DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 219

[Docket No. 170127128–8546–01]

RIN 0648–BG64

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Alaska 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's Office of Protected Resources (OPR) has received a request from NMFS's Alaska Fisheries Science Center (AFSC) for authorization to take marine mammals incidental to fisheries research conducted in multiple specified geographical regions, 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, and requests comments on the proposed regulations. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorization and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than August 31, 2018.

ADDRESSES: You may submit comments on this document, identified by NOAA–NMFS–2018–0070, by any of the following methods:

- *Electronic submission:* Submit all electronic public comments via the federal e-Rulemaking Portal. Go to *www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2018-0070,* click the ''Comment Now!'' icon, complete the required fields, and enter or attach your comments.
- *Mail:* Submit written comments 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: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NMFS. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. NMFS will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, or Adobe PDF file formats only.

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

SUPPLEMENTARY INFORMATION:

Availability

A copy of AFSC's application and any supporting documents, as well as a list of the references cited in this document, may be obtained online 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**).

Purpose and Need for Regulatory Action

This proposed rule would establish a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) to allow for the authorization of take of marine mammals incidental to the AFSC's fisheries research activities in the Gulf of Alaska, Bering Sea, and Arctic Ocean. AFSC's request also includes fisheries research activities of the International Pacific Halibut Commission (IPHC), which occur in the Bering Sea, Gulf of Alaska, and off of the U.S. west coast.

We received an application from the AFSC 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, as well as by visual disturbance of pinnipeds, and by Level A harassment, serious injury, or mortality incidental to the use of fisheries research gear. Please see ''Background'' below for definitions of harassment.

Legal Authority for the Proposed Action

Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1371(a)(5)(A)) 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 for up to five years if, after notice and public comment, the agency makes certain findings and issues regulations that set forth permissible methods of taking pursuant to that activity and other means of effecting the ''least practicable adverse impact'' on the affected species or stocks and their habitat (see the discussion below in the ''Proposed Mitigation'' section), as well as monitoring and reporting requirements. 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 this proposed rule containing five-year regulations, and for any subsequent LOAs. As directed by this legal authority, this proposed rule contains mitigation, monitoring, and reporting requirements.

Summary of Major Provisions Within the Proposed Rule

Following is a summary of the major provisions of this proposed rule regarding AFSC fisheries research activities. These measures include:

- Required monitoring of the sampling areas to detect the presence of marine mammals before deployment of certain research gear.
- Required implementation of the mitigation strategy known as the ''move-on rule mitigation protocol'' which incorporates best professional judgment, when necessary during certain research fishing operations.

Background

Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1361 *et seq.*) directs the Secretary of Commerce (as delegated to NMFS) 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, regulations are issued, and notice is provided to the public.

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.

NMFS has defined ''unmitigable adverse impact'' in 50 CFR 216.103 as an impact resulting from the specified activity:

(1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) directly displacing subsistence users; or (iii) placing physical barriers between the marine mammals and the subsistence hunters; and

(2) That cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

The MMPA states that the term ''take'' means to harass, hunt, capture, kill or attempt to harass, hunt, capture, or kill any marine mammal.

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).

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must evaluate our proposed action (*i.e.,* the promulgation of regulations and subsequent issuance of incidental take authorization) and alternatives with respect to potential impacts on the human environment.

Accordingly, NMFS has prepared a draft Environmental Assessment (EA; *Draft Programmatic Environmental Assessment for Fisheries and Ecosystem Research Conducted and Funded by the Alaska Fisheries Science Center*) to consider the environmental impacts associated with the AFSC's proposed activities as well as the issuance of the regulations and subsequent incidental take authorization. The EA is posted online at: *www.nmfs.noaa.gov/pr/permits/incidental/research.htm.* Information in the EA, AFSC's application, and this notice collectively provide the environmental information related to proposed issuance of these regulations and subsequent incidental take authorization for public review and comment. We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the request for incidental take authorization.

Summary of Request

On June 28, 2016, we received an adequate and complete request from AFSC for authorization to take marine mammals incidental to fisheries research activities. On October 18, 2016 (81 FR 71709), we published a notice of receipt of AFSC's application in the **Federal Register**, requesting comments and information related to the AFSC request for thirty days. We received comments jointly from The Humane Society of the United States and Whale and Dolphin Conservation (HSUS/WDC). Subsequently, AFSC presented substantive revisions to the application, including revisions to the take authorization request as well as incorporation of the IPHC fisheries research activities. We received this revised application, which was determined to be adequate and complete, on September 6, 2017. We then published a notice of its receipt in the **Federal Register**, requesting comments and information for thirty days, on September 14, 2017 (82 FR 43223). We received no comments in response to this second review period. The original comments received from HSUS/WDC were considered in development of this proposed rule and are available online at: *www.nmfs.noaa.gov/pr/permits/incidental/research.htm.*

AFSC proposes to conduct fisheries research using trawl gear used at various levels in the water column, hook-and-line gear (including longlines with multiple hooks), gillnets, and other gear. If a marine mammal interacts with gear deployed by AFSC, the outcome could potentially be Level A harassment, serious injury (*i.e.,* any injury that will likely result in mortality), or mortality. Although any given gear interaction could result in an outcome less severe than mortality or serious injury, we do not have sufficient information to allow parsing these potential outcomes. Therefore, AFSC presents a pooled estimate of the number of potential incidents of gear interaction and, for analytical purposes we assume that gear interactions would result in serious injury or mortality. AFSC 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 may also occur, as a result of visual disturbance from vessels conducting AFSC research.

AFSC requests authorization to take individuals of 19 species by Level A harassment, serious injury, or mortality (hereafter referred to as M/SI) and of 25 species by Level B harassment. The proposed regulations would be valid for five years from the date of issuance.

Description of the Specified Activity

Overview

The AFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. AFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels. Such research may also be conducted by cooperating scientists on non-NOAA vessels when the AFSC helps fund the research. The AFSC proposes to administer and conduct approximately 58 survey programs over the five-year period, within three separate research areas (some survey programs are conducted across more than one research area). The gear types used fall into several categories: Towed nets fished at various levels in the water column, longline gear, gillnets and seine nets, traps, and other gear. Only use of trawl nets, longlines, and gillnets are likely to result in interaction with marine mammals. Many 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 finfish 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 AFSC is the research arm of NMFS in the Alaska region of the United States. The AFSC conducts research and provides scientific advice to manage fisheries and conserve protected species in the geographic research area described below and provides scientific information to support the North Pacific Fishery

Management Council and other domestic and international fisheries management organizations.

The IPHC, established by a convention between the governments of Canada and the United States, is an international fisheries organization mandated to conduct research on and management of the stocks of Pacific halibut (*Hippoglossus stenolepis*) within the Convention waters of both nations. The Northern Pacific Halibut Act of 1982 (16 U.S.C. 773), which amended the earlier Northern Pacific Halibut Act of 1937, is the enabling legislation that gives effect to the Convention in the United States. Although operating in U.S. waters (and, therefore, subject to the MMPA prohibition on ''take'' of marine mammals), the IPHC is not appropriately considered to be a U.S. citizen (as defined by the MMPA) and cannot be issued an incidental take authorization. For purposes of MMPA compliance, the AFSC sponsors the IPHC research activities occurring in U.S. waters, with applicable mitigation, monitoring, and reporting requirements conveyed to the IPHC via Letters of Acknowledgement issued by the AFSC pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

Fishery-independent data necessary to the management of halibut stocks is collected using longline gear aboard chartered commercial vessels within multiple IPHC regulatory areas, including within U.S. waters of the Bering Sea, Gulf of Alaska, and off the U.S. west coast. The IPHC proposes to conduct two survey programs over the five-year period. IPHC activity and requested take authorization is described in Appendix C of AFSC's application.

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 AFSC, weather conditions, or ship contingencies. In addition, cooperative research 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.

Specified Geographical Region

The AFSC conducts research in Alaska within three research areas considered to be distinct specified geographical regions: the Gulf of Alaska Research Area (GOARA), the Bering Sea/Aleutian Islands Research Area (BSAIRA), and the Chukchi Sea and Beaufort Sea Research Area (CSBSRA). Please see Figures 2–1 through 2–3 in the AFSC application for maps of the three research areas. We note here that, while the specified geographical regions within which the AFSC operates may extend outside of the U.S. Exclusive Economic Zone (EEZ), *i.e.,* into the Canadian EEZ (but not including Canadian territorial waters), the MMPA's authority does not extend into foreign territorial waters. For further information about the specified geographical regions, please see 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) and can be related to the carrying capacity of an ecosystem.

The GOARA includes marine waters offshore from Canada north to Alaska and west to longitude 170° W, including marine waters in the archipelagos of southeast Alaska, Prince William Sound, Cook Inlet, Kodiak, and the Alaska Peninsula. The region encompasses fjord-dominated regions out to the Alaska Panhandle as well as the North Pacific slope and basin and is characterized by numerous islands, deep fjords, and sheltered straits, as well as significant freshwater runoff from numerous rivers. The major oceanographic influence on the region is the Alaska Current, and sea ice is generally absent from the region. Average sea surface temperatures (SST) are 1–9 °C (winter) and 10–16 °C (summer), and the region is considered to be of moderately high productivity.

The BSAIRA includes marine waters west of longitude 170° W along the Aleutian Islands chain and north to the Bering Strait, primarily east of the international date line but also including an area west of the date line south of the Gulf of Anadyr. The Bering Sea, noted for its high productivity, is the world's third-largest semi-enclosed water body. This region includes the extremely wide, gradually sloping shelf of the Eastern Bering Sea, the narrow shelf and deep passes along the Aleutian chain, the deep Aleutian Basin, Kamchatka Basin and Bowers Ridge. The continental slope is incised with many canyons before dropping to a generally flat abyssal plain. The annual formation and retreat of sea ice through the Bering Strait and out over the northeast shelf is a major determinant of species distribution. Annual SST in the Bering Sea ranges from less than 2 °C (winter) to 6–14 °C (summer); in the Aleutian Islands annual SST ranges from 1–10 °C. Areas of note within the region include the Pribilof Islands and Bristol Bay.

The Aleutian Islands archipelago includes approximately 150 islands extending about 2,260 km westward from the Alaska Peninsula to the Kamchatka Peninsula that create a partial geographic barrier to the exchange of northern Pacific marine waters with Eastern Bering Sea waters; net circulation flow is from the Bering Sea to the Chukchi Sea through the Bering Strait. The Aleutian Islands continental shelf is narrow, ranging in width on the north and south sides of the islands from about 4 to 46 km, compared with the Eastern Bering Sea shelf, which ranges from 600–800 km from the shore to the shelf edge. The archipelago is adjacent to the Aleutian Trench, a subduction zone characterized by volcanic activity and earthquake zones. Numerous straits and passes connect the temperate North Pacific to the subpolar Bering Sea; the unique combination of rish nutrients and underwater volcanoes has created diverse and abundant coral habitat.

The CSBSRA includes waters of the Chukchi Sea east of the International Date Line and the Beaufort Sea west of the U.S.-Canada border within the U.S. EEZ. The region is a relatively shallow marginal sea with an extensive continental shelf and is characterized by the annual formation and deformation of sea ice. The Chukchi Sea portion is shallow (water depths to approximately 100 m), while the Beaufort Sea portion consists of narrow, shallow shelf descending to the Arctic Ocean slope and plains of the deep Canada Basin. SST is less than 12 °C in summer and averages 8 °C in the southwest and along the Beaufort coast. The area is considered to be of moderately high productivity in the summer during ice melt; however, the region is considered to be heterogeneous, with the Chukchi more productive than the Beaufort. The ice-free zone of the summer is generally about 150–200 km wide. However, the Arctic climate is changing significantly, and one result of the change is a reduction in the sea ice extent in at least some regions of the Arctic (*e.g.,* Doney *et al.,* 2012; Melillo *et al.,* 2014). Kotzebue Sound is a major coastal region here.

IPHC research activities are carried out within the BSAIRA and GOARA but also within a fourth specified geographical region, *i.e.,* off the U.S. west coast (see Figure C–3 of the AFSC application). The IPHC operates from 36°40′ N (approximately Monterey Bay, California) at the southernmost extension northward to the Canadian border, including U.S. waters within Puget Sound. The California Current Large Marine Ecosystem (off the U.S. west coast) is considered to be of moderately high productivity. SST is fairly consistent, ranging from 9–14 °C in winter and 13–15 °C in summer. Cape Mendocino represents a major biogeographic break, and the region includes major estuaries such Puget Sound. The shelf is generally narrow in the region, and shelf-break topography (*e.g.,* underwater canyons) creates localized upwelling conditions that concentrate nutrients into areas of high topographic relief. The California Current determines the general hydrography off the coast of California. The current moves south along the western coast of North America, with extensive seasonal upwelling of colder, nutrient-rich subsurface waters predominant in the area south of Cape Mendocino. Significant interannual variation in productivity results from the effects of this coastal upwelling as well as from the El Niño-Southern Oscillation and the Pacific Decadal Oscillation. Both oscillations involve transitions from cooler, more productive conditions to warmer, less productive conditions but over different timescales.

IPHC conducts research within Puget Sound, which is affected by high amounts of runoff from the Fraser River. The river plume stimulates primary productivity, carrying nutrients northwards past Vancouver Island year-round. Puget Sound is one of the largest estuaries in the United States and is a place of great physical and ecological complexity and productivity. The average surface water temperature is 12.8 °C in summer and 7.2 °C in winter (Staubitz *et al.,* 1997), but surface waters frequently exceed 20 °C in the summer and fall. With nearly six million people (doubled since the 1960s), Puget Sound is also heavily influenced by human activity.

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 nm from the shoreline and include the 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 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 MSA, MMPA, and the Endangered Species Act (ESA). As noted above, the IPHC conducts research in support of halibut management under the terms of a convention between the United States and Canada, originally ratified in 1924 and amended most recently in 1979.

Within NMFS, six regional fisheries science centers direct and coordinate the collection of scientific information needed to inform fisheries management decisions. Each science center is a distinct entity and is the scientific focal point for a particular region. AFSC conducts research and provides scientific advice to manage fisheries and conserve protected species in Alaska. AFSC provides scientific information to support the North Pacific Fishery Management Council and other domestic and international fisheries management organizations.

The AFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. AFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels, and some AFSC-funded research is conducted by cooperative scientists. The AFSC proposes to administer and conduct approximately 58 survey programs over the five-year period, with an additional two survey programs conducted by the IPHC.

The gear types used fall into several categories: Towed nets fished at various levels in the water column, longline gear, gillnets and seine nets, traps, and other gear. Only use of trawl nets, longlines, and gillnets are likely to result in interaction with marine mammals. Many of these surveys also use active acoustic devices. These surveys may be conducted aboard NOAA-operated research vessels (R/V), including the *Oscar Dyson* and *Fairweather,* the Alaska Department of Fish and Game-operated *Resolution,* and assorted other small vessels owned by AFSC, aboard vessels owned and operated by cooperating agencies and institutions, or aboard charter vessels.

In the following discussion, we summarily describe various gear types used by AFSC, with reference to specific fisheries and ecosystem research activities conducted by the AFSC. This is not an exhaustive list of gear and/or devices that may be utilized by AFSC but is representative of gear categories and is complete with regard to all gears with potential for interaction with marine mammals. Additionally, relevant active acoustic devices, which are commonly used in AFSC survey activities, are described separately in a subsequent section. Please see Appendix A of AFSC's application for further description, pictures, and diagrams of research gear and vessels. Full details regarding planned research activities are provided in Tables 1–1 and C–1 of AFSC's application, with specific gear used in association with each research project and full detail regarding gear characteristics and usage provided. Full detail is not repeated here.

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. Bottom trawls may use bobbins or roller gear to protect the footrope as the net is dragged along the seabed.

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. Trawl vessels typically travel at speeds of 2–5 kn while towing the net for time periods up to several hours. 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 the net is retrieved and the contents of the codend are emptied onto the deck. For research purposes, the speed and duration of the tow and the characteristics of the net are typically 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.

AFSC research trawling activities utilize pelagic (or midwater) and surface trawls, which are designed to operate at various depths within the water column but not to contact the seafloor, as well as bottom trawls. Some research efforts use various commercial trawl nets (commercial midwater trawls may be 75–136 m in width with opening height of 10–20 m, while commercial bottom trawls may be 18–24 m in width with 4–8 m opening height), while others use specific trawls. Examples of the latter include the Poly Nor'eastern bottom trawl, which has a 27.2-m headrope, 24.9-m footrope, and 5.8-m vertical opening; otter bottom trawl with 6-m headrope; the 83–112 Eastern bottom trawl, with 25-m headrope and 34-m footrope; Kodiak bottom trawl (3 m x 4 m x 8 m); the 20 m x 20 m Nordic 264 midwater trawl; 12 m x 12 m midwater anchovy trawl (midwater); Cantrawl surface trawl, with 55-m width and 25-m depth; and Aleutian wing pelagic trawl, with 82.3-m footrope/headrope and a 27.4-m vertical opening. Tow durations are typically 10–30 min (though some experimental trawls may be conducted for much longer, *i.e.,* a period of hours), with tow depths dependent on the purpose of the survey.

AFSC also uses beam trawls, a type of bottom trawl in which the horizontal opening of the net is provided by a heavy beam mounted at each end on guides or skids that travel along the seabed. AFSC beam trawls are 1 m x 1m. On sandy or muddy bottoms, a series of ''tickler'' chains are strung between the skids ahead of the net to stir up the fish from the seabed and chase them into the net. On rocky grounds, these ticklers may be replaced with chain matting. Several trawls may be towed, one on each side of the vessel. The trawls are towed along the seafloor at speeds of 1 to 2 kn. In some shallow, nearshore locations, push trawls may be used, *i.e.,* vessels push nets.

Longline—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. Hooks are attached 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. Radar reflectors, radio transmitters, and light sources are often used to help fishers determine the location of the longline gear prior to retrieval. Segments of bottom longline gear, which are connected to form a single continuous mainline, are often referred to as skates.

A commercial longline can be miles long and have thousands of hooks attached, although longlines used for research surveys are often shorter. However, the longline gear used for AFSC research surveys is typically similar in scale to commercial gear, with 16-km mainlines and 7,200 hooks. IPHC gear consists of 1,800-ft (549-m) skates, with 100 hooks per skate. Three to ten skates may be fished at each sampling station. There are no internationally-recognized standard measurements for hook size, and a given size may be inconsistent between manufacturers. Larger hooks, as are used in longlining, are referenced 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).

The time period between deployment and retrieval of the longline gear is the soak time. Soak time is an important parameter for calculating fishing effort. For commercial fisheries the goal is to optimize the soak time 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. AFSC soak times range from 2–3 hours, while IPHC soak times are typically 5 hours. AFSC also uses hook-and-line, *i.e.,* rod-and-reel, for some survey efforts, totaling approximately 240 rod-hrs per year over 5 days.

Other nets—AFSC surveys utilize various small, fine-mesh, towed nets designed to sample small fish and pelagic invertebrates. These nets can be broadly categorized as small trawls (which are separated from large trawl nets due to small trawls' 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 Tucker trawl is a medium-sized single-warp net used to study pelagic fish and zooplankton. The Tucker trawl consists of a series of nets that can be opened and closed sequentially via stepping motor without retrieving the net from the fishing depth. It is designed for deep oblique tows where up to three replicate nets can be sequentially operated by a double release mechanism and is typically equipped with a full suite of instruments, including inside and outside flow meters; conductivity, temperature, and depth profilers (CTD); and pitch sensor.

2. The Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) uses a stepping motor to sequentially control the opening and closing of the net. The MOCNESS uses underwater and shipboard electronics to control the device. The electronics system continuously monitors the functioning of the nets, frame angle, horizontal velocity, vertical velocity, volume filtered, and selected environmental parameters, such as salinity and temperature. The MOCNESS is used for specialized zooplankton surveys.

