether mitigation or monitoring modifications are appropriate. The use of adaptive management allows OPR to consider new information from different sources to determine (with input from the NEFSC regarding practicability) on an annual or biennial basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation measures could be modified if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects to marine mammals and if the measures are practicable.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) Results from monitoring reports, as required by MMPA authorizations; (2) results from general marine mammal and sound research; and (3) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOAs.

Impact on Availability of Affected Species for Taking for Subsistence Uses

There are no relevant subsistence uses of marine mammals implicated by these actions, in any of the three specified geographical regions for which we propose rulemakings. Therefore, we have determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

There are multiple marine mammal species listed under the ESA with confirmed or possible occurrence in the proposed specified geographical region (see Table 3). In the Northeast Region, research surveys occur in two areas that have been designated as critical habitat for the North Atlantic right whale (NOAA, 1994). These are the Cape Cod Bay (CCB) Critical Habitat Area and the Great South Channel GSC Critical Habitat Area. OPR has initiated consultation with NMFS' Greater Atlantic Regional Office under section 7 of the ESA on the promulgation of five-year regulations and the subsequent issuance of LOAs to the NEFSC under section 7 of the ESA. This consultation will be concluded prior to issuing any final rule.

National Environmental Policy Act (NEPA)

The NEFSC has prepared a Draft Environmental Assessment (EA; *Draft Programmatic Environmental Assessment for Fisheries Research Conducted and Funded by the Northeast Fisheries Science Center*) in accordance with NEPA and the regulations published by the Council on Environmental Quality. NMFS posted the document on the internet at: *www.nmfs.noaa.gov/pr/permits/incidental/research.htm*. We have independently evaluated the Draft EA and are proposing to adopt it. We may prepare a separate NEPA analysis and incorporate relevant portions of NEFSC's EA by reference. Information in NEFSC's application, EA, the 2015 addendum to the application, and this notice collectively provide the environmental information related to proposed issuance of these regulations for public review and comment. We will review all comments submitted in response to this notice as we complete the NEPA process, including a decision of whether to sign a Finding of No Significant Impact, prior to a final decision on the incidental take authorization request.

Request for Information

NMFS requests interested persons to submit comments, information, and suggestions concerning the NEFSC request and the proposed regulations (see **ADDRESSES**). All comments will be reviewed and evaluated as we prepare final rules and make final determinations on whether to issue the requested authorization. This notice and referenced documents provide all environmental information relating to our proposed action for public review.

Classification

Pursuant to the procedures established to implement Executive Order 12866, the Office of Management and Budget has determined that this proposed rule is not significant.

Pursuant to section 605(b) of the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. This action is being taken in response to a request from NMFS' Northeast Fisheries Science Center (NEFSC) for authorization to take marine mammals incidental to fisheries research conducted in a specified geographical region, over the course of five years from the date of issuance. As required by the MMPA, NMFS is proposing regulations to govern that take, specific to each geographical region and requests comments on the proposed regulations. The NEFSC is the sole entity that would be subject to the requirements in these proposed regulations. The NEFSC is a federal government entity that does not meet the RFA's definition of small entity, which is defined as a small governmental jurisdiction, small organization, or small business. For this reason, the rule will not have a significant economic impact on a substantial number of small entities. Because of this certification, a regulatory flexibility analysis is not required and none has been prepared.

This proposed rule does not contain a collection-of-information requirement subject to the provisions of the PRA because the applicant is a federal agency. Notwithstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act (PRA) unless that collection of information displays a currently valid OMB control number.

List of Subjects in 50 CFR Part 219

Exports, Fish, Imports, Indians, Labeling, Marine mammals, Penalties, Reporting and recordkeeping requirements, Seafood, Transportation.

Dated: June 30, 2015.

Eileen Sobeck,

Assistant Administrator for Fisheries, National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 219 is proposed to be added to read as follows:

PART 219—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

Subpart D—Taking Marine Mammals Incidental to Northeast Fisheries Science Center Fisheries Research in the Atlantic Coast Region

Sec.

Authority: 16 U.S.C. 1361 *et seq.*

Subpart D—Taking Marine Mammals Incidental to Northeast Fisheries Science Center Fisheries Research in the Atlantic Coast Region

§ 219.31 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the National Marine Fisheries Service's (NMFS) Northeast Fisheries Science Center (NEFSC) and those persons it authorizes or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occurs incidental to research survey program operations.

(b) The taking of marine mammals by NEFSC may be authorized in a Letter of Authorization (LOA) only if it occurs within the Atlantic coast region.

§ 219.32 [Reserved]

§ 219.33 Permissible methods of taking.

(a) Under LOAs issued pursuant to §§ 216.106 and 219.7 of this chapter, the Holder of the LOA (hereinafter ''NEFSC'') may incidentally, but not intentionally, take marine mammals within the area described in § 219.31(b), provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

(b) The incidental take of marine mammals under the activities identified in § 219.31(a) is limited to the indicated number of takes on an annual basis (by Level B harassment) or over the five-year period of validity of these regulations (by mortality) of the following species:

(1) Level B harassment:

(i) Cetaceans:

(A) North Atlantic right whale (*Eubalaena glacialis*)—21;

(B) Humpback whale (*Megaptera novaeangliae*)—15;

(C) Minke whale (*Balaenoptera acutorostrata*)—49;

(D) Sei whale (*Balaenoptera borealis*)—26;

(E) Fin whale (*Balaenoptera physalus*)—31;

(F) Blue whale (*Balaenoptera musculus*) –12;

(G) Sperm whale (*Physeter macrocephalus*)—29;

(H) Pygmy or dwarf sperm whale (*Kogia spp.*)—12;

(I) Cuvier's beaked whale (*Ziphius cavirostris*)—33;

(J) Blainville's, Gervais', Sowerby's, or True's beaked whales (*Mesoplodon spp.*)—33;

(K) Bottlenose dolphin (*Tursiops truncatus*)—685;

(L) Pantropical spotted dolphin (*Stenella attenuata*)—20;

(M) Atlantic spotted dolphin (*Stenella frontalis*)—26;

(N) Spinner dolphin (*Stenella longirostris*)—20;

(O) Striped dolphin (*Stenella coeruleoalba*)—246;

(P) Short-beaked common dolphin (*Delphinis delphis*)—1,393;

(Q) White-beaked dolphin (*Lagenorhynchus albirostris*)—58;

(R) Atlantic white-sided dolphin (*Lagenorhynchus acutus*)—154;

(S) Risso's dolphin (*Grampus griseus*)—79;

(T) Fraser's dolphin (*Lagenodelphis hosei*)—20;

(U) Clymene dolphin (*Stenella clymene*)—20;

(V) Melon-headed whale (*Peponocephala electra*)—20;

(W) Pygmy killer whale (*Feresa attenuata*)—20;

(X) Long and short-finned pilot whales (*Globicephala spp.*)—235;

(Y) Harbor porpoise (*Phocoena phocoena*)—113;

(ii) Pinnipeds:

(A) Gray seal (*Halichoerus grypus*)—80,010;

(B) Harp seal (*Pagophilus groenlandicus*)—10;

(C) Harbor seal (*Phoca vitulina*)—21,768.

(2) Mortality (trawl gear only):

(i) Cetaceans:

(A) Minke whale—5;

(B) Risso's dolphin—2;

(C) Bottlenose dolphin (Western North Atlantic offshore stock)—2;

(D) Bottlenose dolphin (Western North Atlantic Northern migratory stock)—2;

(E) Bottlenose dolphin (Western North Atlantic Southern migratory stock)—2;

(F) Atlantic spotted dolphin—2;

(G) Short-beaked common dolphin—5;

(H) White-beaked dolphin—2;

(I) Atlantic white-sided dolphin—2;

(J) Harbor porpoise—2;

(K) Unidentified cetacean (Family Delphinidae)—1;

(ii) Pinnipeds:

(A) Gray seal—1;

(B) Harbor seal—1;

(C) Unidentified pinniped—1.