3. AFSC also uses various neuston nets, which are frame trawls towed horizontally at the top of the water column in order to capture neuston (*i.e.,* organisms that inhabit the water's surface).

4. An epibenthic tow sled is an instrument designed to collect organisms that live on bottom sediments. It consists of a fine mesh net, typically 1 m x 1 m opening, attached to a rigid frame with runners to help it move along the substrate.

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.

5. Ring nets are used to capture plankton with vertical tows. These nets consist of a circular frame and a cone-shaped net with a collection jar at the codend. The net, attached to a labeled dropline, is lowered into the water while maintaining the net's vertical position. When the desired depth is reached, the net is pulled straight up through the water column to collect the sample.

6. Bongo nets are towed through the water at an oblique angle to sample plankton over a range of depths. Similar to ring nets, these nets typically have a

cylindrical section coupled to a conical portion that tapers to a detachable codend constructed of nylon mesh. During each plankton tow, the bongo nets are deployed to depth and are then retrieved at a controlled rate so that the volume of water sampled is uniform across the range of depths. A collecting bucket, attached to the codend of the net, is used to contain the plankton sample. Some bongo nets can be opened and closed using remote control to enable the collection of samples from particular depth ranges. A group of depth-specific bongo net samples can be used to establish the vertical distribution of zooplankton species in the water column at a site. Bongo nets are generally used to collect zooplankton for research purposes and are not used for commercial harvest.

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. Some AFSC survey activities use small gillnets (10 m x 2 m) with 30-minute set durations; however, gillnet survey activities at Little Port Walter Marine Station in southeast Alaska use larger nets (150 ft x 15 ft (46 m x 5 m)) with longer soak times (2–4 hours).

Seine nets—Seine nets typically hang vertically in the water with the bottom edge held down by weights and the top edge buoyed by floats. Seine nets can be deployed from the shore as a beach seine or from a boat and are actively fished, in comparison with gillnets which may be similar but fish passively. AFSC uses beach seines, which are deployed from shore to surround all fish in the nearshore area, and typically have one end fastened to the shore while the other end is set out in a wide arc and brought back to the beach. This may be done by hand or with a small boat. AFSC research uses some larger beach seines (61 m x 5 m) as well as smaller nets (5 m x 2.5 m). A pole seine is a type of beach seine deployed by hand. The net is pulled along the bottom by hand as two or more people hold the poles and walk through the water. Fish and other organisms are captured by walking the net towards shore or tilting the poles backwards and lifting the net out of the water.

Traps and pots—Traps and pots are submerged, three-dimensional devices, often baited, that permit organisms to enter the enclosure but make escape extremely difficult or impossible. Most traps are attached by a rope to a buoy on the surface of the water and may be deployed in series. The trap entrance can be regulated to control the maximum size of animal that can enter, and the size of the mesh in the body of the trap can regulate the minimum size that is retained. In general, the species caught depends on the type and characteristics of the pot or trap used. AFSC uses fyke traps and crab pots of various sizes.

Fyke traps are bag-shaped nets held open by frames or hoops, often outfitted with wings and/or leaders to guide fish towards the entrance of the actual trap. Fyke trap wings can be set up to form a barrier across a channel, trapping fish that attempt to proceed through the channel. As the tide ebbs, fish eventually seek to leave the wetland channel and are then trapped. AFSC sets fyke traps that are approximately 40 m wide; however, these are only used in freshwater. AFSC also uses net pens, hoop nets, and weirs for some research.

Dredge—A typical dredge consists of a mouth frame with an attached collection bag. Fishers drag a dredge across the sea floor, either scraping or penetrating the bottom. 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. AFSC uses a six foot wide Virginia crab style dredge, which consists of a heavy metal rectangular form bearing a toothed drag bar and a mesh bag to collect specimens.

Conductivity, temperature, and depth profilers—A CTD profiler is the primary research tool for determining chemical and physical properties of seawater. A shipboard CTD is made up of a set of small probes attached to a large (1–2 m diameter) metal rosette wheel. The rosette is lowered through the water column on a cable, and CTD data are observed in real time via a conducting cable connecting the CTD to a computer on the ship. The rosette also holds a series of sampling bottles that can be triggered to close at different depths in order to collect a suite of water samples that can be used to determine additional properties of the water over the depth of the CTD cast. A standard CTD cast, depending on water depth, requires two to five hours to complete. The data from a suite of samples collected at different depths are often called a depth profile. Depth profiles for different variables can be compared in order to glean information about physical, chemical, and biological processes occurring in the water column. Salinity, temperature, and depth data measured by the CTD instrument are essential for characterization of seawater properties.

Tables 1–1 and C–1 of the AFSC's application provide detailed information of all surveys planned by AFSC and IPHC; full detail is not repeated here. We note here that IPHC survey activities do not use active acoustic systems for data acquisition purposes. Therefore, we do not consider the potential for Level B harassment that may result from use of such systems other than for AFSC research programs in the GOARA, BSAIRA, and CSBSRA. Many of these surveys also use small trawls, plankton nets, and/or other gear; however, only gear with likely potential for marine mammal interaction is described. Here we provide a summary of projected annual survey effort in the different research areas for those gears that we believe present the potential for marine mammal interaction (Table 1). This summary is intended only to provide a sense of the level of effort, and actual level of effort may vary from year to year. Gear specifications vary; please see Tables 1–1 and C–1 of AFSC's application.

TABLE 1—PROJECTED ANNUAL AFSC SURVEY EFFORT BY RESEARCH AREA AND GEAR TYPE

Survey type	Gear type	Tows/sets	Duration per tow/set
GOARA			
Bottom trawl	Poly Nor-Eastern (PNE)	59	10 min.
Bottom trawl	Eastern otter	380	10–25 min.
Bottom trawl	Various (commercial)	20–40	45 min to 6.5 hr.
Bottom trawl	To be determined	50	20 min.
Bottom trawl	PNE	820	15 min.
Bottom trawl	PNE	70	15–30 min.

TABLE 1—PROJECTED ANNUAL AFSC SURVEY EFFORT BY RESEARCH AREA AND GEAR TYPE—Continued

Survey type	Gear type	Tows/sets	Duration per tow/set
Bottom trawl	PNE	20	10–20 min.
Bottom trawl	PNE	20	variable.
Bottom trawl	Various (commercial)	4–8	5–10 min.
Bottom trawl	Various (commercial)	6–8	5–45 min.
Midwater trawl	Various (commercial)	20–40	45 min to 3 hr.
Midwater trawl	Anchovy	50–75	Up to 1 hr.
Midwater trawl	Otter	20	20 min.
Midwater trawl	Nordic 264	96	20 min.
Midwater trawl	Cantrawl	80	30 min.
Midwater trawl	Aleutian wing (AWT)	140	10 min to 1 hr.
Gillnet	10 m × 2 m	10	30 min.
Gillnet	46 m × 5 m	50	2–4 hr.
Bottom longline	7,200 hooks (13/0)	95	3 hr.
Bottom longline	< 300 hooks (13/0)	7	2 hr.
BSAIRA			
Bottom trawl	PNE	420	15 min.
Bottom trawl	PNE	70	15–30 min.
Bottom trawl	Bering Sea Combo 101/130	Variable (average 88)	10–90 min.
Bottom trawl	83–112 Eastern otter	536	30 min.
Bottom trawl	83–112 Eastern otter	15	variable.
Bottom trawl	Various (commercial)	40–90	45 min to 6.5 hr
Bottom trawl	PNE	10	variable.
Bottom trawl	PNE	200	30 min.
Bottom trawl	To be determined	50	20 min.
Midwater trawl	Marinovich	35	15–60 min.
Midwater trawl	Cantrawl	185	30 min.
Midwater trawl	Various (commercial)	40–90	45 min to 3 hr.
Midwater trawl	Anchovy	100–125	variable.
Midwater trawl	AWT	110	10 min to 1 hr.
Bottom longline	7,200 hooks (13/0)	75	3 hr.
CSBSRA			
Bottom trawl	83–112 Eastern otter	143	15 min.
Midwater trawl	Cantrawl	70	30 min.

Please note that Table 1 does not include projected survey effort by IPHC. IPHC uses bottom longline gear to sample between an estimated 1,100 and 1,300 survey stations in U.S. waters per year. Although the number of survey stations is estimated, IPHC states that the maximum number of stations would not exceed 1,500. At each station, IPHC fishes 3–10 skates of longline gear, each with 100 hooks (16/0), for a soak time of 5 hours at each station. Hooks are spaced at 18-ft (5.5-m) intervals on 24- to 48-in (0.6- to 1.2-m) gangions. Survey stations are located in water depths from 18–732 m in shelf waters. Please see Figures C–3 through C–5 for depictions of IPHC's survey station distribution.

IPHC also conducts survey effort in order to collect specimens of halibut gonads on a monthly basis. Gear is not standardized for these surveys and would be that which is typically used by the commercial halibut and sablefish fleet. Gear differences are not expected to differentially affect marine mammals, which interact similarly with all of these commercial gears. IPHC requires collection of 50 male and 50 female specimens per month and estimates that this requires approximately 50 total annual days at sea.

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 AFSC'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 AFSC. As noted previously, IPHC does not use active acoustic devices for data acquisition purposes. For general information on sound and its interaction with the marine environment, please see, *e.g.,* Au and Hastings (2008); Richardson *et al.* (1995); Urick (1983).

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 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 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. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square 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 μPa^2-s) represents the total energy in a stated frequency band over a stated time interval or event, and considers both intensity and duration of exposure. The per-pulse SEL is calculated over the time window containing the entire pulse (*i.e.,* 100 percent of the acoustic energy). SEL is a cumulative metric; it can be accumulated over a single pulse, or calculated over periods containing multiple pulses. Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event.

Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-pk) 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 (pk-pk), 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, which is defined as environmental background sound levels lacking a single source or point (Richardson *et al.,* 1995). 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.,* wind and 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 wind and waves, which are a main source of naturally occurring ambient sound for frequencies between 200 hertz (Hz) and 50 kilohertz (kHz) (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Precipitation can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times. Marine mammals can contribute significantly to ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz. Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, geophysical surveys, sonar, and explosions. 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.

The sum of the various natural and anthropogenic sound sources that comprise ambient sound at any given location and time 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 decibels (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. The distinction between these two sound types is not always obvious, as certain signals share properties of both pulsed and non-pulsed sounds. A signal near a source could be categorized as a pulse; but, due to propagation effects as it moves farther from the source, the signal duration becomes longer (*e.g.,* Greene and Richardson, 1988).

Pulsed sound sources (*e.g.,* airguns, explosions, gunshots, 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 an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or intermittent (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. 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 of 160 dB rms SPL and 120 dB rms SPL to determine when an activity that produces impulsive or continuous sound, respectively, might result in impacts to a marine mammal such that a take by Level B 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.

As noted above, continuous sounds are those whose sound pressure level remains above that of the ambient sound, with negligibly small fluctuations in level, while intermittent sounds are defined as sounds with interrupted levels of low or no sound. Thus, echosounder signals are not continuous sounds but rather intermittent sounds. Intermittent sounds can further be defined as either impulsive or non-impulsive. Similar to impulsive sounds, echosounder signals have durations that are typically very brief (< 1 sec) and have temporal characteristics that more closely resemble those of impulsive sounds than non-impulsive sounds, which typically have more gradual rise times and longer decays. With regard to behavioral thresholds, we consider the temporal and spectral characteristics of echosounder signals to more closely resemble those of an impulse sound than a continuous sound. Therefore, NMFS has determined that the 160-dB threshold for impulsive sources is most appropriate for use in considering the potential effects of the AFSC's activities.

A wide range of active acoustic devices are used in AFSC fisheries surveys for remotely sensing bathymetric, oceanographic, and biological features of the environment. Most of these sources involve relatively high frequency, directional, and brief repeated signals tuned to provide sufficient focus and resolution on specific objects. AFSC also uses passive listening sensors (*i.e.,* remotely and passively detecting sound rather than producing it), which do not have the potential to impact marine mammals. AFSC 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.,* 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 (Category 1 and Category 2), 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 (>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.,* Møhl, 1968). 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.

We are aware of two studies (Deng *et al.*, 2014; Hastie *et al.*, 2014) demonstrating some behavioral reaction by marine mammals to acoustic systems operating at user-selected frequencies above 200 kHz. These studies generally indicate only that sub-harmonics could be detectable by certain species at distances up to several hundred meters. However, this detectability is in reference to ambient noise, not to NMFS's established 160-dB threshold for assessing the potential for incidental take for these sources. Source levels of the secondary peaks considered in these studies—those within the hearing range of some marine mammals—range from 135–166 dB, meaning that these sub-harmonics would either be below levels likely to result in Level B harassment or would attenuate to such a level within a few meters. Beyond these important study details, these high-frequency (*i.e.,* Category 1) sources and any energy they may produce below the primary frequency that could be audible to marine mammals would be dominated by a few primary sources that are operated near-continuously, and the potential range above threshold would be so small as to essentially discount them. Therefore, Category 1 sources are not expected to have any effect on marine mammals. Further, recent sound source verification testing of these and other similar systems did not observe any sub-harmonics in any of the systems tested under controlled conditions (Crocker and Fratantonio, 2016). While this can occur during actual operations, the phenomenon may be the result of issues with the system or its installation on a vessel rather than an issue that is inherent to the output of the system. Category 1 sources are not considered further in this document.

Category 2 acoustic sources, which are present on most AFSC 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 AFSC. 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. Primary source categories are described below, and characteristics of representative predominant sources are summarized in Table 2. Predominant sources are those that, when operated, would be louder than and/or have a larger acoustic footprint than other concurrently operated sources, at relevant frequencies.

(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 AFSC 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.

(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.

(3) *Single-Frequency Omnidirectional Sonar*—These sources provide omnidirectional imaging around the source with different vertical beamwidths available, which results in differential transmitting beam patterns. The cylindrical multi-element transducer allows the omnidirectional sonar beam to be electronically tilted down to −90°, allowing automatic tracking of schools of fish within the entire water volume around the vessel.

(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.

TABLE 2—OPERATING CHARACTERISTICS OF REPRESENTATIVE PREDOMINANT AFSC ACTIVE ACOUSTIC SOURCES

Active acoustic system	Operating frequencies	Maximum source level	Single ping duration (ms) and repetition rate (Hz)	Orientation/directionality	Nominal beamwidth
Simrad EK60 narrow beam echosounder.	18, 38, 70, 120, 200 kHz	226.7 dB	1 ms at 1 Hz	Downward looking	11°

TABLE 2—OPERATING CHARACTERISTICS OF REPRESENTATIVE PREDOMINANT AFSC ACTIVE ACOUSTIC SOURCES—Continued

Active acoustic system	Operating frequencies	Maximum source level	Single ping duration (ms) and repetition rate (Hz)	Orientation/directionality	Nominal beamwidth
Simrad ME70 narrow beam echosounder.	70 kHz	226.7 dB	1 ms at 1 Hz	Downward looking	11°
Simrad ES60 multibeam echosounder.	38 and 120 kHz	226.6 dB	1 ms at 1 Hz	Downward looking	7°
Reson 7111 multibeam echosounder.	38, 50, 100, 180, 300 kHz	230 dB	not provided	Downward looking	150°

Description of Marine Mammals in the Area of the Specified Activity

We have reviewed AFSC's 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 AFSC's application (and Sections 3 and 4 of Appendix C, which specifically addresses the IPHC activities), instead of reprinting the information here. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SAR; *www.nmfs.noaa.gov/pr/sars/*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS's website (*www.nmfs.noaa.gov/pr/species/mammals/*).

Table 3 lists all species with expected potential for occurrence in the specified geographical regions where AFSC and IPHC propose to conduct the specified activities and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2017). 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 Analysis'').

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 or survey area. NMFS's 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. All managed stocks in the specified geographical regions are assessed in either NMFS's U.S. Alaska SARs or U.S. Pacific SARs. All values presented in Table 3 are the most recent available at the time of writing and are available in the 2016 SARs (Carretta *et al.,* 2017; Muto *et al.,* 2017) or draft 2017 SARs (available online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*).

Forty species (with 88 managed stocks) are considered to have the potential to co-occur with AFSC and IPHC activities. Species that could potentially occur in the proposed research areas but are not expected to have the potential for interaction with AFSC research gear or that are not likely to be harassed by AFSC's use of active acoustic devices are described briefly but omitted from further analysis. These include extralimital species, 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. The only species considered to be extralimital here are the narwhal (*Monodon monoceros;* CSBSRA only) and the Bryde's whale (*Balaenoptera edeni brydei;* IPHC U.S. west coast research area only). In addition, the sea otter is found in coastal waters—with the northern (or eastern) sea otter (*Enhydra lutris kenyoni*) found in Alaska—and the Pacific walrus (*Odobenus rosmarus divergens*) and polar bear (*Ursus maritimus*) may also occur in AFSC research areas. However, these species are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

Two populations of gray whales are recognized, eastern and western North Pacific (ENP and WNP). WNP whales are known to feed in the Okhotsk Sea and off of Kamchatka before migrating south to poorly known wintering grounds, possibly in the South China Sea. The two populations have historically been considered geographically isolated from each other; however, data from satellite-tracked whales indicate that there is some overlap between the stocks. Two WNP whales were tracked from Russian foraging areas along the Pacific rim to Baja California (Mate *et al.,* 2011), and, in one case where the satellite tag remained attached to the whale for a longer period, a WNP whale was tracked from Russia to Mexico and back again (IWC, 2012). Between 22–24 WNP whales are known to have occurred in the eastern Pacific through comparisons of ENP and WNP photo-identification catalogs (IWC, 2012; Weller *et al.,* 2011; Burdin *et al.,* 2011). Urban *et al.* (2013) compared catalogs of photo-identified individuals from Mexico with photographs of whales off Russia and reported a total of 21 matches. Therefore, a portion of the WNP population is assumed to migrate, at least in some years, to the eastern Pacific during the winter breeding season.

However, the AFSC does not believe that any gray whale (WNP or ENP) would be likely to interact with its research gear, as it is extremely unlikely that a gray whale in close proximity to AFSC research activity would be one of the few WNP whales that have been documented in the eastern Pacific. The likelihood that a WNP whale would interact with AFSC research gear is insignificant and discountable, and WNP gray whales are omitted from further analysis.

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Table 3. Marine Mammals Potentially Present in the Vicinity of AFSC Research Activities.