(3) Mortality (gillnet gear only):

(i) Cetaceans:

(A) Bottlenose dolphin (Western North Atlantic offshore stock)—5;

(B) Bottlenose dolphin (Western North Atlantic Northern migratory stock)—5;

(C) Bottlenose dolphin (Western North Atlantic Southern migratory stock)—5;

(D) Atlantic spotted dolphin—1;

(E) Short-beaked common dolphin—1;

(F) Harbor porpoise—5;

(G) Unidentified cetacean (Family Delphinidae)—1;

(ii) Pinnipeds:

(A) Gray seal—5;

(B) Harbor seal—5;

(C) Unidentified pinniped—1.

(4) Mortality (pelagic longline gear only):

(A) Risso's dolphin—1;

(B) Bottlenose dolphin (Western North Atlantic offshore stock)—1;

(C) Bottlenose dolphin (Western North Atlantic Northern migratory stock)—1;

(D) Bottlenose dolphin (Western North Atlantic Southern migratory stock)—1;

(F) Short-beaked common dolphin—1;

(G) Unidentified cetacean (Family Delphinidae)—1;

(ii) Pinnipeds:

(A) Unidentified pinniped—1.

(B) [Reserved]

(5) Mortality (fyke net gear only):

(i) Pinnipeds:

(A) Gray seal—1;

(B) Harbor seal—5;

(C) Unidentified pinniped—1.

§ 219.34 Prohibitions.

Notwithstanding takings contemplated in § 219.31 and authorized by a LOA issued under

§ 216.106 of this chapter and § 219.7, no person may, in connection with the activities described in § 219.31:

(a) Take any marine mammal not specified in § 219.33(b);

(b) Take any marine mammal specified in § 219.33(b) in any manner other than as specified;

(c) Take a marine mammal specified in § 219.33(b) if NMFS determines such taking results in more than a negligible impact on the species or stocks of such marine mammal;

(d) Take a marine mammal specified in § 219.33(b) if NMFS determines such taking results in an unmitigable adverse impact on the species or stock of such marine mammal for taking for subsistence uses; or

(e) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under § 216.106 of this chapter and § 219.37.

§ 219.35 Mitigation requirements.

When conducting the activities identified in § 219.31(a), the mitigation measures contained in any LOA issued under §§ 216.106 and 219.37 of this chapter must be implemented. These mitigation measures shall include but are not limited to:

(a) General conditions:

(1) NEFSC shall take all necessary measures to coordinate and communicate in advance of each specific survey with the National Oceanic and Atmospheric Administration's (NOAA) Office of Marine and Aviation Operations (OMAO) or other relevant parties on non-NOAA platforms to ensure that all mitigation measures and monitoring requirements described herein, as well as the specific manner of implementation and relevant event-contingent decision-making processes, are clearly understood and agreed upon.

(2) NEFSC shall coordinate and conduct briefings at the outset of each survey and as necessary between ship's crew (Commanding Officer/master or designee(s), as appropriate) and scientific party in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

(3) NEFSC shall coordinate as necessary on a daily basis during survey cruises with OMAO personnel or other relevant personnel on non-NOAA platforms to ensure that requirements, procedures, and decision-making processes are understood and properly implemented.

(4) When deploying any type of sampling gear at sea, NEFSC shall at all times monitor for any unusual circumstances that may arise at a sampling site and use best professional judgment to avoid any potential risks to marine mammals during use of all research equipment.

(5) All vessels must comply with applicable and relevant take reduction plans, including any required use of acoustic deterrent devices.

(6) All vessels must comply with applicable speed restrictions.

(7) NEFSC shall implement handling and/or disentanglement protocols as specified in the guidance provided to NEFSC survey personnel (''Identification, Handling, and Release of Protected Species'').