Common name	Scientific name	Stock	Occurrence[1]				ESA/ MMPA status; Strategic (Y/N)[2]	Stock abundance (CV, N_{min}, most recent abundance survey)[3]	PBR	Annual M/SI[4]
			WC	GOA	BSAI	CSBS				
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)										
Family Balaenidae										
North Pacific right whale	*Eubalaena japonica*	Eastern North Pacific (ENP)		X	X		E/D; Y	31 (0.226; 26; 2013)	0.05	0
Bowhead whale	*Balaena mysticetus*	Western Arctic			X	X	E/D; Y	16,820 (0.052; 16,100; 2011)	161	43
Family Eschrichtiidae										
Gray whale	*Eschrichtius robustus*	ENP	X	X	X	X	-; N	20,990 (0.05; 20,125; 2011)	624	132
Family Balaenopteridae (rorquals)										
Humpback whale	*Megaptera novaeangliae kuzira*	California/ Oregon/ Washington (CA/OR/WA)*	X				E/D; Y	1,918 (0.03; 1,876; 2014)	11[11]	≥9.2
		Central North Pacific (CNP)*		X	X		E/D; Y	10,103 (0.3; 7,890; 2006)	83	25
		Western North Pacific*		X	X	X	E/D; Y	1,107 (0.3; 865; 2006)	3	3.2
Minke whale	*Balaenoptera acutorostrata scammoni*	CA/OR/WA	X				-; N	636 (0.72; 369; 2014)	3.5	≥1.3
		Alaska*		X	X	X	-; N	Unknown	n/a	0
Sei whale	*B. borealis borealis*	ENP	X	X	X		E/D; Y	519 (0.4; 374; 2014)	0.75	0
Fin whale	*B. physalus physalus*	CA/OR/WA	X				E/D; Y	9,029 (0.12; 8,127; 2014)	81	≥2.0
		Northeast Pacific*		X	X	X	E/D; Y	Unknown	n/a	0.4
Blue whale	*B. musculus musculus*	ENP	X	X	X		E/D; Y	1,647 (0.07; 1,551; 2011)	2.3[11]	≥0.2
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)										
Family Physeteridae										
Sperm whale	*Physeter macrocephalus*	CA/OR/WA	X				E/D; Y	1,997 (0.57; 1,270; 2014)	2.5	0.9
		North Pacific*		X	X		E/D; Y	Unknown	n/a	3.7
Family Kogiidae										
Pygmy sperm whale	*Kogia breviceps*	CA/OR/WA	X				-; N	4,111 (1.12; 1,924; 2014)	19	0

Dwarf sperm whale	*K. sima*	CA/OR/WA[6]	X				-; N	Unknown	n/a	0
Family Ziphiidae (beaked whales)										
Cuvier's beaked whale	*Ziphius cavirostris*	CA/OR/WA	X				-; N	3,274 (0.67; 2,059; 2014)	21	<0.1
		Alaska		X	X		-; N	Unknown	n/a	0
Baird's beaked whale	*Berardius bairdii*	CA/OR/WA	X				-; N	2,697 (0.6; 1,633; 2014)	16	0
		Alaska		X	X		-; N	Unknown	n/a	0
Stejneger's beaked whale	*Mesoplodon stejnegeri*	Alaska		X	X		-; N	Unknown	n/a	0
Hubbs' beaked whale	*M. carlhubbsi*	CA/OR/WA[7]	X				-; N	3,044 (0.54; 1,967; 2014)	20	0.1
Blainville's beaked whale	*M. densirostris*		X							
Ginkgo-toothed beaked whale	*M. ginkgodens*		X							
Perrin's beaked whale	*M. perrini*		X							
Lesser (pygmy) beaked whale	*M. peruvianus*		X							
Stejneger's beaked whale	*M. stejnegeri*		X							
Family Monodontidae										
Beluga whale	*Delphinapterus leucas*	Beaufort Sea[9]			X	X	-; N	39,258 (0.229; 32,453; 1992)	649	139
		Eastern Chukchi Sea			X	X	-; N	20,752 (0.7; 12,194; 2012)	244	67
		Eastern Bering Sea[9]			X		-; N	19,186 (0.32; 14,751; 2000)	n/a	181
		Bristol Bay[9]			X		-; N	1,926 (0.25; 2,435; 2005)	58	25
		Cook Inlet		X			E/D; Y	312 (0.1; 287; 2014)	n/a	0
Family Delphinidae										
Common bottlenose dolphin	*Tursiops truncatus truncatus*	CA/OR/WA Offshore	X				-; N	1,924 (0.54; 1,255; 2014)	11	≥1.6
		California Coastal	X				-; N	453 (0.06; 346; 2011)	2.7	≥2.0
Striped dolphin	*Stenella coeruleoalba*	CA/OR/WA	X				-; N	29,211 (0.2; 24,782; 2014)	238	≥0.8

ENP long-beaked common dolphin	*Delphinus delphis bairdii*	California	X				-; N	101,305 (0.49; 68,432; 2014)	657	≥35.4
Common dolphin	*D. d. delphis*	CA/OR/WA	X				-; N	969,861 (0.17; 839,325; 2014)	8,393	≥40
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	CA/OR/WA	X				-; N	26,814 (0.28; 21,195; 2014)	191	7.5
		North Pacific[9]		X	X		-; N	26,880 (n/a; 26,880; 1990)	n/a	0
Northern right whale dolphin	*Lissodelphis borealis*	CA/OR/WA	X				-; N	26,556 (0.44; 18,608; 2014)	179	3.8
Risso's dolphin	*Grampus griseus*	CA/OR/WA	X				-; N	6,336 (0.32; 4,817; 2014)	46	≥3.7
Killer whale	*Orcinus orca*[5]	ENP Offshore	X	X	X		-; N	240 (0.49; 162; 2014)	1.6	0
		West Coast Transient[8]	X	X			-; N	243 (n/a; 2009)	2.4	0
		AT1 Transient		X			D; Y	7 (n/a; 2016)	0	0
		ENP Gulf of Alaska, Aleutian Islands, and Bering Sea Transient		X	X	X	-; N	587 (n/a; 2012)	5.9	1
		ENP Southern Resident	X				E/D; Y	83 (n/a; 2016)	0.14	0
		ENP Northern Resident	X	X			-; N	261 (n/a; 2011)	1.96	0
		ENP Alaska Resident		X	X		-; N	2,347 (n/a; 2012)	24	1
Short-finned pilot whale	*Globicephala macrorhynchus*	CA/OR/WA	X				-; N	836 (0.79; 466; 2014)	4.5	1.2
Family Phocoenidae (porpoises)										
Harbor porpoise	*Phocoena phocoena vomerina*	Morro Bay	X				-; N	2,917 (0.41; 2,102; 2012)	21	≥0.6
		Monterey Bay	X				-; N	3,715 (0.51; 2,480; 2011)	25	0
		San Francisco-Russian River	X				-; N	9,886 (0.51; 6,625; 2011)	66	0
		Northern CA/Southern OR	X				-; N	35,769 (0.52; 23,749; 2011)	475	≥0.6
		Northern OR/WA Coast	X				-; N	21,487 (0.44; 15,123; 2011)	151	≥3
		Washington	X				-; N	11,233	66	≥7.2

		Inland Waters						(0.37; 8,308; 2015)		
		Southeast Alaska*		X			-; Y	Unknown	n/a	34
		Gulf of Alaska[9]		X			-; Y	31,046 (0.214; 25,987; 1998)	n/a	72
		Bering Sea[9]			X	X	-; Y	48,215 (0.223; 40,039; 1999)	n/a	0.4
Dall's porpoise	*Phocoenoides dalli dalli*	CA/OR/WA	X				-; N	25,750 (0.45; 17,954; 2014)	172	0.3
		Alaska[9]		X	X		-; N	83,400 (0.097; n/a; 1993)	n/a	38
Order Carnivora – Superfamily Pinnipedia										
Family Otariidae (eared seals and sea lions)										
Guadalupe fur seal	*Arctocephalus philippii townsendi*	Mexico to California	X				T/D; Y	20,000 (n/a; 15,830; 2010)	542	≥3.2[12]
Northern fur seal	*Callorhinus ursinus*	Pribilof Islands/Eastern Pacific	X	X	X		D; Y	637,561 (0.2; 539,638; 2015)	11,602	436
		California	X	X			-; N	14,050 (n/a; 7,524; 2013)	451	1.8
California sea lion	*Zalophus californianus*	United States	X				-; N	296,750 (n/a; 153,337; 2011)	9,200	389
Steller sea lion	*Eumetopias jubatus monteriensis*	Eastern U.S.	X	X			-; N	41,638 (n/a; 2015)	2,498	108
	E. j. jubatus	Western U.S.		X	X		E/D; Y	53,303 (n/a; 2016)	320	241
Family Phocidae (earless seals)										
Bearded seal	*Erignathus barbatus nauticus*	Alaska (Beringia DPS)*			X	X	T/D; Y	273,676*	8,210*	391
Harbor seal	*Phoca vitulina richardii*	California	X				-; N	30,968 (n/a; 27,348; 2012)	1,641	43
		OR/WA Coast[9]	X				-; N	24,732 (0.12; 22,380; 1999)	n/a	10.6
		Washington Northern Inland Waters[9]	X				-; N	11,036 (0.15; 7,213; 1999)	n/a	9.8
		Southern Puget Sound[9]	X				-; N	1,568 (0.15; 1,025; 1999)	n/a	3.4
		Hood Canal[9]	X				-; N	1,088 (0.15; 711; 1999)	n/a	0.2
		Clarence Strait[10]		X			-; N	31,634	1,222	41

								(4,518; 29,093; 2011)		
		Dixon/Cape Decision[10]		X			-; N	18,105 (1,614; 16,727; 2011)	703	69
		Sitka/Chatham Strait[10]		X			-; N	14,855 (2,106; 13,212; 2011)	555	77
		Lynn Canal/ Stephens Passage[10]		X			-; N	9,478 (1,467; 8,605; 2011)	155	50
		Glacier Bay/Icy Strait[10]		X			-; N	7,210 (1,866; 5,647; 2011)	169	104
		Cook Inlet/ Shelikof Strait[10]		X			-; N	27,386 (3,328; 25,651; 2011)	770	234
		Prince William Sound[10]		X			-; N	29,889 (13,846; 27,936; 2011)	838	279
		South Kodiak[10]		X			-; N	19,199 (2,429; 17,479; 2011)	314	128
		North Kodiak[10]		X			-; N	8,321 (1,619; 7,096; 2011)	298	37
		Bristol Bay[10]			X		-; N	32,350 (6,882; 28,146; 2011)	1,182	142
		Pribilof Islands[10]			X		-; N	232 (n/a; 2010)	7	0
		Aleutian Islands[10]			X		-; N	6,431 (882; 5,772; 2011)	173	90
Spotted seal	*P. largha*	Alaska			X	X	-; N	461,625 (n/a; 423,237; 2013)	12,697	329
Ringed seal	*Pusa hispida hispida*	Alaska*			X	X	T/D; N	Unknown	n/a	1,054
Ribbon seal	*Histriophoca fasciata*	Alaska			X	X	-; N	184,000 (n/a; 163,086; 2013)	9,785	3.8
Northern elephant seal	*Mirounga angustirostris*	California Breeding	X	X	X		-; N	179,000 (n/a; 81,368; 2010)	4,882	8.8

*Stocks marked with an asterisk are addressed in further detail in text below.

[1]WC: west coast (including Puget Sound); GOA: Gulf of Alaska; BSAI: Bering Sea/Aleutian Islands; CSBS: Chukchi Sea/Beaufort Sea

[2]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. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[3]NMFS marine mammal stock assessment reports at: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*. CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For most stocks of killer whales, the abundance values represent direct counts of individually identifiable animals; therefore there is only a single abundance estimate with no associated CV. For certain stocks of pinnipeds, abundance estimates are based upon observations of animals (often pups) ashore multiplied by some correction factor derived from knowledge of the species' (or similar species') life history to arrive at a best abundance estimate; therefore, there is no associated CV. In these cases, the minimum abundance may represent actual counts of all animals ashore.

[4]These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.*, commercial fisheries, subsistence hunting, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value. All M/SI values are as presented in the 2016 SARs (Carretta *et al.*, 2017; Muto *et al.*, 2017).

[5]Transient and resident killer whales are considered unnamed subspecies (Committee on Taxonomy, 2017).

[6]No information is available to estimate the population size of dwarf sperm whales off the U.S. west coast, as no sightings of this species have been documented despite numerous vessel surveys of this region (Carretta *et al.*, 2017). Dwarf and pygmy sperm whales are difficult to differentiate at sea but, based on previous sighting surveys and historical stranding data, it is thought that recent ship survey sightings were of pygmy sperm whales.

[7]The six species of Mesoplodont beaked whales occurring in the CA/OR/WA region are managed as a single stock due to the rarity of records and the difficulty in distinguishing these animals to species in the field. Based on bycatch and stranding records, it appears that *M. carlhubbsi* is the most commonly encountered of these species (Carretta *et al.*, 2008; Moore and Barlow, 2013).

[8]The abundance estimate for this stock includes only animals from the "inner coast" population occurring in inside waters of southeastern Alaska, British Columbia, and Washington—excluding animals from the "outer coast" subpopulation, including animals from California—and therefore should be considered a minimum count. For comparison, the previous abundance estimate for this stock, including counts of animals from California that are now considered outdated, was 354.

[9]Abundance estimates for these stocks are not considered current. PBR is therefore considered undetermined for these stocks, as there is no current minimum abundance estimate for use in calculation. We nevertheless present the most recent abundance estimates, as these represent the best available information for use in this document. For some stocks of beluga whale, PBR is calculated despite a lack of current recent survey data. For the Beaufort Sea stock, recent trend data suggest that the stock is at least as large as it was when the minimum abundance was last estimated; therefore, it is acceptable to use the information to calculate PBR. Similarly, the Bristol Bay stock of beluga whales is known to be increasing, and the available abundance information may be used to calculate a PBR value. Despite current abundance information for the Cook Inlet stock of beluga whales, a PBR cannot be calculated because the stock does not meet the assumptions inherent to the use of the PBR equation, *i.e.*, despite low abundance relative to historical estimates and low known levels of human-caused mortality since 1999, the stock is not increasing (for unknown reasons).

[10]For harbor seal stocks in Alaska, abundance estimates are based on aerial survey data with survey counts adjusted to account for the influence of external conditions (*e.g.*, tide, time of day, day of year) on the number of seals hauled out on shore, and counted, during the surveys. Corrections are also made to account for the proportion of seals in the water and not counted. The minimum population estimate is calculated as the lower bound of the 80 percent credible interval obtained from the posterior distribution of abundance estimates. For these stocks, an estimate of standard error associated with the abundance estimate is provided rather than CV. For the Pribilof Islands stock, the abundance estimate represents a complete count of individuals in the stock.

[11]These stocks are known to spend a portion of their time outside the U.S. EEZ. Therefore, the PBR presented here is the allocation for U.S. waters only and is a portion of the total. The total PBR for blue whales is 9.3 (one-quarter allocation for U.S. waters), and the total for CA/OR/WA humpback whales is 22 (one half allocation for U.S. waters). Annual M/SI presented for these species is for U.S. waters only.

[12]This represents annual M/SI in U.S. waters. However, the vast majority of M/SI for this stock—the level of which is unknown—would likely occur in Mexican waters.

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Prior to 2016, humpback whales were listed under the ESA as an endangered species worldwide. Following a 2015 global status review (Bettridge *et al.*, 2015), NMFS established 14 distinct population segments (DPS) with different listing statuses (81 FR 62259; September 8, 2016) pursuant to the ESA. The DPSs that occur in U.S. waters do not necessarily equate to the existing stocks designated under the MMPA and shown in Table 3. Because MMPA stocks cannot be portioned, *i.e.,* parts managed as ESA-listed while other parts managed as not ESA-listed, until such time as the MMPA stock delineations are reviewed in light of the DPS designations, NMFS considers the existing humpback whale stocks under the MMPA to be endangered and depleted for MMPA management purposes (*e.g.,* selection of a recovery factor, stock status).

Within Alaska and U.S. west coast waters, four current DPSs may occur: The Western North Pacific (WNP) DPS (endangered), Hawaii DPS (not listed), Mexico DPS (threatened), and Central America DPS (endangered). According to Wade *et al.* (2016), in the Aleutian Islands and Bering, Chukchi, and Beaufort Seas, encountered whales are most likely to be from the Hawaii DPS (86.5 percent), but could be from the Mexico DPS (11.3 percent) or WNP DPS (4.4 percent). The same pattern holds in the Gulf of Alaska, with the probability of encountering whales from these same DPSs expected to be 89 percent, 10.5 percent, and 0.5 percent, respectively, and in southeast Alaska (93.9 percent from Hawaii DPS and 6.1 percent from Mexico DPS). Off of Washington, whales remain most likely to be from the Hawaii DPS (52.9 percent), but are almost equally likely to be from the Mexico DPS (41.9 percent), and could also be from the Central America DPS (14.7 percent). Off of Oregon and California, whales are most likely to be from the Mexico DPS (89.6 percent), with a 19.7 percent probability of an encountered whale being from the Central America DPS. Note that these probabilities reflect the upper limit of the 95 percent confidence interval of the probability of occurrence; therefore, numbers may not sum to 100 percent for a given area.

Although no comprehensive abundance estimate is available for the Alaska stock of minke whales, recent surveys provide estimates for portions of the stock's range. A 2010 survey conducted on the eastern Bering Sea shelf produced a provisional abundance estimate of 2,020 (CV = 0.73) whales (Friday *et al.,* 2013). This estimate is considered provisional because it has not been corrected for animals missed on the trackline, animals submerged when the ship passed, or responsive movement. Additionally, line-transect surveys were conducted in shelf and nearshore waters (within 30–45 nautical miles of land) in 2001–2003 between the Kenai Peninsula (150° W) and Amchitka Pass (178° W). Minke whale abundance was estimated to be 1,233 (CV = 0.34) for this area (also not been corrected for animals missed on the trackline) (Zerbini *et al.,* 2006). The majority of the sightings were in the Aleutian Islands, rather than in the Gulf of Alaska, and in water shallower than 200 m. These estimates cannot be used as an estimate of the entire Alaska stock of minke whales because only a portion of the stock's range was surveyed. Similarly, although a comprehensive abundance estimate is not available for the northeast Pacific stock of fin whales, provisional estimates representing portions of the range are available. The same 2010 survey of the eastern Bearing sea shelf provided an estimate of 1,061 (CV = 0.38) fin whales (Friday *et al.,* 2013). The estimate is not corrected for missed animals, but is expected to be robust as previous studies have shown that only small correction factors are needed for fin whales (Barlow, 1995). Zerbini *et al.* (2006) produced an estimate of 1,652 (95% CI: 1,142–2,389) fin whales for the area described above.

Current and historical estimates of the abundance of sperm whales in the North Pacific are considered unreliable, and caution should be exercised in interpreting published estimates (Muto *et al.,* 2017). However, Kato and Miyashita (1998) produced an abundance estimate of 102,112 (CV = 0.155) sperm whales in the western North Pacific (believed to be positively biased). The number of sperm whales occurring within Alaska waters is unknown.

Using 2010–2012 survey data for the inland waters of southeast Alaska, Dahlheim *et al.* (2015) calculated a combined abundance estimate for harbor porpoise in the northern (including Cross Sound, Icy Strait, Glacier Bay, Lynn Canal, Stephens Passage, and Chatham Strait) and southern (including Frederick Sound, Sumner Strait, Wrangell and Zarembo Islands, and Clarence Strait as far south as Ketchikan) regions of the inland waters of 975 (CV = 0.1). Because this abundance estimate has not been corrected for detection biases, which are expected to be high for harbor porpoise, the estimate is likely conservative (Muto *et al.,* 2017). However, this estimate may be used to calculate a minimum abundance estimate of 896 harbor porpoise for the area, with a corresponding PBR value of 8.9.

No estimate of population abundance is available for the entire Alaska stock of bearded seals (note that this stock corresponds with the Beringia DPS designated pursuant to the ESA and listed as threatened). However, during 2012–2013, U.S. and Russian researchers conducted aerial abundance and distribution surveys over the entire Bering Sea and Sea of Okhotsk (Moreland *et al.* 2013). A sub-sample of data from the U.S. portion of the Bering Sea were analyzed by Conn *et al.* (2014) to produce an abundance estimate of approximately 299,174 (95% CI: 245,476–360,544) bearded seals in U.S. waters. However, this estimate does not include seals that were in the Chukchi and Beaufort seas at the time of the surveys and therefore must be considered an underestimate. Using this estimate, a minimum abundance of 273,676 seals in the U.S. sector of the Bering Sea (and associated PBR of 8,210) was calculated.

Most taxonomists recognize five subspecies of ringed seals. The Arctic ringed seal subspecies occurs in the Arctic Ocean and Bering Sea and is the only stock that occurs in U.S. waters (referred to as the Alaska stock). NMFS listed the Arctic ringed seal subspecies as threatened under the ESA on December 28, 2012 (77 FR 76706), primarily due to anticipated loss of sea ice through the end of the 21st century due to ongoing climate change. On March 11, 2016, the U.S. District Court for the District of Alaska issued a memorandum decision in a lawsuit challenging the listing of ringed seals under the ESA (*Alaska Oil and Gas Association, et al.* v. *National Marine Fisheries Service, et al.,* Case No. 4:14–cv–00029–RRB). The decision vacated NMFS's listing of the Arctic subspecies of ringed seals as a threatened species. NMFS appealed that decision and on February 12, 2018, the Ninth Circuit U.S. Court of Appeals upheld the decision to list the ringed seal as threatened. The decision was affirmed and the listing reinstated on May 15, 2018.

A comprehensive and reliable abundance estimate for the Alaska stock of ringed seals is not available. However, using data from surveys in the late 1990s and 2000 (Bengtson *et al.,* 2005; Frost *et al.,* 2004), Kelly *et al.* (2010) estimated the total population in the Alaska Chukchi and Beaufort seas to be at least 300,000 ringed seals. This is likely an underestimate since surveys in the Beaufort Sea were limited to within 40 km from shore (Muto *et al.,* 2017). Using the same survey data described above for bearded seals, Conn *et al.* (2014) calculated an abundance estimate of about 170,000 ringed seals for the U.S. portion of the Bering Sea. This estimate did not account for availability bias and did not include ringed seals in the shorefast ice zone, which were surveyed using a different method. Thus, the actual number of ringed seals in the U.S. sector of the Bering Sea is likely much higher, perhaps by a factor of two or more (Muto *et al.,* 2017).

Take Reduction Planning—Take reduction plans are designed to 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. Take reduction teams are convened to develop these plans.

There are no take reduction plans currently in effect for Alaskan fisheries. For marine mammals off the U.S. west coast, there is currently one take reduction plan in effect (Pacific Offshore Cetacean Take Reduction Plan). The goal of this plan is to reduce M/SI of several marine mammal stocks incidental to the California thresher shark/swordfish drift gillnet fishery (CA DGN). A team was convened in 1996 and a final plan produced in 1997 (62 FR 51805; October 3, 1997). Marine mammal stocks of concern initially included the California, Oregon, and Washington stocks for beaked whales, short-finned pilot whales, pygmy sperm whales, sperm whales, and humpback whales. The most recent five-year averages of M/SI for these stocks are below PBR. More information is available online at: *www.nmfs.noaa.gov/pr/interactions/trt/poctrp.htm.* Of the stocks of concern, the AFSC has requested the authorization of incidental M/SI for the short-finned pilot whale only (on behalf of IPHC; see ''Estimated Take'' later in this document). The most recent reported average annual human-caused mortality for short-finned pilot whales (2010–14) is 1.2 animals. The IPHC does not use drift gillnets in its fisheries research program; therefore, take reduction measures applicable to the CA DGN fisheries are not relevant.

Unusual Mortality Events (UME)—A UME is defined under the MMPA 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 19 formally recognized UMEs on the U.S. west coast or in Alaska involving species under NMFS' jurisdiction. The only currently ongoing investigations involve Guadalupe fur seals and California sea lions along the west coast. Increased strandings of Guadalupe fur seals (up to eight times the historical average) have occurred along the entire coast of California. These increased strandings were reported beginning in January 2015 and peaked from April through June 2015, but have remained well above average through 2017. Findings from the majority of stranded animals include malnutrition with secondary bacterial and parasitic infections. Beginning in January 2013, elevated strandings of California sea lion pups were observed in southern California, with live sea lion strandings nearly three times higher than the historical average. Findings to date indicate that a likely contributor to the large number of stranded, malnourished pups was a change in the availability of sea lion prey for nursing mothers, especially sardines. These UMEs are occurring in the same areas and the causes and mechanisms of this remain under investigation (*www.nmfs.noaa.gov/pr/health/mmume/guadalupefurseals2015.html; www.nmfs.noaa.gov/pr/health/mmume/californiasealions2013.htm;* accessed November 24, 2017).

Another recent, notable UME involved large whales and occurred in the western Gulf of Alaska and off of British Columbia, Canada. Beginning in May 2015, elevated large whale mortalities (primarily fin and humpback whales) occurred in the areas around Kodiak Island, Afognak Island, Chirikof Island, the Semidi Islands, and the southern shoreline of the Alaska Peninsula. Although most carcasses have been non-retrievable as they were discovered floating and in a state of moderate to severe decomposition, the UME is likely attributable to ecological factors, *i.e.,* the 2015 El Niño, ''warm water blob,'' and the Pacific Coast domoic acid bloom. While the UME remains under investigation at the time of this writing, the dates of the UME are considered to be from May 22, through December 31, 2015 (western Gulf of Alaska) and from April 23, 2015 through April 16, 2016 (British Columbia). More information is available online at *www.nmfs.noaa.gov/pr/health/mmume/large_whales_2015.html.*

Additional UMEs in the past ten years include those involving ringed, ribbon, spotted, and bearded seals (collectively ''ice seals'') (2011; disease); harbor porpoises in California (2008; cause determined to be ecological factors); Guadalupe fur seals in the Northwest (2007; undetermined); large whales in California (2007; human interaction); cetaceans in California (2007; undetermined); and harbor porpoises in the Pacific Northwest (2006; undetermined). For more information on UMEs, please visit: *www.nmfs.noaa.gov/pr/health/mmume/events.html.*

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 mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2016) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with an exception for lower limits for low-frequency cetaceans where the result was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. 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): Generalized hearing is estimated to occur between approximately 7 Hz and 35 kHz, with best hearing estimated to be from 100 Hz to 8 kHz;

• Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids): Generalized hearing is estimated to occur between approximately 150 Hz and 160 kHz, with best hearing from 10 to less than 100 kHz;

• High-frequency cetaceans (porpoises, river dolphins, and members of the genera *Kogia* and *Cephalorhynchus;* including two members of the genus *Lagenorhynchus,* on the basis of recent echolocation data and genetic data): Generalized hearing is estimated to occur between approximately 275 Hz and 160 kHz;

• Pinnipeds in water; Phocidae (true seals): Functional hearing is estimated to occur between approximately 50 Hz to 86 kHz, with best hearing between 1–50 kHz;

• Pinnipeds in water; Otariidae (eared seals): Functional hearing is estimated to occur between 60 Hz and 39 kHz for Otariidae, with best hearing between 2–48 kHz.

For more detail concerning these groups and associated frequency ranges, please see NMFS (2016) for a review of available information. Forty marine mammal species (30 cetacean and ten pinniped (four otariid and six phocid) species) have the potential to co-occur with AFSC and IPHC research activities. Please refer to Table 3. Of the 30 cetacean species that may be present, eight are classified as low-frequency cetaceans (*i.e.,* all mysticete species), eighteen are classified as mid-frequency cetaceans (*i.e.,* all delphinid and ziphiid species and the sperm whale), and four are classified as high-frequency cetaceans (*i.e.,* porpoises and *Kogia* spp.).

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'' section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The ''Negligible Impact Analysis and Determination'' section considers the content of this section and the material it references, the ''Estimated Take'' section, and the ''Proposed Mitigation'' section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species 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. Superficial strikes may not kill or result in the death of the animal. These interactions are typically associated with large 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 90 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 kn. The chances of a lethal injury decline from approximately 80 percent at 15 kn to approximately 20 percent at 8.6 kn. At speeds below 11.8 kn, the chances of lethal injury drop below fifty percent, while the probability asymptotically increases toward one hundred percent above 15 kn.

In an effort to reduce the number and severity of strikes of the endangered North Atlantic right whale (*Eubalaena glacialis*), 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 80 to 90 percent.

For vessels used in AFSC research activities, transit speeds average 10 kn (but vary from 6–14 kn), while vessel speed during active sampling with towed gear is typically only 2–4 kn. 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 is less than 50 percent. However, the likelihood of a strike actually happening is again unlikely. 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 hydrographic survey vessel traveling at low speed (5.5 kn) while conducting 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. The strike represents the only such incident in approximately 540,000 hours of similar coastal mapping activity ($p = 1.9 \times 10^{-6}$; 95% CI = $0\text{–}5.5 \times 10^{-6}$; 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.

Although the likelihood of vessels associated with research surveys striking a marine mammal are low, we require a robust ship strike avoidance protocol (see ''Proposed Mitigation''), which we believe eliminates any foreseeable risk of ship strike. We anticipate that vessel collisions involving AFSC research vessels, while not impossible, represent unlikely, unpredictable events for which there are no preventive measures. No ship strikes have been reported from any fisheries research activities conducted or funded by the AFSC. 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 relative to commercial ship traffic, 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 AFSC were described previously under ''Detailed Description of Activity.'' Here, we broadly categorize these gears into those whose use we consider to have an extremely unlikely potential to result in marine mammal interaction and those whose use we believe may result in marine mammal interaction. Gears in the former category are not considered further, while those in the latter category are carried forward for further analysis. Gears with likely potential for marine mammal interaction include trawls, longlines, and gillnets.

Trawl nets, longlines, and gillnets deployed by AFSC 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 and set or passive fishing gear (*e.g.,* gillnets, traps) the most likely to be interacted with (*e.g.,* 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, 2017). 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 pelagic trawls (midwater or surface, *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 pelagic 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 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 in order 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, pelagic 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 17 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 (Perez, 2006; Young and Iudicello, 2007; Karpouzli and Leaper, 2004; Hall *et al.,* 2000; Fertl and Leatherwood, 1997; Northridge, 1991; Song *et al.,* 2010). At least eighteen species of seals and sea lions are known to have been killed in trawl nets (Wickens, 1995; Perez, 2006; Zeeberg *et al.,* 2006). Generally, direct interaction between trawl nets and marine mammals (both cetaceans and pinnipeds) has been recorded wherever trawling and animals co-occur. A lack of recorded interactions where animals are known to be present may indicate simply that trawling is absent or an insignificant component of fisheries in that region or that interactions were not observed, recorded, or reported.

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,'' AFSC has recorded marine mammal interactions with the Cantrawl surface trawl net but also has one recorded interaction with a bottom trawl. Other midwater trawl nets, such as the Nordic 264 and Cobb trawl, have demonstrated potential for marine mammal interaction based on interaction records from other NMFS science centers.

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 (the latter not used by AFSC). 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. 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).

As was noted for trawl nets, many species of cetaceans and pinnipeds are documented to have been killed by longlines, including several large whales, porpoises, a variety of delphinids, seals, and sea lions (Perez, 2006; Young and Iudicello, 2007; Northridge, 1984, 1991; Wickens, 1995). Generally, direct interaction between longlines and marine mammals (both cetaceans and pinnipeds) has been recorded wherever longline fishing and animals co-occur. A lack of recorded interactions where animals are known to be present may indicate simply that longlining is absent or an insignificant component of fisheries in that region or that interactions were not observed, recorded, or reported.

In evaluating risk relative to a specific fishery (or research survey), one must consider the length of the line and number of hooks deployed as well as frequency, timing, and location of deployment. These considerations inform determinations of whether interaction with marine mammals is likely. AFSC has not recorded marine mammal interactions with any longline survey, while the IPHC has recorded five interactions (all pinnipeds) from 1999–2016. While a lack of historical interactions does not in and of itself indicate that future interactions are unlikely, we believe that the historical record, considered in context with the frequency and timing of these activities, as well as mitigation measures employed indicate that future marine mammal interactions with these gears would be uncommon.

Gillnets—Marine mammal interactions with gillnets are well-documented, with a large proportion of species of all types of marine mammals (*e.g.,* mysticetes, odontocetes, pinnipeds) recorded as gillnet bycatch (Reeves *et al.,* 2013; Lewison *et al.,* 2014; Zollett, 2009). 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. Because of the well-documented risk to marine mammals, and to coastally distributed pinnipeds and small cetaceans in particular, we believe there is some risk of interaction inherent to AFSC use of gillnets, as described below in ''Estimated Take.'' However, this risk is limited by AFSC's minimal use of gillnets, primarily at the Little Port Walter in southeast Alaska (see Table 1–1 of AFSC's application), and by use of pingers on gillnets as a deterrent (see ''Proposed Mitigation'').

The AFSC also uses some traps and pots, both of which are passive fishing gear that have limited species selectivity and may be set for long durations (FAO, 2001). Thus, these gears have the potential to capture non-targeted fauna that use the same habitat as targeted species, even without the use of bait. Mortality in fyke nets can arise from stress and injury associated with anoxia, abrasion, confinement, and starvation (Larocque, 2011). In 2010, NMFS Northeast Fisheries Science Center captured a harbor seal in a fyke trap. However, AFSC fyke traps are used in freshwater habitats with only limited deployments. Other traps and pots are likewise used in only very limited fashion, with some traps deployed without bait. Therefore, we do not believe that there is a reasonable potential for marine mammal interaction with fyke traps or pots used by the AFSC, and these gears are not considered further in this document.

Other research gear—The only AFSC research gears with any record of marine mammal interactions are trawl nets, while IPHC has recorded marine mammal interactions with longlines. Because of ample evidence from commercial fishing operations, we assume that there is also risk of marine mammal interaction due to AFSC use of gillnets. All other gears used in AFSC fisheries research (*e.g.,* a variety of plankton nets, CTDs, remotely operated vehicles (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, ROVs, small surface trawls, plankton nets, other small nets, camera traps, dredges, and vertically deployed or towed imaging systems to be no-impact gear types.

Unlike trawl nets, seine 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 or 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 AFSC (see ''Description of Active Acoustic Sound Sources''), as well as background information on marine mammal hearing (see ''Description of Marine Mammals in the Area of the Specified Activity''). Here, we discuss the potential effects of AFSC use of active acoustic sources on marine mammals.

Potential Effects of Underwater Sound—Note that, in the following discussion, we refer in many cases to a review article concerning studies of noise-induced hearing loss conducted from 1996–2015 (*i.e.,* Finneran, 2015). For study-specific citations, please see that work. 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; Götz *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 AFSC'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 AFSC 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 (Finneran, 2015). 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, and there is no PTS data for cetaceans, but such relationships 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). AFSC 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.

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, 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 (Finneran, 2015). TTS was not observed in trained spotted and ringed seals exposed to impulsive noise at levels matching previous predictions of TTS onset (Reichmuth *et al.,* 2016). In general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran, 2015). 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), Finneran and Jenkins (2012), Finneran (2015), and NMFS (2016).

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). However, many delphinids approach low-frequency seismic airgun source vessels with no apparent discomfort or obvious behavioral change (*e.g.,* Barkaszi *et al.,* 2012), indicating the importance of frequency output in relation to the species hearing sensitivitiy.

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; Goldbogen *et al.,* 2013a, 2013b). 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, 2005, 2006; Gailey *et al.,* 2007; Gailey *et al.,* 2016).

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.,* 2007). 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 airgun 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; Erbe *et al.,* 2016). 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 critical behaviors. 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.,* 2007; 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 AFSC Activity—As described previously (see ''Description of Active Acoustic Sound Sources''), the AFSC 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 AFSC 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 AFSC. 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, 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 AFSC, SPLs in the range of approximately 180–220 dB rms might be required to induce onset TTS levels for most species (Southall *et al.,* 2007). 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 (Lucke *et al.,* 2009). 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 AFSC 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 AFSC 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 AFSC, 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 the 2008 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. For the multibeam echosounder, Boebel *et al.* (2005) note that the high output and broad width of the swath abeam of the vessel makes displacement of animals more likely. However, the fore and aft beamwidth 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 seaways—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). More recently, Lurton (2016) conducted a modeling exercise and concluded similarly that likely potential for acoustic injury from these types of systems is negligible, but that behavioral response cannot be ruled out.

We have, however, considered the potential for severe behavioral responses such as stranding and associated indirect injury or mortality from AFSC use of the multibeam echosounder, on the basis of a 2008 mass stranding of approximately one hundred melon-headed whales (*Peponocephala electra*) 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 AFSC 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 AFSC 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 some 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 AFSC 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.

Despite these observations, few experiments have been conducted to explicitly test for potential effects of echosounders on the behavior of wild cetaceans. Quick *et al.* (2017) describe an experimental approach to assess potential changes in short-finned pilot whale behavior during exposure to an echosounder (Simrad EK60 operated at 38 kHz, which is commonly used by AFSC). Previous studies of the effects of military tactical sonars on pilot whales failed to document overt avoidance responses, but did show changes in heading variance, which may be indicative of avoidance (Miller *et al.,* 2012; Quick *et al.,* 2017). In 2011, digital acoustic recording tags (DTAG) were attached to pilot whales off of North Carolina, with five of the whales exposed to signals from the echosounder over a period of eight days and four treated as control animals. DTAGS record both received levels of noise as well as orientation of the animal. Results did not show an overt response to the echosounder or a change to foraging behavior of tagged whales, but the whales did increase heading variance during exposure. The authors suggest that this response was not a directed avoidance response but was more likely a vigilance response, with animals maintaining awareness of the location of the echosounder through increased changes in heading variance (Quick *et al.,* 2017). Visual observations of behavior did not indicate any dramatic response, unusual behaviors, or changes in heading, and cessation of biologically important behavior such as feeding was not observed. These less overt responses to sound exposure are difficult to detect by visual observation, but may have important consequences if the exposure does interfere with biologically important behavior. Given the transient nature of AFSC use of active acoustic sources, we do not expect any behavioral disturbance to carry meaningful biological consequences for individuals.

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, 2005, 2008a, 2008b; 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

During AFSC surveys conducted in coastal areas, pinnipeds are expected to be hauled out and at times experience incidental close approaches by researchers in small vessels during the course of fisheries research activities. AFSC expects 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. Pups could be present at times during AFSC research effort, but AFSC researchers take precautions to minimize disturbance and prevent any possibility of stampedes, including choosing travel routes as far away from hauled pinnipeds as possible and by moving sample site locations to avoid consistent haulout areas. In addition, harbor seal pups are extremely precocious, swimming and diving immediately after birth and throughout the lactation period, unlike most other phocids which normally enter the sea only after weaning (Lawson and Renouf, 1985; Cottrell *et al.,* 2002; Burns *et al.,* 2005). Lawson and Renouf (1987) investigated harbor seal mother-pup bonding in response to natural and anthropogenic disturbance. In summary, they found that the most critical bonding time is within minutes after birth. As such, it is unlikely that infrequent disturbance resulting from AFSC research would interrupt the brief mother-pup bonding period within which disturbance could result in separation.

Disturbance of pinnipeds caused by AFSC survey activities 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. There is some overlap in prey of marine mammals and the species sampled and removed during AFSC research surveys, with primary species of concern being walleye pollock (*Gadus chalcogrammus*), Pacific cod (*G. macrocephalus*), Atka mackerel (*Pleurogrammus monopterygius*), sablefish (*Anoplopoma fimbria*), salmonids (*Oncorhynchus* spp.), and small, energy-rich, forage fish species such as Pacific sandlance (*Ammodytes* spp.) and Pacific herring (*Clupea pallasi*).

However, the total amount of these species taken in research surveys is very small relative to their overall biomass in the area (See Section 4.3.3 of the AFSC EA for more information on fish catch during research surveys). For example, AFSC research surveys are expected to catch approximately 433 metric tons (mt) of pollock per year in the GOARA. Research catch is therefore negligible compared to the allowable commercial harvest (111,530 mt in 2014) in the same area. For most commercial species, the average annual research catch is less than one percent of the allowable commercial catch. Other species of fish and invertebrates that are used as prey by marine mammals are taken in research surveys as well but, as indicated by these examples, the proportions of research catch compared to biomass and commercial harvest is very small.