(b) Beam, mid-water, and bottom trawl survey protocols:

(1) NEFSC shall conduct trawl operations as soon as is practicable upon arrival at the sampling station.

(2) NEFSC shall initiate marine mammal watches (visual observation) prior to sampling. Marine mammal watches shall be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular). During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

(3) NEFSC shall implement the ''move-on rule.'' If a marine mammal is sighted around the vessel before setting the gear, NEFSC may decide to move the vessel away from the marine mammal to a different section of the sampling area if the animal appears to be at risk of interaction with the gear. If, after moving on, marine mammals are still visible from the vessel, NEFSC may decide to move again or to skip the station. NEFSC may use best professional judgment in making this decision.

(4) NEFSC shall maintain visual monitoring effort during the entire period of time that trawl gear is in the water (*i.e.,* throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, NEFSC shall take the most appropriate action to avoid marine mammal interaction. NEFSC may use best professional judgment in making this decision.

(5) If trawling operations have been suspended because of the presence of marine mammals, NEFSC may resume trawl operations when practicable only when the animals are believed to have departed the area. NEFSC may use best professional judgment in making this determination.

(6) NEFSC shall implement standard survey protocols to minimize potential for marine mammal interaction, including maximum tow durations at target depth and maximum tow distance, and shall carefully empty the trawl as quickly as possible upon retrieval. Trawl nets must be cleaned prior to deployment.

(c) Dredge survey protocols:

(1) NEFSC shall deploy dredge gear as soon as is practicable upon arrival at the sampling station.

(2) NEFSC shall initiate marine mammal watches (visual observation) prior to sampling. Marine mammal watches shall be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular). During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

(3) NEFSC shall implement the ''move-on rule.'' If marine mammals are sighted around the vessel before setting the gear, the NEFSC may decide to move the vessel away from the marine mammal to a different section of the sampling area if the animal appears to be at risk of interaction with the gear. If, after moving on, marine mammals are still visible from the vessel, NEFSC may decide to move again or to skip the station. NEFSC may use best professional judgment in making this decision but may not elect to conduct dredge survey activity when animals remain near the vessel.

(4) NEFSC shall maintain visual monitoring effort during the entire period of time that dredge gear is in the water (*i.e.,* throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, NEFSC shall take the most appropriate action to avoid marine mammal interaction. NEFSC may use best professional judgment in making this decision.

(5) If dredging operations have been suspended because of the presence of marine mammals, NEFSC may resume operations when practicable only when the animals are believed to have departed the area. NEFSC may use best professional judgment in making this determination.

(6) NEFSC shall carefully empty the dredge gear as quickly as possible upon retrieval to determine if marine mammals are present in the gear.

(d) Longline survey protocols:

(1) NEFSC shall deploy longline gear as soon as is practicable upon arrival at the sampling station.

(2) NEFSC shall initiate marine mammal watches (visual observation) no less than thirty minutes prior to both deployment and retrieval of the longline gear. Marine mammal watches shall be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular).

During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

(3) NEFSC shall implement the ''move-on rule.'' If marine mammals are sighted near the vessel 30 minutes before setting the gear, the NEFSC may decide to move the vessel away from the marine mammal to a different section of the sampling area if the animal appears to be at risk of interaction with the gear. If, after moving on, marine mammals are still visible from the vessel, NEFSC may decide to move again or to skip the station. NEFSC may use best professional judgment in making this decision but may not elect to conduct longline survey activity when animals remain near the vessel.

(4) For the Apex Predators Bottom Longline Coastal Shark Survey, if one or more marine mammals are observed within 1 nautical mile of the planned location in the thirty minutes before gear deployment, NEFSC shall transit to a different section of the sampling area to maintain a minimum set distance of 1 nm from the observed marine mammals. If, after moving on, marine mammals remain within 1 nautical mile, NEFSC may decide to move again or to skip the station. NEFSC may use best professional judgment in making this decision but may not elect to conduct pelagic longline survey activity when animals remain within the 1-nautical mile zone.