Several AFSC fisheries research projects target prey of endangered western DPS Steller sea lions within the GOARA and BSAIRA. These studies are, in part, designed to assess aspects of the seasonal abundance and distribution of sea lion prey as part of a comprehensive examination of how nutritional status and prey availability may affect the recovery of the species. Some of these studies may be conducted within designated critical habitat for Steller sea lions, no-transit zones around rookeries, and areas designated as fishery closure zones. The primary prey caught in critical habitat includes rockfishes, pollock, Atka mackerel, arrowtooth flounder, and Pacific cod. Table 9–1 of AFSC's application shows the average annual AFSC fisheries research catch within Steller sea lion critical habitat. As described above, these amounts of prey are a small fraction of the commercial harvest total allowable catch, and an even smaller fraction of the biomass available to Steller sea lions. AFSC fisheries research catches are therefore anticipated to result in little to no effects on foraging sea lions in the general area or in their critical habitat. Prior ESA section 7 consultations conducted as part of the process for obtaining regional scientific research permits have not found any of the fisheries research prey removals to jeopardize listed species or to adversely modify critical habitat.

In addition to the small total biomass taken, some of the size classes of fish targeted in research surveys are very small (*e.g.,* juvenile salmonids are typically only centimeters long), and these small size classes are not known to be prey of 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. The overall effect of research catches on marine mammals through competition for prey may therefore be considered insignificant for all species.

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 AFSC'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 also see the previous discussion on masking in the ''Acoustic Effects'' subsection), 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 AFSC 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. AFSC 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 AFSC use of these sources would, on their own, have any appreciable effect on acoustic habitat. Sounds emitted by AFSC vessels would be of lower frequency and continuous, but would also be widely dispersed in both space and time. AFSC 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—AFSC conducts some bottom trawling, which may physically damage seafloor habitat. Physical damage may include furrowing and smoothing of the seafloor as well as the displacement of rocks and boulders, and such damage can increase with multiple contacts in the same area (Schwinghamer *et al.,* 1998; Kaiser *et al.,* 2002; Malik and Mayer, 2007; NRC, 2002). The effects of bottom contact gear differ in each type of benthic environment. In sandy habitats with strong currents, the furrows created by mobile bottom contact gear quickly begin to erode because lighter weight sand at the edges of furrows can be easily moved by water back towards the center of the furrow (NRC, 2002). Duration of effects in these environments therefore tend to be very short because the terrain and associated organisms are accustomed to natural disturbance. By contrast, the physical features of more stable hard bottom habitats are less susceptible to disturbance, but once damaged or removed by fishing gear, the organisms that grow on gravel, cobbles, and boulders can take years to recover, especially in deeper water where there is less natural disturbance (NRC, 2002). However, the area of benthic habitat affected by AFSC research each year would be a very small fraction of total area and effects are not expected to occur in areas of particular importance.

Damage to seafloor habitat may also harm infauna and epifauna (*i.e.,* animals that live in or on the seafloor or on structures on the seafloor), including corals (Schwinghamer *et al.,* 1998; Collie *et al.,* 2000; Stevenson *et al.,* 2004). In general, recovery of biological damage varies based on the type of fishing gear used, the type of seafloor surface (*i.e.,* mud, sand, gravel, mixed substrate), and the level of repeated disturbances, but would be expected to occur within 1–18 months. However, repeated disturbance of an area can prolong the recovery time (Stevenson *et al.,* 2004), and recovery of corals may take significantly longer. However, AFSC catch records show that only minimal amounts of coral are captured (annual average of 100 kg of coral per year for most species groups). Relatively small areas would be impacted by AFSC bottom trawling and, because such surveys are conducted in the same areas but not in the exact same locations, they are expected to cause single rather than repeated disturbances in any given area. AFSC activities would not be expected to have any other impacts on physical habitat.

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

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization, which will inform both NMFS's consideration of whether the number of takes is ''small'' and the negligible impact determination.

Except with respect to certain activities not pertinent here, section 3(18) of 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).

Take of marine mammals incidental to AFSC research activities could occur as a result of (1) injury or mortality due to gear interaction (Level A harassment, serious injury, or mortality); (2) behavioral disturbance resulting from the use of active acoustic sources (Level B harassment only); or (3) behavioral disturbance of pinnipeds resulting from incidental approach of researchers (Level B harassment only). Below we describe how the potential take is estimated.

Estimated Take Due to Gear Interaction

In order to estimate the number of potential incidents of take that could occur through gear interaction, we first consider AFSC's and IPHC's record of past such incidents, and then consider in addition other species that may have similar vulnerabilities to AFSC trawl and IPHC longline gear as those species for which we have historical interaction records. Historical interactions with research gear are described in Table 4, and we anticipate that all species that interacted with AFSC or IPHC fisheries research gear historically could potentially be taken in the future. Available records are for the years 2004 through present (AFSC) and 1998 through present (IPHC). All historical AFSC interactions have taken place in the GOARA, and have occurred during use of either the Cantrawl surface trawl net or with a bottom trawl. Historical IPHC interactions have occurred during use of bottom longlines and were located in the GOARA (southeast Alaska) or west coast (offshore Oregon). AFSC has no historical interactions for any longline or gillnet gear, and there are no historical interactions in the BSAIRA or CSBSRA. Please see Figures 6–1 and C–6 in the AFSC request for authorization for specific locations of these incidents.

TABLE 4—HISTORICAL INTERACTIONS WITH RESEARCH GEAR

Gear	Survey	Date	Location [1]	Species	Number killed	Number released alive	Total
Bottom longline	IPHC setline	7/17/1999	West coast	Harbor seal	1		1
Bottom longline	IPHC setline	7/23/2003	SE Alaska	Steller sea lion	1		1
Bottom longline	IPHC setline	7/16/2007	SE Alaska	Steller sea lion	1		1

TABLE 4—HISTORICAL INTERACTIONS WITH RESEARCH GEAR—Continued

Gear	Survey	Date	Location [1]	Species	Number killed	Number released alive	Total
Bottom trawl	Gulf of Alaska Biennial Shelf and Slope Bottom Trawl Groundfish Survey.	6/13/2009	GOARA	Northern fur seal [2]	1		1
Bottom longline	IPHC setline	7/31/2011	West coast	Harbor seal	1		1
Surface trawl (Cantrawl).	Gulf of Alaska Assessment.	9/10/2011	GOARA	Dall's porpoise	1		1
Surface trawl (Cantrawl).	Gulf of Alaska Assessment.	9/21/2011	GOARA	Dall's porpoise	1		1
Bottom trawl	ADFG Large Mesh Trawl Survey.	9/5/2014	GOARA	Harbor seal	1		1
Bottom longline	IPHC setline	7/22/2016	SE Alaska	Steller sea lion	1		1
Total individuals captured.				Northern fur seal	1		1
				Dall's porpoise	2		2
				Harbor seal	3		3
				Steller sea lion	3		3

[1] AFSC interactions are described by research area. IPHC research programs are not distributed according to AFSC research areas and so are described by geographic location. Specific locations of all interactions are shown in Figures 6–1 and C–6 of the application.
[2] Based on the location of this incident, the captured animal was believed to be from the eastern Pacific stock of northern fur seal.

In order to use these historical interaction records 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 for these fishing gear interactions. AFSC and IPHC have historically had only infrequent interactions with marine mammals, *e.g.,* from 2004–2015 AFSC conducted at least 1,250 trawl tows per year, with only three (a fourth occurred during a survey conducted by the Alaska Department of Fish and Game) marine mammal interactions (Table 4). However, we assume that any of the historically-captured species (northern fur seal, Dall's porpoise, harbor seal, Steller sea lion) could be captured in any year.

We consider all of the interaction records available to us. In consideration of these data, we assume that one individual of each of the historically-captured species (Table 4) could be captured per year over the course of the five-year period of validity for these proposed regulations, specific to relevant survey operations where the species occur (*e.g.,* one harbor seal taken per year specific to IPHC longline survey operations, one Dall's porpoise taken per year specific to AFSC trawl survey operations in GOARA, one Dall's porpoise taken per year specific to AFSC trawl survey operations in BSAIRA). Table 5 shows the projected five-year total captures of the historically-captured species for this proposed rule, as described above, for AFSC trawl gear and IPHC longline gear only. Although more than one individual Dall's porpoise has been captured in a single year, interactions have historically occurred only infrequently. Therefore, we believe that the above assumption appropriately reflects the likely total number of individuals involved in research gear interactions over a five-year period and that the assumption is precautionary in that it separately accounts for potential vulnerability of species to gear interaction in the different research areas. Harbor seals are expected to have less frequency of interaction than the fur seal or Steller sea lion due to its more inshore and coastal distribution. AFSC requests authorization of one take per harbor seal stock in each relevant research area over the 5-year period (note that these takes are not included in Table 5 but are incorporated in Table 7). These estimates are based on the assumption that annual effort (*e.g.,* total annual trawl tow time) over the proposed five-year authorization period will be approximately equivalent to the annual effort during prior years for which we have interaction records.

TABLE 5—PROJECTED FIVE-YEAR TOTAL TAKE FOR HISTORICALLY CAPTURED SPECIES [1]

Gear	Species	AFSC GOARA average annual take (total)	AFSC BSAIRA average annual take (total)	IPHC average annual take (total) [2]	Projected 5-year total
Trawl	Northern fur seal [3]	1 (5)	1 (5)		10
	Dall's porpoise	1 (5)	1 (5)		10
Longline	Harbor seal			1 (5)	5
	Steller sea lion			1 (5)	5

[1] Projected takes based on species interaction records in analogous commercial fisheries (versus historical records) are incorporated in Table 7 below, as are all projected takes within the CSBSRA.
[2] IPHC activities are not defined by the three AFSC research areas and may occur anywhere within the IPHC research areas off the U.S. west coast or in the Gulf of Alaska and Bering Sea. Projected IPHC harbor seal takes could occur to any stock of harbor seal. Historical IPHC takes of Steller sea lion have been of the eastern DPS (based on geographic location), but potential future takes could occur to either eastern or western DPS.
[3] Referring to expected potential future takes of eastern Pacific stock northern fur seals in AFSC trawl gear on basis of historical record. Additional take of California stock northern fur seals, inferred based on vulnerability and geographic overlap, are incorporated in Table 7 below.

As background to the process of determining which species not historically taken may have sufficient vulnerability to capture in AFSC gear to justify inclusion in the take authorization request (or whether species historically taken may have vulnerability to gears in which they have not historically been taken or additional vulnerability not reflected above due to activity in other areas such as the CSBSRA), we note that the AFSC is NMFS' research arm in Alaska and may be considered as a leading source of expert knowledge regarding marine mammals (*e.g.,* behavior, abundance, density) in the areas where they operate. The species for which the take request was formulated were selected by the AFSC, and we have concurred with these decisions. We also note that, in addition to consulting NMFS's List of Fisheries (LOF; described below), the historical interaction records described above for the IPHC informed our consideration of risk of interaction due to AFSC's use of longline gear (for which there are no historical interaction records).

In order to estimate the total potential number of incidents of takes that could occur incidental to the AFSC's use of trawl, longline, and gillnet gear, and IPHC's use of longline gear, over the five-year period of validity for these proposed regulations (*i.e.,* takes additional to those described in Table 5), we first consider whether there are additional species that may have similar vulnerability to capture in trawl or longline gear as the five species described above that have been taken historically and then evaluate the potential vulnerability of these and other species to additional gears.

We believe that the Pacific white-sided dolphin likely has similar vulnerability to capture in trawl gear as the Dall's porpoise, given similar habitat preferences and with documented vulnerability to capture in both commercial and research trawls. The harbor porpoise is also considered vulnerable to capture in trawl gear, but likely with less frequency of interaction given its inshore and coastal distribution. The Steller sea lion is considered to have similar vulnerability to capture in trawl gear as the northern fur seal, given similar habitat preferences and with documented vulnerability to capture in commercial trawls. In addition to the one northern fur seal per year from the eastern Pacific stock that could be captured in each relevant research area (Table 5), we assume that one additional northern fur seal from the California stock could be taken in trawl gear over the 5-year period. The assumed lesser frequency of interaction is due to presumed lower occurrence of California stock fur seals in AFSC research areas. Only approximately half of this relatively small stock of fur seals ranges to the eastern GOARA. Similar to the harbor porpoise, spotted seals are expected to have similar vulnerability to capture in trawl gear as historically captured pinnipeds, but with less frequency of interaction due to its more inshore and coastal distribution. AFSC requests authorization of one take of spotted seal in each relevant research area over the 5-year period. This assumption is supported by LOF records (Table 7).

Historical IPHC take records also illustrate likely similar vulnerabilities to capture by AFSC longline gear. However, due to reduced use of longline gear by AFSC relative to IPHC activity, expects that one Steller sea lion from each DPS could be taken over the 5-year period in each relevant research area. Despite IPHC records of harbor seal capture in longline gear, we do not believe that AFSC use of longline gear presents similar risk, in part due to the relative infrequency of use but also because of a lack of expected geographic overlap between AFSC longline sets and harbor seal occurrence. IPHC conducts many more longline sets per year but also conducts survey effort further inshore than does IPHC (water depths of 18 m). No take of harbor seals incidental to AFSC longline survey effort is proposed. Northern fur seals and California sea lions are considered analogous to Steller sea lions due to similar vulnerability to capture in longline gear. AFSC has requested authorization of one take over the 5-year period for each fur seal stock in each research area where fur seals are found and, on behalf of IPHC, requests authorization of one fur seal per year (which could be from either stock) and one California sea lion over the 5-year period. Finally, the spotted seal may have similar vulnerability to interaction with longline gear as the harbor seal, but likely with less frequency given the limited overlap between the species range and survey effort. We propose to authorize one take over the 5-year period for IPHC survey effort, but none for AFSC given very little expected overlap. These assumptions are supported by LOF records (Table 7).

In order to evaluate the potential vulnerability of additional species to trawl and longline and of all species to gillnet gear, we first consulted the 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 summary information, as presented in the 2017 LOF (82 FR 3655; January 12, 2017), in Table 6. 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). Where there are 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 AFSC or IPHC research gear. For a listing of all Category I, II, and II fisheries using relevant gears, associated estimates of fishery participants, and specific locations and fisheries associated with the historical fisheries takes indicated in Table 6 below, please see the 2017 LOF. For specific numbers of marine mammal takes associated with these fisheries, please see the relevant SARs. More information is available online at *www.nmfs.noaa.gov/pr/interactions/fisheries/lof.html* and *www.nmfs.noaa.gov/pr/sars/.*

TABLE 6—U.S. COMMERCIAL FISHERIES INTERACTIONS FOR TRAWL, LONGLINE, AND GILLNET GEAR FOR RELEVANT SPECIES

Species [1]	Trawl [2]	Vulnerability inferred?	Longline [2]	Vulnerability inferred?	Gillnet [2]	Vulnerability inferred?
North Pacific right whale	N	N	N	N	N	N
Bowhead whale	N	N	N	N	N	N
Gray whale	Y	N	N	N	Y	N
Humpback whale	Y	N	Y	N	Y	N

TABLE 6—U.S. COMMERCIAL FISHERIES INTERACTIONS FOR TRAWL, LONGLINE, AND GILLNET GEAR FOR RELEVANT SPECIES—Continued

Species [1]	Trawl [2]	Vulnerability inferred?	Longline [2]	Vulnerability inferred?	Gillnet [2]	Vulnerability inferred?
Balaenoptera spp	Y	N	Y	N	Y	N
Sperm whale	N	N	Y	Y	N	N
Kogia spp	n/a	n/a	Y	N	n/a	n/a
Cuvier's beaked whale	N	N	Y	N	N	N
Baird's beaked whale	N	N	N	N	N	N
Mesoplodon spp	N	N	Y	N	N	N
Beluga whale	N	Y	N	N	Y	N
Common bottlenose dolphin	n/a	n/a	Y	Y	n/a	n/a
Stenella spp	n/a	n/a	Y	N	n/a	n/a
Delphinus spp	n/a	n/a	Y	Y	n/a	n/a
Lagenorhynchus spp	Y	Y	N	N	Y	Y
Northern right whale dolphin	n/a	n/a	N	N	n/a	n/a
Risso's dolphin	n/a	n/a	Y	Y	n/a	n/a
Killer whale	Y	N	Y	Y	N	N
Globicephala spp	n/a	n/a	Y	Y	n/a	n/a
Harbor porpoise	Y	Y	Y	N	Y	Y
Dall's porpoise [3]	n/a	n/a	Y	Y	Y	Y
Guadalupe fur seal [4]	n/a	n/a	N	N	n/a	n/a
Northern fur seal [3]	n/a	n/a	Y	Y	Y	Y
California sea lion [5]	n/a	n/a	Y	Y	n/a	n/a
Steller sea lion [3]	Y	Y	n/a	n/a	Y	Y
Bearded seal	Y	Y	N	N	N	N
Phoca spp [3]	Y	Y	n/a	n/a	Y	Y
Ringed seal	Y	Y	Y	Y	N	N
Ribbon seal	Y	Y	N	N	N	N
Northern elephant seal	Y	Y	Y	N	Y	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. For those species not expected to occur in Alaskan waters, trawl and gillnet gear are not applicable (these gears would only be used in Alaskan waters).
[3] This exercise is considered "not applicable" for those species historically captured by AFSC or IPHC gear. Historical record, rather than analogy, is considered the best information upon which to base a take estimate.
[4] It is likely that Guadalupe fur seals are taken in Mexican fisheries, but there are no records available to us.
[5] There are no records of take for California sea lions in commercial longline fisheries, but there have been multiple takes of California sea lions in longline surveys conducted by NMFS's Southwest Fisheries Science Center. We therefore infer vulnerability for the species to research longline gear.

Information related to incidental M/SI in relevant commercial fisheries is not, however, the sole determinant of whether it may be appropriate to authorize take incidental to AFSC survey operations. A number of factors (*e.g.,* species-specific knowledge regarding animal behavior, overall abundance in the geographic region, density relative to AFSC survey effort, feeding ecology, propensity to travel in groups commonly associated with other species historically taken) were taken into account by the AFSC 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 AFSC research gear. Similarly, we have determined that some species groups with documented M/SI are not likely to be vulnerable to capture in AFSC gear. In these instances, we provide further explanation below. Those species with no records of historical interaction with AFSC research gear and no documented M/SI in relevant commercial fisheries, and for which the AFSC has not requested the authorization of incidental take, are not considered further in this section. The AFSC believes generally that any sex or age class of those species for which take authorization is requested could be captured.

In order to estimate a number of individuals that could potentially be captured in AFSC research gear for those species not historically captured, we first determine which species may have vulnerability to capture in a given gear. Of those species, we then determine whether any may have similar propensity to capture in a given gear as a historically captured species. For these species, we assume it is possible that take could occur while at the same time contending that, absent significant range shifts or changes in habitat usage, capture of a species not historically captured would likely be a very rare event. Therefore, we assume that capture would be a rare event such that authorization of a single take over the five-year period, for each region where the gear is used and the species is present, is likely sufficient to capture the risk of interaction.

Trawl—From the 2017 LOF, we infer vulnerability to trawl gear for the bearded seal, ringed seal, ribbon seal, and northern elephant seal. This is in addition to the species for which vulnerability is indicated by historical AFSC interactions (described above).

For the beluga whale, we believe that there is a reasonable likelihood of incidental take in trawl gear although there are no records of incidental M/SI in relevant commercial fisheries. Commercial fisheries using trawl gear have largely been absent from areas where beluga whales occur and, in particular, there are no commercial trawl fisheries in the CSBSRA. AFSC examined the potential for incidental take of beluga whales by evaluating the areas of overlap between the proposed fisheries research activities and beluga whale distribution, considering the seasonality of both the research activities and the species distributions as well as other factors that may influence the degree of potential overlap such as sea and shorefast ice occurrence. In considering the possible take of beluga whales, the AFSC considered that beluga whales show behavior similar to large dolphins and porpoises. While no belugas have been taken in AFSC research or commercial trawl fisheries, there have been takes of large dolphins elsewhere in trawls. Beluga whales may occur in summer periods within the Chukchi and Beaufort Sea regions where the AFSC may be conducting trawl surveys. Thus, AFSC has requested authorization of one take each from two stocks of beluga whale (eastern Chukchi stock and Beaufort Sea stock) in fisheries research trawl surveys over the 5-year authorization period. Potential spatiotemporal overlap between AFSC trawl survey activities and other beluga whale stocks was evaluated and determined to not support a take authorization request for other stocks of beluga whale.

It is also possible that a captured animal may not be able to be identified to species 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 AFSC has requested the authorization of incidental take for one unidentified pinniped and one unidentified small cetacean in trawl gear for each research area over the course of the five-year period of proposed authorization. One exception is for small cetaceans in the CSBSRA, as no cetacean interactions with trawl gear are expected in that region (other than the aforementioned potential beluga whale interactions), as small cetaceans occur only rarely in this region.

Longline—The process is the same as is described above for trawl gear. From the 2017 LOF, we infer vulnerability to longline gear for the Dall's porpoise, Risso's dolphin, bottlenose dolphin, common dolphin, short-finned pilot whale, and ringed seal. This is in addition to the species for which vulnerability is indicated by historical AFSC interactions (described above).

Based on the 2017 LOF and historical observations of sperm whale and killer whale interactions with research longline gear, we also infer vulnerability to interaction with longline gear for killer whales (Alaska resident stock only) and sperm whales (North Pacific stock only). Although we generally believe that, despite records of interaction with analogous commercial fisheries, the potential for incidental take of any large whale (*i.e.,* baleen whales or sperm whale), beaked whale, or killer whale in research gear is so unlikely as to be discountable, there is a long history of attempted depredation of longline gear by animals from these stocks in Alaska, with take of these species having occurred in commercial fisheries. Between 2010 and 2014, five sperm whales are recorded as having been seriously injured in the Gulf of Alaska sablefish longline fishery, while there have been two instances of killer whale M/SI in BSAI longline fisheries (Helker *et al.,* 2016). Cetaceans have never been caught or entangled in AFSC or IPHC longline research gear. If interactions occur, marine mammals depredate hooked fish from the gear, but typically leave the hooks attached although occasionally bent or broken (*i.e.,* evidence of the interaction). Certain species, particularly killer whales in the Bering Sea and sperm whales in the Gulf of Alaska, are commonly attracted to longline fishing operations and are adept at removing fish from longline gear as it is retrieved. Although we consider it unlikely that AFSC or IPHC research activities would result in any takes of either sperm whales or killer whales, AFSC has requested the authorization of such take as a precautionary measure, given the observed interactions of these species with research longline gear. Since longline depredation by sperm whales is known to occur only in Alaskan waters, requested take is limited to the North Pacific stock. Commercial fishery takes have been reported for both transient and resident stocks of killer whale. However, the Alaska resident stock consumes fish (*e.g.,* Herman *et al.,* 2005) and is most likely to be involved in depredation of research catch. In contrast, transient killer whales feed on marine mammals and are less likely to interact with research longline gears, and the limited effort for AFSC and IPHC research surveys compared to commercial fisheries does not justify take authorization for transient whales.

Although there are LOF interaction records in longlines for stenellid dolphin species, the harbor porpoise, and the northern elephant seal, we do not propose to authorize take of these species through use of longline. No take is anticipated for the striped dolphin or for the long-beaked stock of common dolphin and coastal stock of bottlenose dolphin because of their expected pelagic and southerly distributions (respectively) relative to expected IPHC survey effort. Harbor porpoise have only been recorded as taken in commercial fisheries through use of pelagic longline in the Atlantic Ocean; there are no records of incidental take of harbor porpoise in longline fisheries in Alaska or off the U.S. west coast. Similarly, the LOF indicates that elephant seal interaction occurred only in a Hawaiian pelagic longline fishery.

As described for trawl gear, it is also possible that a captured animal may not be able to be identified to species with certainty. Although we expect that cetaceans would likely be able to be identified when captured in longline gear, pinnipeds are considered more likely to escape before the animal may be identified. Therefore, the AFSC has requested the authorization of incidental take for one unidentified pinniped for each relevant research area, in addition to one unidentified pinniped captured in IPHC surveys, over the course of the five-year period of proposed authorization.

Gillnet—The process is the same as is described above for trawl gear. From the 2017 LOF, we infer vulnerability to gillnet gear for the Pacific white-sided dolphin, harbor porpoise, Dall's porpoise, harbor seal, northern fur seal, and Steller sea lion. Gillnets are used only in Prince William Sound and at Little Port Walter in southeast Alaska. Therefore, only one take is proposed for authorization for relevant stocks of the vulnerable species over the 5-year period. This includes both the eastern Pacific and California stocks of northern fur seal and the Prince William Sound and Sitka/Chatham Strait stocks of harbor seal. Although there are LOF interaction records in gillnets for the beluga whale and the northern elephant seal, we do not expect these species to be present in areas where AFSC proposes to use gillnet research gear and no take of these species through use of gillnet is proposed for authorization.

AFSC also expects that there may be an interaction resulting in escape of an unidentified cetacean in gillnet gear, and has requested the authorization of incidental take for one unidentified cetacean over the course of the five-year period of proposed authorization.

TABLE 7—TOTAL ESTIMATED TAKE DUE TO GEAR INTERACTION, 2018–23 [1]

Species	Estimated 5-year total, trawl	Estimated 5-year total, longline (AFSC)	Estimated 5-year total, longline (IPHC) [2]	Estimated 5-year total, gillnet	Total, all gears
Sperm whale (North Pacific)		1 (GOARA)	1		2
Beluga whale (eastern Chukchi)	1 (CSBSRA)				1
Beluga whale (Beaufort Sea)	1 (CSBSRA)				1
Bottlenose dolphin (offshore)			1		1
Common dolphin			1		1
Pacific white-sided dolphin	5 (GOARA)			1	6
Risso's dolphin			1		1
Killer whale (Alaska resident)		1 (BSAIRA)	1		2
Short-finned pilot whale			1		1
Harbor porpoise (Southeast Alaska) [3].					1
Harbor porpoise (Gulf of Alaska)	1			1	2
Harbor porpoise (Bering Sea)	1				1
Dall's porpoise	10 (5 GOARA/5 BSAIRA).	2 (1 GOARA/1 BSAIRA).	1	1	14
Northern fur seal (eastern Pacific).	10 (5 GOARA/5 BSAIRA).	2 (1 GOARA/1 BSAIRA).	5	1	13–18
Northern fur seal (California)	1 (GOARA)	1 (GOARA)		1	3–8
California sea lion			1		1
Steller sea lion (eastern)	5	1	5	1	7–12
Steller sea lion (western)	10 (5 GOARA/5 BSAIRA).	2 (1 GOARA/1 BSAIRA).		1	13–18
Bearded seal	2 (1 BSAIRA/1 CSBSRA).				2
Harbor seal [4]	12		5	2	19
Spotted seal	2 (1 BSAIRA/1 CSBSRA).		1		3
Ringed seal	2 (1 BSAIRA/1 CSBSRA).	1	1		4
Ribbon seal	2 (1 BSAIRA/1 CSBSRA).				2
Northern elephant seal	1				1
Unidentified pinniped [5]	3	2	1		6
Unidentified small cetacean [6]	2			1	3

[1] Please see Table 6 and preceding text for derivation of take estimates. Takes proposed for authorization are informed by area- and gear-specific vulnerability. However, IPHC longline takes are considered separately. AFSC use of gillnets occurs only in the GOARA. Only trawl gear is used in the CSBSRA.

[2] Potential IPHC takes are not specific to any area or stock. For example, the one expected take of Dall's porpoise could occur to an individual of either the CA/OR/WA or Alaska stocks. For harbor seals, although five total takes may occur over the 5-year period of the proposed regulations, no more than one take is anticipated from any given stock.

[3] For harbor porpoise in southeast Alaska, we propose to authorize take of one animal in all gears combined (*i.e.,* trawl and gillnet) over the 5-year period. In general, harbor porpoise would be expected to have the same vulnerability to particular gears regardless of stock. However, AFSC proposes to use acoustic pingers on surface trawl nets in southeast Alaska, reducing the likelihood of porpoise interaction with that gear. Use of acoustic pingers is proposed for gillnets in both southeast Alaska and in the Gulf of Alaska.

[4] For trawl gear, the numbers include one take during the 5-year period for each Alaskan harbor seal stock (three stocks in BSAIRA and nine stocks in GOARA). For gillnet gear, the numbers include one take during the 5-year period for the Prince William Sound and Sitka/Chatham Strait stocks. For IPHC longline surveys, the five takes proposed for authorization could occur for any harbor seal stock, though no more than one take would be expected to occur over the 5-year period for any given stock.

[5] Includes one unidentified pinniped in each research area (trawl) and one unidentified pinniped in the GOARA and BSAIRA and for IPHC surveys (longline).

[6] Includes one unidentified small cetacean in the GOARA and BSAIRA (trawl) and one unidentified cetacean in the GOARA (gillnet). This is not anticipated to apply to harbor porpoise in southeast Alaska, as the already low probability of gear interaction is further reduced through use of additional mitigation (described in footnote 3).

Whales—For large whales (baleen whales and sperm whales) and small whales (considered here to be beaked whales, *Kogia* spp., and killer whales), observed M/SI is extremely rare for trawl and gillnet gear and, for most of these species, only slightly more common in longline gear. Furthermore, with the exception of sperm whales and killer whales (who attempt to depredate longline gear), most of these species longline interactions are with pelagic gear. Baleen whale interactions with longline gear represent entanglements in pelagic mainlines, while beaked whales and *Kogia* spp. typically have a pelagic distribution resulting in a lack of spatial overlap with bottom longline fisheries. Although whale species could become captured or entangled in AFSC gear, the probability of interaction is extremely low considering the lower level of effort relative to that of commercial fisheries. For example, there were estimated to be three total incidents of sperm whale M/SI in the Hawaii deep-set longline fishery over a five-year period. This fishery has 129 participants, and the fishery as a whole exerts substantially greater effort in a given year than does the AFSC. In a very rough estimate, we can say that these three estimated incidents represent an insignificant per-participant interaction rate of 0.005 per year, despite the greater effort. Similarly, there were zero documented interactions over a five-year period in the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagics longline fishery, despite a reported fishing effort of 8,044 sets and 5,955,800 hooks in 2011 alone (Garrison and Stokes, 2012). With an average soak time of ten to fourteen hours, this represents an approximate minimum of almost sixty million hook hours. AFSC and IPHC effort would be a small fraction of this per year. Other large whales and small whales have similarly low rates of interaction with commercial fisheries, despite the significantly greater effort. In addition, most large whales and small whales generally have, with few exceptions, very low densities in areas where AFSC and IPHC research occurs relative to other species (see Tables 10–12). With exceptions for sperm whales and killer whales that are known to depredate research longline gear in particular locations, we believe it extremely unlikely that any large whale or small whale would be captured or entangled in AFSC research gear.

Estimated Take Due to Acoustic Harassment

As described previously (''Potential Effects of the Specified Activity on Marine Mammals and Their Habitat''), we believe that AFSC 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 AFSC 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, 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 may be seen as an 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 these estimates are described below.

In 2016, NMFS released updated ''Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing'' with revised metrics and thresholds to assess the potential for injury (*e.g.,* permanent threshold shift) from acoustic sources. While the AFSC's documents refer to NMFS's historic guidelines, as the acoustic analysis was completed prior to the release of the technical guidance, the conclusions regarding the potential for injury remain the same. Most importantly, the technical guidance now explicitly takes into account the duration of the sound through the use of the sound exposure level (SEL) metric, as opposed to the previous use of root mean square (rms) sound pressure level (SPL). The effect of this different metric, in particular for the very short duration sounds used for these echosounders, is to largely reduce the exposure level of sound an animal is exposed to for short duration sounds (*e.g.,* for a 1 ms ping, an SPL source level is reduced by 30 dB in the SEL metric) offsetting changes in the thresholds themselves. While energy is accumulated over time using SEL, the previous conclusion that an individual would have to remain exceptionally close to a sound source for unrealistic lengths of time holds, suggesting the likelihood of injury occurring is exceedingly small and is therefore not considered further in this analysis.

The assessment paradigm for active acoustic sources used in AFSC fisheries research is relatively straightforward and has a number of key simplifying assumptions. NMFS's 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. Sound produced by these sources are very short in duration (typically on the order of milliseconds), intermittent, have high rise times, and are operated from moving platforms. They are consequently considered most similar to impulsive sources, which are subject to the 160 dB rms criterion. Estimating the number of exposures at the specified received level requires several determinations, each of which is described sequentially below:

(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 (to a maximum depth of 500 m) 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. Because depths range dramatically along the margin of the continental slope that define the outer edge of the survey areas, but deeper surveyed depths rarely range over 500 m in practice, the depth range for determining volumes was set at 500 m for deep diving species. Methods for estimating each of these calculations are described in greater detail in the following sections, along with the simplifying assumptions made, and followed by the take estimates. Note that the IPHC does not use active acoustic systems for data acquisition purposes; therefore, potential Level B harassment is only considered for AFSC survey operations in the GOARA, BSAIRA, and CSBSRA.

Sound Source Characteristics—An initial characterization of the general source parameters for the primary active acoustic sources operated by the AFSC was conducted, enabling a full assessment of all sound sources used by the AFSC and delineation of Category 1 and Category 2 sources, the latter of which were carried forward for analysis here (see Table 2). 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.

Note that, for purposes of this analysis, the EK60 is assumed to operate at 18 kHz, the ES60 is assumed to operate at 38 kHz, and the 7111 is assumed to operate at 100 kHz. Therefore, we assume that Level B harassment of low-frequency cetaceans may only occur in response to exposure to signals from the EK60, as signals from the other two systems are outside the generalized hearing range for this group. Similarly, we assume that pinnipeds would not experience harassment upon exposure to signals from the 7111, which produces signals outside the generalized hearing range of both otariid and phocid pinnipeds.

TABLE 8—EFFECTIVE EXPOSURE AREAS FOR PREDOMINANT ACOUSTIC SOURCES ACROSS TWO DEPTH STRATA

Active acoustic system	Effective exposure area: Sea surface to 200 m depth (km^2)	Effective exposure area: Sea surface to 500 m depth (km^2)
Simrad EK60/ME70 narrow beam echosounder	0.0173	0.056
Simrad ES60 multibeam echosounder	0.0112	0.036
Reson 7111 multibeam echosounder	0.1419	0.914

Among Category 2 sources (Table 2), three predominant sources (Table 8) were identified 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. Estimated effective cross-sectional areas of exposure were estimated for each of the predominant sources using a commercial software package (MATLAB) and key input parameters including source-specific operational characteristics (*e.g.,* frequency, beamwidth, source level; see Table 2) and environmental characteristics (*i.e.,* temperature, salinity, pH, and latitude). Where relevant, calculations were performed for different notional operational scenarios and the largest cross-sectional area used in estimating take (*e.g.,* see Figure 6–2 of AFSC's application, which displays a simple visualization of a two-dimensional slice of modeled sound propagation to illustrate the predicted area ensonified to the 160-dB threshold by the nominal EK60 beam pattern assuming side lobes of ensonification).

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 (Table 8; ES60, EK60/ME70, and 7111) comprising the total effective line-kilometers, their relative proportions depending on the nature of each survey.

Calculating Effective Line-Kilometers—As described below, based on the operating parameters for each source type, an estimated volume of water ensonified at or above the 160 dB rms threshold was determined. 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, which in some cases resulted in different sources being predominant in each depth stratum for all line-kilometers when multiple sources were in operation; this was accounted for in estimating overall exposures for species that utilize both depth strata (deep divers). The total number of line-kilometers associated with relevant surveys was determined, as was the relative percentage of surveyed linear kilometers associated with each depth stratum (equating to the proportion of each survey occurring on the shallower upper continental shelf versus those in deeper waters). The total line-kilometers for each survey, the predominant source, the effective percentages associated with each depth, and the effective total volume ensonified are given below (Table 9).

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. We 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), a reasonable approximation over the relatively short ranges involved. Spherical spreading is a reasonable assumption even in relatively shallow waters since, taking into account the beam angle, the reflected energy from the seafloor will be much weaker than the direct source and the volume influenced by the reflected acoustic energy would be much smaller over the relatively short ranges involved. We also 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. These results, shown in Table 9, were applied differentially based on the typical vertical stratification of marine mammals (see Table 10).

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. 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 AFSC's application) multiplied by the total distance traveled by the ship. Where different sources operating simultaneously would be predominant in each different depth strata, 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. 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 and other sources (please see Table 6–10d of AFSC's application). 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 AFSC fisheries surveys (detailed previously in ''Detailed Description of Activities'').

(2) Marine mammal survey areas do not necessarily coincide spatially with the entire AFSC fisheries research area boundaries. Estimated densities from the survey areas are assumed to apply to the entire research area.

(3) 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 500 m, *i.e.,* nominal maximum water depth in regions where these surveys occur.

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). The two-dimensional and resulting three-dimensional (volumetric) densities for each species in each ecosystem area are shown below.

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 by using (1) the combined results from output characteristics of each source and identification of the predominant sources in terms of acoustic output; (2) their relative annual usage patterns for each operational area; (3) a source-specific determination made of the area of water associated with received sounds at the extent of a depth boundary; and (4) determination of a biologically-relevant volumetric density of marine mammal species in each area. 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 relevant survey and the volumetric density of animals for each species. These annual estimates are given below.

Most species designated as shallow divers (< 200 m depth) were considered to be shelf and inshore species, and their lineal distance was the extent of survey areas to 200 m in depth. However, some shallow diving species also occur in offshore waters so the density to 200 m depth was applied to the volumetric density of all survey tracks. These species included gray whale; harbor porpoise (GOARA only); northern fur seal; Steller sea lion; Dalls' porpoise; beluga whale (Bristol Bay stock only); humpback whale, killer whales, and sei whales (BSAIRA only); and bearded, ribbon, ringed, and spotted seals (BSAIRA only). Ensonified volumes for deep diving species were summed for the shallow inshore component and the deeper waters.

TABLE 9—ANNUAL LINEAR SURVEY KILOMETERS FOR EACH VESSEL AND ITS PREDOMINANT SOURCE WITHIN TWO DEPTH STRATA

Vessel	Survey	Line-kms	Dominant source	Distance 0–200 m (percent)	Distance > 200 m (percent)	Volume ensonified (0–200 m)	Volume ensonified (200–500 m)
GOARA							
Oscar Dyson	Pollock summer acoustic trawl	17,558	EK60/ME70	74	26	224.8	256.1
Oscar Dyson	Pollock winter acoustic trawl (Shelikof Strait)	9,540	EK60/ME70	31	69	51.2	369.3
Oscar Dyson	Pollock winter acoustic trawl (Shumagin/Sanak Islands)	4,520	EK60/ME70	99	1	77.4	2.5
Charter vessels	Shelf and slope bottom trawl groundfish	9,189	ES60	76	24	78.2	79.4
BSAIRA							
Oscar Dyson	Pollock summer acoustic trawl (Bering Sea)	25,460	EK60/ME70	91	9	400.8	128.5
Oscar Dyson	Pollock winter acoustic trawl (Bogoslof Island)	2,788	EK60/ME70	15	85	7.2	132.9
Charter vessels	Aleutian Islands shelf and slope bottom trawl groundfish.	3,190	ES60	61	39	21.8	44.8
Charter vessels	Arctic Ecosystem Integrated Survey	2,599	ES60	100	0	29.1	0
Charter vessels	Bering Sea shelf bottom trawl	11,200	ES60	100	0	125.4	0
Charter vessels	Eastern Bering Sea upper continental slope trawl summer.	1,125	ES60	0	100	0	40.5
Charter vessels	Bering Aleutian Salmon International Survey (BASIS)	12,288	ES60	95	5	130.7	34.5
Charter vessels	Northern Bering Sea bottom trawl	1,440	ES60	100	0	16.1	0
Charter vessels	Response of fish to drop camera systems	259	ES60	100	0	2.9	0
Fairweather	Acoustic research and mapping to characterize EFH (FISHPAC).	145	Reson 7111	100	0	20.6	0
CSBSRA							
Charter vessels	Arctic Ecosystem Integrated Survey	5,915	ES60	100	0	66.2	0

Next, we provide volumetric densities for marine mammals and total estimated takes by Level B harassment, by dominant source and total, for each stock in each of the three research areas (Tables 10–12). We also provide a sample calculation.