(5) NEFSC shall maintain visual monitoring effort during the entire period of gear deployment or retrieval. If marine mammals are sighted before the gear is fully deployed or retrieved, NEFSC shall take the most appropriate action to avoid marine mammal interaction. NEFSC may use best professional judgment in making this decision.

(6) If deployment or retrieval operations have been suspended because of the presence of marine mammals, NEFSC may resume such operations after there are no sightings of marine mammals for at least 15 minutes within the area or within the 1 nautical mile area for the Apex Predators Bottom Longline Coastal Shark Survey. NEFSC may use best professional judgment in making this decision.

(7) NEFSC shall implement standard survey protocols, including maximum soak durations and a prohibition on chumming.

(e) Gillnet survey protocols:

(1) NEFSC and/or cooperating institutions shall deploy gillnet gear as soon as is practicable upon arrival at the sampling station.

(2) NEFSC and/or cooperating institutions shall initiate marine mammal watches (visual observation) prior to both deployment and retrieval of the gillnet gear. Marine mammal watches shall be conducted during the soak by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular).

(3) NEFSC and/or cooperating institutions shall implement the ''move-on rule.'' If marine mammals are sighted near the vessel before setting the gear, the NEFSC, as appropriate may decide to move the vessel away from the marine mammal to a different section of the sampling area if the animal appears to be at risk of interaction with the gear. If, after moving on, marine mammals are still visible from the vessel, the NEFSC may decide to move again or to skip the station. The NEFSC may use best professional judgment in making this decision but may not elect to conduct the gillnet survey activity when animals remain near the vessel.

(4) If marine mammals are sighted near the vessel during the soak and are determined to be at risk of interacting with the gear, then the NEFSC as appropriate shall carefully retrieve the gear as quickly as possible. NEFSC and/or cooperating institutions may use best professional judgment in making this decision.

(5) NEFSC shall implement standard survey protocols, including continuously monitoring the gillnet gear during soak time; removing debris with each pass as the net is reset into the water to minimize bycatch.

(6) NEFSC shall ensure that surveys deploy acoustic pingers on gillnets in areas where required for commercial fisheries. NEFSC must ensure that the devices are operating properly before deploying the net.

(7) NEFSC shall ensure that cooperating institutions conducting gillnet surveys adhere to monitoring and mitigation requirements and shall include required protocols in all survey instructions, contracts, and agreements.

(8) For the COASTSPAN gillnet surveys, the NEFSC will actively monitor for potential bottlenose dolphin entanglements by hand-checking the gillnet every 20 minutes. In the unexpected case of a bottlenose dolphin entanglement, the NEFSC would request and arrange for expedited genetic sampling for stock determination. The NEFSC would also photograph the dorsal fin and submit the image to the Southeast Stranding Coordinator for identification/matching to bottlenose dolphins in the Mid-Atlantic Bottlenose Dolphin Photo-identification Catalog.

(f) Fyke net gear protocols:

(1) NEFSC shall conduct fyke net gear deployment as soon as is practicable upon arrival at the sampling station.

(2) NEFSC shall visually survey the area prior to both deployment and retrieval of the fyke net gear. NEFSC shall conduct monitoring and retrieval of the gear every 12 to 24-hour soak period.

(3) If marine mammals are in close proximity (approximately 100 meters) of the setting location, NEFSC shall determine if the set location should be moved. NEFSC may use best professional judgment in making this decision.

(4) If marine mammals are observed to interact with the gear during the setting, NEFSC shall lift and remove the gear from the water.

(5) NEFSC must install and use a marine mammal excluder device at all times when the 2-meter fyke net is used.

(g) Beach seine gear protocols:

(1) NEFSC shall conduct beach seine deployment as soon as is practicable upon arrival at the sampling station.