We first determine the source-specific ensonified volume of water for each relevant survey and then determine species-specific exposure estimates for the shallow and deep (if applicable; Tables 10–12) depth strata. First, we know the estimated source-specific cross-sectional ensonified area within the shallow and deep strata (Table 8) and the number of annual line-kilometers for each survey and use these values to derive an estimated ensonified volume. Survey- and stratum-specific exposure estimates are the product of these ensonified volumes and the species-specific volumetric densities (Table 10).

To illustrate the process, we focus on the EK60 and the sperm whale in the GOARA.

(1) EK60 ensonified volume; 0–200 m: 0.0173 km^2 * 17,558 km * 0.74 = 224.8 km^3.

(2) EK60 ensonified volume; >200 m: 0.0561 km^2 * 17,558 km * 0.26 = 256.1 km^3.

(3) Repeat steps 1 and 2 for each relevant survey; sum total ensonified volumes in each depth stratum

(4) Estimated exposures to sound ≥160 dB rms; sperm whale; EK60: (0.002 sperm whales/km^3 * 353.4 km^3 (total ensonified volume; 0–200 m) = 0.7) + (0.002 sperm whales/km^3 * 627.9 km^3 (total ensonified volume; 200–500 m) = 1.3) = 2 estimated sperm whale exposures to SPLs ≥160 dB rms resulting from use of the EK60.

(5) Repeat steps 1–4 for additional surveys with other predominant sound sources.

Totals in Tables 10–12 represent sums across all relevant surveys/sources rounded up to the nearest whole number. The AFSC has requested the authorization of take indicated by rounding.

TABLE 10—DENSITIES AND ESTIMATED SOURCE-, STRATUM-, AND SPECIES-SPECIFIC ANNUAL ESTIMATES OF LEVEL B HARASSMENT IN THE GOARA

Species	Shallow	Deep	Area density (animals/km^2) [1]	Volumetric density (animals/km^3) [2]	Estimated level B harassment, 0–200 m		Estimated level B harassment, >200 m		Total
					EK60	ES60	EK60	ES60	
North Pacific right whale	X		0.005	0.027	0.1				1
Gray whale	X		1.700	8.500	4,649.4				4,650
Humpback whale (CNP)	X		0.065	0.327	115.4				116
Humpback whale (WNP)	X		0.001	0.004	1.2				2
Minke whale	X		0.001	0.006	2.1				3
Sei whale	X		0.000	0.000	0.01				1
Fin whale	X		0.020	0.100	35.3				36
Blue whale	X		0.000	0.001	0.2				1
Sperm whale		X	0.001	0.002	0.7	0.2	1.3	0.2	3
Cuvier's beaked whale		X	0.000	0.000	0.1	0	0.1	0	1
Baird's beaked whale		X	0.002	0.003	1.2	0.3	2.1	0.3	4
Stejneger's beaked whale		X	0.005	0.010	3.6	0.8	6.4	0.8	12
Beluga whale (Cook Inlet) [3]	X		0.200	1.000		2.5			3
Pacific white-sided dolphin	X		0.015	0.075	26.5	5.9			33
Killer whale (offshore)	X		0.011	0.055	19.4	4.3			24
Killer whale (west coast transient)	X		0.006	0.028	9.9	2.2			13
Killer whale (AT1 transient)	X		0.001	0.004	1.2	0.3			2
Killer whale (GOA/BSAI transient)	X		0.001	0.004	1.2	0.3			2
Killer whale (northern resident)	X		0.003	0.013	4.4	1.0			6
Killer whale (AK resident)	X		0.009	0.045	15.9	3.5			20
Harbor porpoise (GOA)	X		0.200	1.000	547.0	102.9			650
Harbor porpoise (SEAK)	X		0.110	0.550	300.8	56.6			358
Dall's porpoise	X		1.600	8.000	4,375.9	823.3			5,200
Northern fur seal (CA) [4]	X		0.044	0.219	119.5	22.5			143
Northern fur seal (EP—winter) [5]	X		0.377	1.883	458.0				459
Northern fur seal (EP—summer)	X		0.116	0.582	176.7	59.9			237
Steller sea lion (eastern; GOA-wide)	X		0.059	0.294	160.8	30.3			192
Steller sea lion (eastern; E144)	X		0.221	1.103	603.3	113.5			717
Steller sea lion (eastern; W144)	X		0.001	0.006	3.3	0.6			4
Steller sea lion (western; GOA-wide)	X		0.035	0.176	96.0	18.1			115

TABLE 10—DENSITIES AND ESTIMATED SOURCE-, STRATUM-, AND SPECIES-SPECIFIC ANNUAL ESTIMATES OF LEVEL B HARASSMENT IN THE GOARA—Continued

Species	Shallow	Deep	Area density (animals/ km^2) [1]	Volumetric density (animals/ km^3) [2]	Estimated level B harassment, 0–200 m		Estimated level B harassment, >200 m		Total
					EK60	ES60	EK60	ES60	
Steller sea lion (western; E144)	X		0.003	0.015	7.9	1.5			10
Steller sea lion (western; W144)	X		0.048	0.239	130.7	24.6			156
Harbor seal (Clarence Strait)	X		0.099	0.494	174.6	38.7			214
Harbor seal (Dixon/Cape Decision)	X		0.057	0.283	99.9	22.1			123
Harbor seal (Sitka/Chatham Strait)	X		0.046	0.232	82.0	18.2			101
Harbor seal (Lynn Canal/Stephens Passage)	X		0.030	0.148	52.3	11.6			64
Harbor seal (Glacier Bay/Icy Strait)	X		0.022	0.113	39.8	8.8			49
Harbor seal (Cook Inlet/Shelikof Strait)	X		0.031	0.156	54.9	12.2			68
Harbor seal (Prince William Sound)	X		0.061	0.303	107.2	23.7			131
Harbor seal (South Kodiak)	X		0.022	0.109	38.6	8.5			48
Harbor seal (North Kodiak)	X		0.009	0.472	16.7	3.7			21
Northern elephant seal		X	0.020	0.045	15.9	3.5	28.3	3.6	52

[1] Sources and derivation of marine mammal density information are provided in Table 6–10d of AFSC's application.
[2] Volumetric density estimates derived by dividing area density estimates by 0.2 km (for shallow species) or 0.5 km (for deep species), corresponding with defined depth strata.
[3] The EK60 is not used in areas of Cook Inlet where beluga whales may be present.
[4] Individuals from the California stock of northern fur seals are assumed to occur only east of 144°W.
[5] The EK60 is not used in winter in areas where the northern fur seal may be present.

TABLE 11—DENSITIES AND ESTIMATED SOURCE-, STRATUM-, AND SPECIES-SPECIFIC ANNUAL ESTIMATES OF LEVEL B HARASSMENT IN THE BSAIRA

Species	Shallow	Deep	Area density (animals/ km^2) [1]	Volumetric density (animals/ km^3) [2]	Estimated level B harassment, 0–200 m			Estimated level B harassment, >200 m		Total
					EK60	ES60	7111	EK60	ES60	
North Pacific right whale	X		0.000	0.002	0.1					1
Bowhead whale	X		0.017	0.085	41.5					42
Gray whale	X		0.380	1.900	928.5					929
Humpback whale (CNP)	X		0.018	0.092	45.0					45
Humpback whale (WNP)	X		0.002	0.008	3.9					4
Minke whale	X		0.002	0.011	4.3					5
Sei whale	X		0.000	0.001	0.4					1
Fin whale	X		0.001	0.007	3.4					4
Sperm whale		X	0.008	0.016	6.5	5.5	0.3	4.2	1.9	19
Cuvier's beaked whale		X	0.000	0.000	0.1	0.1	0	0	0	1
Baird's beaked whale		X	0.002	0.003	1.4	1.2	0.1	0.9	0.4	4
Stejneger's beaked whale		X	0.001	0.002	1.0	0.8	0	0.6	0.3	3
Beluga whale (Bristol Bay) [3]	X		0.700	3.500						0
Beluga whale (eastern Bering Sea)	X		0.242	0.484	493.7	419.5	24.9			939
Pacific white-sided dolphin	X		0.005	0.027	11.0	9.4	0.6			21
Killer whale (offshore)	X		0.011	0.055	22.4	19.1	1.1			43
Killer whale (GOA/BSAI transient)	X		0.003	0.013	5.3	4.5	0.3			11
Killer whale (AK resident)	X		0.001	0.005	2.0	1.7	0.1			4
Harbor porpoise (Bering Sea)	X		0.450	2.250	918.1	780.1	46.3			1,745
Dall's porpoise	X		0.033	0.164	79.9	58.8	3.4			143
Northern fur seal (EP—winter) [4]	X		0.075	0.377	18.2					19
Northern fur seal (EP—summer)	X		0.215	1.075	473.6	386.6				861
Steller sea lion (eastern)	X		0.000	0.001	0.2	0.2				1
Steller sea lion (western)	X		0.012	0.060	29.1	21.4				51
Bearded seal	X		0.394	1.968	961.5	707.4				1,669
Harbor seal (Aleutian Islands)	X		0.003	0.014	5.9	5.0				11
Harbor seal (Pribilof Islands)	X		0.000	0.001	0.2	0.2				1
Harbor seal (Bristol Bay)	X		0.015	0.072	29.5	25.1				55
Spotted seal	X		0.601	3.006	1,125.1	827.8				1,953
Ringed seal	X		0.349	1.746	853.3	627.7				1,481

TABLE 11—DENSITIES AND ESTIMATED SOURCE-, STRATUM-, AND SPECIES-SPECIFIC ANNUAL ESTIMATES OF LEVEL B HARASSMENT IN THE BSAIRA—Continued

Species	Shallow	Deep	Area density (animals/ km²) [1]	Volumetric density (animals/ km³) [2]	Estimated level B harassment, 0–200 m			Estimated level B harassment, >200 m		Total
					EK60	ES60	7111	EK60	ES60	
Ribbon seal	X	....	0.241	1.204	450.5	331.4	....	....	....	782

[1] Sources and derivation of marine mammal density information are provided in Table 6–10d of AFSC's application.
[2] Volumetric density estimates derived by dividing area density estimates by 0.2 km (for shallow species) or 0.5 km (for deep species), corresponding with defined depth strata.
[3] Acoustic sources considered in this analysis are not used in areas of Bristol Bay where beluga whales may occur.
[4] The ES60 is not used during winter in BSAIRA.

TABLE 12—DENSITIES AND ESTIMATED SOURCE-, STRATUM-, AND SPECIES-SPECIFIC ANNUAL ESTIMATES OF LEVEL B HARASSMENT IN THE CSBSRA

Species	Shallow	Deep	Area density (animals/ km²) [1]	Volumetric density (animals/ km³) [2]	Estimated level B harassment, 0–200 m	Total
					ES60	
Bowhead whale	X	....	2.270	11.350	....	0
Gray whale	X	....	0.010	0.050	....	0
Humpback whale (CNP)	X	....	0.000	0.001	....	0
Humpback whale (WNP)	X	....	0.000	0.000	....	0
Minke whale	X	....	0.000	0.001	....	0
Fin whale	X	....	0.000	0.001	....	0
Beluga whale (Beaufort Sea)	X	....	0.008	0.040	3.0	3
Beluga whale (eastern Chukchi Sea)	X	....	0.008	0.040	3.0	3
Killer whale (GOA/BSAI transient)	X	....	0.000	0.000	0.003	1
Harbor porpoise (Bering Sea)	X	....	0.000	0.001	0.03	1
Bearded seal	X	....	0.175	0.875	58.0	58
Spotted seal	X	....	0.460	2.302	152.5	153
Ringed seal	X	....	1.765	8.825	584.6	585
Ribbon seal	X	....	0.184	0.922	75	62

[1] Sources and derivation of marine mammal density information are provided in Table 6–10d of AFSC's application.
[2] Volumetric density estimates derived by dividing area density estimates by 0.2 km.

Estimated Take Due to Physical Disturbance

Take due to physical disturbance could potentially happen, as it is likely that some pinnipeds will move or flush from known haul-outs into the water in response to the presence or sound of AFSC vessels or researchers. Such events could occur as a result of unintentional approach during survey activity, in the GOARA or BSAIRA only. Physical disturbance would result in no greater than Level B harassment. Behavioral responses may be considered according to the scale shown in Table 13 and based on the method developed by Mortenson (1996). We consider responses corresponding to Levels 2–3 to constitute Level B harassment.

TABLE 13—PINNIPED RESPONSE TO DISTURBANCE

Level	Type of response	Definition
1	Alert	Seal head orientation or brief movement in response to disturbance, which may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, changing from a lying to a sitting position, or brief movement of less than twice the animal's body length.
2	Movement	Movements away from the source of disturbance, ranging from short withdrawals at least twice the animal's body length to longer retreats over the beach.
3	Flight	All retreats (flushes) to the water.

The AFSC has estimated potential incidents of Level B harassment due to physical disturbance (Table 14) by considering the number of seals believed to potentially be present at affected haul-outs or rookeries and the number of visits within a certain distance of the haul-out expected to be made by AFSC researchers. AFSC compared haul-out and rookery locations and research survey station and track line locations. Analysis was limited to activities that occurred within a 5-km buffer zone from the shoreline. For point data, a 2-km zone around the point was assumed to represent the extent of the vessel and survey activity around the point. For line data representing the Alaska longline survey and the Gulf of Alaska acoustic pollock survey, a 0.5 nmi (0.9 km) buffer around the line was used to represent the potential interaction area. Take interactions where then tallied if the buffered line or point data from the research activities intersected within a 0.5 nmi buffer zone around any identified rookery or haul-out. When on the basis of this analysis a ‘‘disturbance’’ was assumed, the number of individuals expected to be present at the location are assumed to be disturbed. Number of individuals was determined based on count data for Steller sea lions and based on a density value multiplied by the buffered haul-out area for harbor seals. AFSC does not believe that any research activities would result in physical disturbance of pinnipeds other than Steller sea lions or harbor seals. Similarly, no disturbance is expected of eastern Steller sea lions due to a lack of overlap between known haul-outs or rookeries and research activities.

Although not all individuals on ''disturbed'' haul-outs would necessarily actually be disturbed, and some haul-outs may experience some disturbance at distances greater than expected, we believe that this approach is a reasonable effort towards accounting for this potential source of disturbance. The results are likely overestimates, because some activities may only be one-time, sporadic, or biennial activities, but are assumed to happen on an annual basis.

TABLE 14—ESTIMATED ANNUAL LEVEL B HARASSMENT OF PINNIPEDS ASSOCIATED WITH DISTURBANCE BY RESEARCHERS

Species	Stock	Estimated annual level B harassment
Harbor seal	Clarence Strait	28
	Dixon/Cape Decision	30
	Sitka/Chatham Strait	864
	Lynn Canal/Stephens Passage	45
	Glacier Bay/Icy Strait	20
	Cook Inlet/Shelikof Strait	2,554
	Prince William Sound	3,063
	South Kodiak	3,761
	North Kodiak	885
	Bristol Bay	132
	Pribilof Islands	28
	Aleutian Islands	290
Steller sea lion	Western DPS (GOARA)	3,082
	Western DPS (BSAIRA)	112

Effects of Specified Activities on Subsistence Uses of Marine Mammals

The availability of the affected marine mammal stocks or species for subsistence uses may be impacted by this activity. The subsistence uses that may be affected and the potential impacts of the activity on those uses are described in section 8 of the AFSC's application. Measures included in this proposed rulemaking to reduce the impacts of the activity on subsistence uses are described in Appendix B of the AFSC's application. For full details, please see those documents. Last, the information from this section and the Proposed Mitigation section is analyzed to determine whether the necessary findings may be made in the Unmitigable Adverse Impact Analysis and Determination section.

Proposed Mitigation

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 taking for certain subsistence uses (''least practicable adverse impact''). NMFS does not have a regulatory definition for ''least practicable adverse impact.'' However, NMFS's implementing regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, implementation of the measure(s) is expected to reduce impacts to marine mammal species or stocks, their habitat, and their availability for subsistence uses. This analysis will consider such things as the nature of the potential adverse impact (such as likelihood, scope, and range), the likelihood that the measure will be effective if implemented, and the likelihood of successful implementation.

(2) The practicability of the measure for applicant implementation. Practicability of implementation may consider such things as cost, impact on operations, personnel safety, and practicality of implementation.

The following suite of mitigation measures and procedures, *i.e.,* measures taken to monitor, avoid, or minimize the encounter and potential take of marine mammals, will be employed by the AFSC during research cruises and activities. These procedures are the same whether the survey is conducted AFSC, IPHC, or is an AFSC-supported survey, which may be conducted onboard a variety of vessels, *e.g.,* on board a NOAA vessel or charter vessel. The procedures described are based on protocols used during previous research surveys and/or best practices developed for commercial fisheries using similar gear. The AFSC conducts a large variety of research operations, but only activities using trawl, longline, and gillnet gears are expected to present a reasonable likelihood of resulting in incidental take of marine mammals. AFSC's past survey operations have resulted in marine mammal interactions. These protocols are designed to continue the past record of few interactions while providing credible, documented, and safe encounters with observed or captured animals. Mitigation procedures will be focused on those situations where mammals, in the best professional judgement of the vessel operator and Chief Scientist (CS), pose a risk of incidental take. In many instances, the AFSC will use streamlined protocols and training for protected species developed in collaboration with the North Pacific Groundfish and Halibut Observer Program.

The AFSC has invested significant time and effort in identifying technologies, practices, and equipment to minimize the impact of the proposed activities on marine mammal species and stocks and their habitat. These efforts have resulted in the consideration of many potential mitigation measures, including those the AFSC has determined to be feasible and has implemented in recent years as a standard part of sampling protocols. These measures include the move-on rule mitigation protocol (also referred to in the preamble as the move-on rule), protected species visual watches and use of acoustic pingers on gillnet gear and on surface trawls in southeast Alaska.

Effective monitoring is a key step in implementing mitigation measures and is achieved through regular marine mammal watches. Marine mammal watches are a standard part of conducting AFSC fisheries research activities, particularly those activities that use gears that are known to or potentially interact with marine mammals. Marine mammal watches and monitoring occur during daylight hours prior to deployment of gear (*e.g.,* trawls, gillnets, and longline gear), and they continue until gear is brought back on board. If marine mammals are sighted in the area and are considered to be at risk of interaction with the research gear, then the sampling station is either moved or canceled or the activity is suspended until the marine mammals are no longer in the area. On smaller vessels, the CS and the vessel operator are typically those looking for marine mammals and other protected species. When marine mammal researchers are on board (distinct from marine mammal observers dedicated to monitoring for potential gear interactions), they will record the estimated species and numbers of animals present and their behavior using protocols similar or adapted from the North Pacific Groundfish and Halibut Observer Program. If marine mammal researchers are not on board or available, then the CS in cooperation with the vessel operator will monitor for marine mammals and provide training as practical to bridge crew and other crew to observe and record such information. Because marine mammals are frequently observed in Alaskan waters, marine mammal observations may be limited to those animals that directly interact with or are near to the vessel or gear. NOAA vessels, chartered vessels, and affiliated vessels or studies are required to monitor interactions with marine mammals but are limited to reporting direct interactions, dead animals, or entangled whales.

General Measures

Coordination and Communication—When AFSC 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 AFSC 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 AFSC survey effort is conducted aboard cooperative platforms (*i.e.,* non-NOAA vessels), ultimate responsibility and decision authority again rests with non-AFSC 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 AFSC survey effort is composed, in part or whole, of AFSC staff and is led by a CS. Therefore, because the AFSC—not OMAO or any other entity that may have authority over survey platforms used by AFSC—is the applicant to whom any incidental take authorization issued under the authority of these proposed regulations would be issued, we require that the AFSC 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. AFSC 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.