(2) NEFSC shall visually survey the area prior to both deployment and retrieval of the seine net gear.

(3) If marine mammals are in close proximity of the seining location, NEFSC shall lift the net and remove it from the water. NEFSC may use best professional judgment in making this decision.

(h) Rotary screw trap gear protocols:

(1) NEFSC shall conduct rotary screw trap deployment as soon as is practicable upon arrival at the sampling station.

(2) NEFSC shall visually survey the area prior to both 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 judgment in making this decision.

(3) NEFSC shall tend to the trap on a daily basis to monitor for marine mammal interactions with the gear.

(4) If the rotary screw trap captures a marine mammal, NEFSC shall carefully release the animal as soon as possible.

§ 219.36 Requirements for monitoring and reporting.

(a) Visual monitoring program:

(1) Marine mammal visual monitoring shall occur: prior to deployment of beam, mid-water, and bottom trawl, pelagic longline, gillnet, fyke net, beach seine, and rotary screw trap gear; throughout deployment of gear and active fishing of all research gears; and throughout retrieval of all research gear.

(2) Marine mammal watches shall be conducted by watch-standers (those

navigating the vessel and/or other crew) at all times when the vessel is being operated.

(3) NEFSC shall monitor any potential disturbance of pinnipeds on ledges, paying particular attention to the distance at which different species of pinniped are disturbed. Disturbance shall be recorded according to a three-point scale representing increasing seal response to disturbance.

(b) Training:

(1) NEFSC must conduct annual training for all chief scientists and other personnel who may be responsible for conducting dedicated marine mammal visual observations to explain mitigation measures and monitoring and reporting requirements, mitigation and monitoring protocols, marine mammal identification, completion of datasheets, and use of equipment. NEFSC may determine the agenda for these trainings.

(2) NEFSC shall also dedicate a portion of training to discussion of best professional judgment, including use in any incidents of marine mammal interaction and instructive examples where use of best professional judgment was determined to be successful or unsuccessful.

(3) NEFSC shall coordinate with NMFS' Southeast Fisheries Science Center (SEFSC) regarding surveys conducted in the southern portion of the Atlantic coast region, such that training and guidance related to handling procedures and data collection is consistent.

(c) Handling procedures and data collection:

(1) NEFSC must develop and implement standardized marine mammal handling, disentanglement, and data collection procedures. These standard procedures will be subject to approval by NMFS Office of Protected Resources (OPR).

(2) When practicable, for any marine mammal interaction involving the release of a live animal, NEFSC shall collect necessary data to facilitate a serious injury determination.

(3) NEFSC shall provide its relevant personnel with standard guidance and training regarding handling of marine mammals, including 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.

(4) NEFSC shall record such data on standardized forms, which will be subject to approval by OPR. NEFSC shall also answer a standard series of supplemental questions regarding the details of any marine mammal interaction.

(d) Reporting:

(1) NEFSC shall report all incidents of marine mammal interaction to NMFS' Protected Species Incidental Take database within 48 hours of occurrence.

(2) NEFSC shall provide written reports to OPR following any marine mammal interaction (animal captured or entangled in research gear) and/or survey leg or cruise, summarizing survey effort on the leg or cruise. In the event of a marine mammal interaction, these reports shall include full descriptions of any observations of the animals, the context (vessel and conditions), decisions made and rationale for decisions made in vessel and gear handling.

(3) Annual reporting:

(i) NEFSC shall submit an annual summary report to OPR not later than ninety days following the end of a calendar year, with the reporting period being a given calendar year.

(ii) These reports shall contain, at minimum, the following:

(A) Annual line-kilometers surveyed during which the EK60, ME70, DSM300 (or equivalent sources) were predominant;

(B) Summary information regarding use of the following: all trawl gear, all longline gear, all gillnet gear, all dredge gear, fyke net gear, beach seine net gear, and rotary screw trap gear (including number of sets, hook hours, tows, and tending frequency specific to each gear type);

(C) Accounts of all incidents of marine mammal interactions, including circumstances of the event and descriptions of any mitigation procedures implemented or not implemented and why;

(D) Summary information related to any disturbance of pinnipeds, including event-specific total counts of animals present, counts of reactions according to a three-point scale of response severity (1 = alert; 2 = movement; 3 = flight), and distance of closest approach;

(E) A written evaluation of the effectiveness of NEFSC mitigation strategies in reducing the number of marine mammal interactions with survey gear, including best professional judgment and suggestions for changes to the mitigation strategies, if any;

(F) Final outcome of serious injury determinations for all incidents of marine mammal interactions where the animal(s) were released alive; and

(e) Reporting of injured or dead marine mammals:

(1) In the unanticipated event that the activity defined in § 219.31(a) clearly causes the take of a marine mammal in a prohibited manner, NEFSC shall immediately cease the specified activities and report the incident to OPR and the Greater Atlantic Region Stranding Coordinator, NMFS. The report must include the following information:

(i) Time, date, and location (latitude/longitude) of the incident;

(ii) Description of the incident;

(iii) Environmental conditions (including wind speed and direction, Beaufort sea state, cloud cover, and visibility);

(iv) Description of all marine mammal observations in the 24 hours preceding the incident;

(v) Species identification or description of the animal(s) involved;

(vi) Status of all sound source use in the 24 hours preceding the incident;

(vii) Water depth;

(viii) Fate of the animal(s); and

(ix) Photographs or video footage of the animal(s).

(2) Activities shall not resume until OPR is able to review the circumstances of the prohibited take. OPR shall work with NEFSC to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. NEFSC may not resume their activities until notified by OPR.

(3) In the event that NEFSC discovers an injured or dead marine mammal and determines that the cause of the injury or death is unknown and the death is relatively recent (for example, in less than a moderate state of decomposition), NEFSC shall immediately report the incident to OPR and the Greater Atlantic Region Regional Stranding Coordinator, NMFS. The report must include the information identified in § 219.36(e)(1) of this section. Activities may continue while OPR reviews the circumstances of the incident. OPR will work with NEFSC to determine whether additional mitigation measures or modifications to the activities are appropriate.

(4) In the event that NEFSC discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities defined in § 219.31(a) (for example, previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), NEFSC shall report the incident to OPR and the Greater Atlantic Region Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. NEFSC shall provide photographs or video footage or other documentation of the stranded animal sighting to OPR.

§ 219.37 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, NEFSC must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of these regulations.

(c) If an LOA expires prior to the expiration date of these regulations, NEFSC may apply for and obtain a renewal of the LOA.

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, NEFSC must apply for and obtain a modification of the LOA as described in § 219.38.

(e) The LOA shall set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (*i.e.,* mitigation) on the species, its habitat, and on the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(f) Issuance of the LOA shall be based on a determination that the level of taking will be consistent with the findings made for the total taking allowable under these regulations.

(g) Notice of issuance or denial of an LOA shall be published in the **Federal Register** within thirty days of a determination.

§ 219.38 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under § 216.106 of this chapter and § 219.37 for the activity identified in § 219.31(a) shall be renewed or modified upon request by the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for these regulations (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section), and

(2) OPR determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For an LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in in paragraph (c)(1) of this section) that do not change the findings made for the regulations or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), OPR may publish a notice of proposed LOA in the **Federal Register**, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under § 216.106 of this chapter and § 219.37 for the activity identified in § 219.31(a) may be modified by OPR under the following circumstances:

(1) Adaptive Management—OPR may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with NEFSC regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring set forth in the preamble for these regulations.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA:

(A) Results from NEFSC's monitoring from the previous year(s).

(B) Results from other marine mammal and/or sound research or studies.

(C) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, OPR will publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

(2) Emergencies—If OPR determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 219.32(b), an LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the **Federal Register** within thirty days of the action.

§ 219.39 [Reserved]

§ 219.40 [Reserved]

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