As described previously, for IPHC longline survey operations, applicable mitigation, monitoring, and reporting requirements would be conveyed from the AFSC to the IPHC via Letters of Acknowledgement issued by the AFSC pursuant to the MSA. Although IPHC survey effort is not conducted aboard NOAA platforms, the same communication and coordination requirements would apply to IPHC surveys.

Vessel Speed—Vessel speed during active sampling rarely exceeds 5 kn, with typical speeds being 2–4 kn. Transit speeds vary from 6–14 kn but average 10 kn. 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). In addition, when research vessels are operating in areas and times where greater risk is expected due to marine mammal presence, *e.g.,* Seguam Pass during humpback whale migration, additional crew are brought up to the bridge to monitor for whales. In such cases vessel captains may also reduce speed to improve the chances of observing whales and avoiding them. At any time during a survey or in transit, if a crew member or designated marine mammal observer standing watch 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 AFSC 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. However, at all times when the AFSC 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—Handling procedures are those taken to return a live animal to the sea or process a dead animal. The AFSC 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; these have been adapted from the North Pacific Fishery Observer Manual. These procedures are expected to increase post-release survival and, 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.

Captured live or injured marine mammals are released from research gear and returned to the water as soon as possible with no gear or as little gear remaining on the animal as possible. Animals are released without removing them from the water if possible and data collection is conducted in such a manner as not to delay release of the animal(s) or endanger the crew. AFSC staff will be instructed on how to identify different species; handle and bring marine mammals aboard a vessel; assess the level of consciousness; remove fishing gear; and return marine mammals to water. For further information regarding proposed handling procedures, please see section 11.7 of AFSC's application.

Other Measures—AFSC scientists are aware of the need to prevent or minimize disturbance of marine mammals when operating vessels nearshore around pinniped rookeries and haul-outs, and other places where marine mammals are aggregated. Minimum approaches shall be not less than 1 km from the aggregation area.

Trawl Survey Visual Monitoring and Operational Protocols

Visual monitoring protocols, described above, are an integral component of trawl mitigation protocols. Observation of marine mammal presence and behaviors in the vicinity of AFSC trawl survey operations allows for the application of professional judgment in determining the appropriate course of action to minimize the incidence of marine mammal gear interactions.

The OOD, CS or other designated member of the scientific party, and crew standing watch on the bridge visually scan surrounding waters with the naked eye and rangefinding binoculars (or monocular) for marine mammals prior to, during, and until all trawl operations are completed. Some sets may be made at night or other limited visibility conditions, when visual observation may be conducted using the naked eye and available vessel lighting with limited effectiveness.

Most research vessels engaged in trawling will have their station in view for 15 minutes or 2 nmi prior to reaching the station, depending upon the sea state and weather. Many vessels will inspect the tow path before deploying the trawl gear, adding another 15 minutes of observation time and gear preparation prior to deployment. Lookouts immediately alert the OOD and CS as to their best estimate of the species and number of animals observed and any observed animal's distance, bearing, and direction of travel relative to the ship's position. If any marine mammals are sighted around the vessel before setting gear, the vessel may be moved away from the animals to a different section of the sampling area if the animals appear to be at risk of interaction with the gear. This is what is referred to as the ''move-on'' rule.

If marine mammals are observed at or near the station, the CS and the vessel operator will determine the best strategy to avoid potential takes 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. After moving on, if marine mammals are still visible from the vessel and appear to be at risk, the CS may decide, in consultation with the vessel operator, to move again or to skip the station. In many cases, the survey design can accommodate sampling at an alternate site. In most cases, gear is not deployed if marine mammals have been sighted from the ship in its approach to the station unless those animals do not appear to be in danger of interactions with the gear, as determined by the judgment of the CS and vessel operator. The efficacy of the ''move-on'' rule is limited during night time or other periods of limited visibility; although operational lighting from the vessel illuminates the water in the immediate vicinity of the vessel during gear setting and retrieval. In these cases, it is again the judgment of the CS as based on experience and in consultation with the vessel operator to exercise due diligence and to decide on appropriate course of action to avoid unintentional interactions.

Once the trawl net is in the water, the OOD, CS or other designated scientist, and/or crew standing watch continue to monitor the waters around the vessel and maintain a lookout for marine mammals as environmental conditions allow (as noted previously, visibility can be limited for various reasons). If marine mammals are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take is determined by the professional judgment of the OOD, in consultation with the CS and vessel operator as necessary. These judgments take into consideration the species, numbers, and behavior of the animals, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. If marine mammals are sighted during haul-back operations, there is the potential for entanglement during retrieval of the net, especially when the trawl doors have been retrieved and the net is near the surface and no longer under tension. The risk of catching an animal may be reduced if the trawling continues and the haul-back is delayed until after the marine mammal has lost interest in the gear or left the area. The appropriate course of action to minimize the risk of incidental take is determined by the professional judgment of the OOD, vessel operator, and the CS based on all situation variables, even if the choices compromise the value of the data collected at the station. 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 prioritize 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 AFSC 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'').

If trawling operations have been suspended because of the presence of marine mammals, the vessel will resume trawl operations (when practicable) only when the animals are believed to have departed the area. This decision is at the discretion of the OOD/CS and is dependent on the situation.

Standard survey protocols that are expected to lessen the likelihood of marine mammal interactions include standardized tow durations and distances. Standard bottom trawl tow durations of not more than 15–30 minutes at the target depth will typically be implemented, excluding deployment and retrieval time, to reduce the likelihood of attracting and incidentally taking marine mammals. Short tow durations, and the resulting short tow distances (typically 1–2 nmi), decrease the opportunity for marine mammals to find the vessel and investigate. The scientific crew will avoid dumping previous catches when the net is being retrieved, especially when the net is at the surface at the trawl alley. This practice of dumping fish when the net is near the vessel may train marine mammals to expect food when the net is retrieved and may capture the protected species.

In operations in areas of southeast Alaska deploying surface nets, several additional measures have been employed to minimize the likelihood of marine mammal encounters, including no offal discard prior to or during the trawling at a station, trawling of short duration and seldom at night, no trawling less than one kilometer from pinniped rookeries or haul-outs, and deployment of acoustic pingers attached on the trawl foot or head ropes. Pingers are acoustic deterrents that are intended to deter the presence of marine mammals and therefore decrease the probability of entanglement or unintended capture of marine mammals.

Acoustic Deterrent Devices—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; Carlström *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.,* 2017) 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 AFSC surface trawl gear in southeast Alaska.

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 AFSC 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. AFSC 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 AFSC 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). Potential taking of marine mammals resulting from AFSC use of pingers is not discussed further in this document.

As described above, pingers (10 kHz, 132 dB, 300 ms every 4 s) would be deployed on surface trawl nets deployed in southeast Alaska. Pingers would also be deployed on gillnets. Please see ''Marine Mammal Hearing'' below for reference to functional and best hearing ranges for marine mammals.

Longline Survey Visual Monitoring and Operational Protocols

Visual monitoring requirements for all longline surveys are similar to the general protocols described above for trawl surveys. Please see that section for full details of the visual monitoring protocol and the move-on rule mitigation protocol. In summary, requirements for longline surveys are to: (1) Conduct visual monitoring prior to arrival on station; (2) implement the move-on rule if marine mammals are observed within the area around the vessel and may be at risk of interacting with the vessel or gear; (3) deploy gear as soon as possible upon arrival on station (depending on presence of marine mammals); and (4) maintain visual monitoring effort throughout deployment and retrieval of the longline gear. As was described for trawl gear, the OOD, CS, or watch leader will use best professional judgment to minimize the risk to marine mammals from potential gear interactions during deployment and retrieval of gear. If marine mammals are detected during setting operations and are considered to be at risk, immediate retrieval or suspension of operations may be warranted. If operations have been suspended because of the presence of marine mammals, the vessel will resume setting (when practicable) only when the animals are believed to have departed the area. If marine mammals are detected during retrieval operations and are considered to be at risk, haul-back may be postponed. These decisions are at the discretion of the OOD/CS and are dependent on the situation.

As for trawl surveys, some standard survey protocols are expected to minimize the potential for marine mammal interactions. Soak times are typically short relative to commercial fishing operations, measured from the time the last hook is in the water to when the first hook is brought out of the water. AFSC longline protocols specifically prohibit chumming (releasing additional bait to attract target species to the gear). Spent bait and offal are discarded away from the longline retrieval area but not retained until completion of longline retrieval. Due to the volume of fish caught with each set and the length of time it takes to retrieve the longline (up to eight hours), the retention of spent bait and offal until the gear is completely retrieved is not possible.

Whales, particularly killer whales in the Bering Sea and sperm whales in the Gulf of Alaska, are commonly attracted to longline fishing operations and have learned how to remove fish from longline gear as it is retrieved. Such depredation of fish off the longline by whales can significantly affect catch rate and species composition of data collected by the survey. The effect of depredation activity on survey results has been a research subject for many years and many aspects are therefore recorded as part of normal survey protocols, including the amount of catch potentially depredated (percent of empty hooks or damaged fish), number of whales visible, behavior of whales, whale proximity to the vessel, and any whale/vessel interactions. Sperm whale depredation can be difficult to determine because they can alternate between diving deep to depredate the line and swimming at the surface eating offal (see below). The presence of sperm whales at the surface does not mean they are actively depredating the line.

The Alaska Longline Survey uses bottom longline gear with a 16-km mainline. Sets are made in the morning if no killer whales or sperm whales are present and the longline gear is allowed to soak for three hours before haul-back begins. Due to the length of the mainline and numbers of hooks involved, it takes up to eight hours to complete the haul-back. Whales have learned to associate particular sounds with longline operations and typically arrive on scene as the gear is being retrieved. Efforts have been made to avoid depredation by allowing the line to sink back down but such strategies have proved impractical as whales can wait in the area for days and fish caught on the line are then eaten by other demersal marine organisms. The only practical way to minimize depredation if whales find the vessel is to continue retrieving the gear as quickly as possible. As killer whales may also follow the survey vessel between stations, the station order has been altered to disrupt the survey pattern as a means to dissuade the animals from this behavior and to avoid continued interactions.

Gillnet Survey Visual Monitoring and Operational Protocols

Visual monitoring and operational protocols for gillnet surveys are similar to those described previously for trawl surveys, with a focus on visual observation in the survey area and avoidance of marine mammals that may be at risk of interaction with survey vessels or gear. Gillnets 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 continuously 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. As noted above, pingers would be deployed on gillnets, which are used only at the Little Port Walter Research Station in southeast Alaska and in Prince William Sound.

We have carefully evaluated the AFSC'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. Based on our evaluation of these 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, and on the availability of such species or stock for subsistence uses.

Proposed Monitoring and Reporting

In order to issue an LOA 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 the authorized taking. NMFS's MMPA implementing regulations further describe the information that an applicant should provide when requesting an authorization (50 CFR 216.104(a)(13)), including the means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and the level of taking or impacts on populations of marine mammals.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

• Occurrence of significant interactions with marine mammal species in action area (*e.g.,* animals that came close to the vessel, contacted the gear, or are otherwise rare or displaying unusual behavior).

• 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 marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.

• How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.

• Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or important physical components of marine mammal habitat).

• Mitigation and monitoring effectiveness.

AFSC 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.'' Dedicated marine mammal visual monitoring occurs as described (1) for some period prior to deployment of most research gear; (2) throughout deployment and active fishing of all research gears; (3) for some period prior to retrieval of longline gear; and (4) throughout retrieval of all research gear. This visual monitoring is performed by trained AFSC personnel or other trained crew during the monitoring period. Observers record the species and estimated number of animals present and their behaviors, which may be valuable information towards an understanding of whether certain species may be attracted to vessels or certain survey gears. Separately, marine mammal watches are conducted by watch-standers (those navigating the vessel and other crew; these will typically not be AFSC personnel) at all times when the vessel is being operated. The primary focus for this type of watch is to avoid striking marine mammals and to generally avoid navigational hazards. These watch-standers typically have other duties associated with navigation and other vessel operations and are not required to record or report to the scientific party data on marine mammal sightings, except when gear is being deployed or retrieved.

AFSC will also monitor disturbance of hauled-out pinnipeds resulting from the presence of researchers, 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 13.

Training

AFSC anticipates that additional information on practices to avoid marine mammal interactions can be gleaned from training sessions and more systematic data collection standards. The AFSC will conduct annual trainings for all chief scientists and other personnel who may be responsible for conducting marine mammal visual observations or handling incidentally captured marine mammals to explain mitigation measures and monitoring and reporting requirements, mitigation and monitoring protocols, marine mammal identification, recording of count and disturbance observations, completion of datasheets, and use of equipment. Some of these topics may be familiar to AFSC staff, who may be professional biologists; the AFSC shall determine the agenda for these trainings and ensure that all relevant staff have necessary familiarity with these topics. The AFSC will work with the North Pacific Fisheries Groundfish and Halibut Observer Program to customize a new training program. The first such training will include three primary elements: (1) An overview of the purpose and need for the authorization, including mandatory mitigation measures by gear and the purpose for each, and species that AFSC is authorized to incidentally take; (2) detailed descriptions of reporting, data collection, and sampling protocols; and (3) discussion of best professional judgment (which is recognized as an integral component of mitigation implementation; see ''Proposed Mitigation'').

The second topic will include instruction on how to complete new data collection forms such as the marine mammal watch log, the incidental take form (*e.g.,* specific gear configuration and details relevant to an interaction with protected species), and forms used for species identification and biological sampling.

The third topic will include use of professional judgment 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 AFSC 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 AFSC 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, AFSC believes adopting these protocols for data collection will also increase the information on which ''serious injury'' determinations (NMFS, 2012a, 2012b) are based and improve scientific knowledge about marine mammals that interact with fisheries research gears and the factors that contribute to these interactions. AFSC 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.

AFSC will record interaction information on their own standardized forms. To aid in serious injury determinations and comply with the current NMFS Serious Injury Guidelines (NMFS, 2012a, 2012b), researchers will also answer a series of supplemental questions on the details of marine mammal interactions.

Finally, for any marine mammals that are killed during fisheries research activities, scientists will collect data and samples pursuant to Appendix D of the AFSC DEA, ''Protected Species Mitigation and Handling Procedures for AFSC Fisheries Research Vessels.''

Reporting

As is normally the case, AFSC 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 AFSC 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 AFSC leadership and to the Office of Protected Resources (OPR). 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 AFSC 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 AFSC will submit annual summary reports to OPR including: (1) Annual line-kilometers surveyed during which the EK60, ME70, ES60, 7111 (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, gillnet, and trawl gear, including number of sets, tows, etc., specific to each research area 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, including event-specific total counts of animals present, counts of reactions according to the three-point scale shown in Table 13, and distance of closest approach; and (5) a written evaluation of the effectiveness of AFSC 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 annually, beginning one year post-issuance of any LOA, and the report must be submitted not less than ninety days following the end of a given 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 leadership and other relevant staff, alerting them to the event and to the fact that updated information describing the circumstances of the event has been inputted to 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.

AFSC 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. AFSC will require that the CS complete data forms and address supplemental questions, both of which have been developed to aid in SI determinations. AFSC 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 AFSC will perform all necessary reporting to ensure that any incidental M/SI is incorporated as appropriate into relevant SARs.

Negligible Impact Analysis and Determination

Introduction—NMFS has defined negligible impact 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 (50 CFR 216.103). 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, and the likely effectiveness of mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, and specific consideration of take by M/SI previously authorized for other NMFS research activities).

We note here that the takes from potential gear interactions enumerated below could result in non-serious injury, but their worse potential outcome (mortality) is analyzed for the purposes of the negligible impact determination. We discuss here the connection between the mechanisms for authorizing incidental take under section 101(a)(5) for activities, such as AFSC's research activities, and for authorizing incidental take from commercial fisheries. In 1988, Congress amended the MMPA's provisions for addressing 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 develop a system suited to the unique circumstances of commercial fishing operations led NMFS to suggest a new conceptual means and associated regulatory framework. That concept, Potential Biological Removal (PBR), and a system for developing plans containing regulatory and voluntary measures to reduce incidental take for fisheries that exceed PBR were incorporated as sections 117 and 118 in the 1994 amendments to the MMPA.

PBR is defined in 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, and is a measure to be considered when evaluating the effects of M/SI on a marine mammal species or stock. Optimum sustainable population (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 species or stock of marine mammal is maintained at or returned to its OSP.

PBR values are calculated by NMFS as the level of annual removal from a stock that will allow that stock to equilibrate within OSP at least 95 percent of the time, and is the product of factors relating to the minimum population estimate of the stock (N_{min}); the productivity rate of the stock at a small population size; and a recovery factor. Determination of appropriate values for these three elements incorporates significant precaution, such that application of the parameter to the management of marine mammal stocks may be reasonably certain to achieve the goals of the MMPA. For example, calculation of N_{min} incorporates the precision and variability associated with abundance information and is intended to provide reasonable assurance that the stock size is equal to or greater than the estimate (Barlow *et al.,* 1995). In general, the three factors are developed on a stock-specific basis in consideration of one another in order to produce conservative PBR values that appropriately account for both imprecision that may be estimated as well as potential bias stemming from lack of knowledge (Wade, 1998).

PBR can be used as a consideration of the effects of M/SI on a marine mammal stock but was applied specifically to work within the management framework for commercial fishing incidental take. PBR cannot be applied appropriately outside of the section 118 regulatory framework for which it was designed without consideration of how it applies in section 118 and how other statutory management frameworks in the MMPA differ. PBR was not designed as an absolute threshold limiting commercial fisheries, but rather as a means to evaluate the relative impacts of those activities on marine mammal stocks. Even where commercial fishing is causing M/SI at levels that exceed PBR, the fishery is not suspended. When M/SI exceeds PBR, NMFS may develop a take reduction plan, usually with the assistance of a take reduction team. The take reduction plan will include measures to reduce and/or minimize the taking of marine mammals by commercial fisheries to a level below the 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 utilizes the take reduction process to further mitigate the effects of fishery activities via additional bycatch reduction measures. PBR is not used to grant or deny authorization of commercial fisheries that may incidentally take marine mammals.

Similarly, to the extent consideration of PBR may be relevant to considering the impacts of incidental take from activities other than commercial fisheries, using it as the sole reason to deny incidental take authorization for those activities would be inconsistent with Congress's intent under section 101(a)(5) and the use of PBR under section 118. The standard for authorizing incidental take under section 101(a)(5) continues to be, among other things, whether the total taking will have a negligible impact on the species or stock. When Congress amended the MMPA in 1994 to add section 118 for commercial fishing, it did not alter the standards for authorizing non-commercial fishing incidental take under section 101(a)(5), acknowledging that negligible impact under section 101(a)(5) is a separate standard from PBR under section 118. In fact, in 1994 Congress also amended section 101(a)(5)(E) (a separate provision governing commercial fishing incidental take for species listed under the Endangered Species Act) to add compliance with the new section 118 but kept the requirement for a negligible impact finding, showing that the determination of negligible impact and application of PBR may share certain features but are different.

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. 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 and the determination of whether a stock is ''strategic'' (16 U.S.C. 1362(19))), but nothing in the MMPA requires the application of PBR outside the management of commercial fisheries interactions with marine mammals.

Nonetheless, NMFS recognizes that as a quantitative metric, PBR may be useful in certain instances as a consideration when evaluating the impacts of other human-caused activities on marine mammal stocks. Outside the commercial fishing context, and in consideration of all known human-caused mortality, PBR can help inform the potential effects of M/SI caused by activities authorized under 101(a)(5)(A) on marine mammal stocks. As noted by NMFS and the USFWS in our implementation regulations for the 1986 amendments to the MMPA (54 FR 40341, September 29, 1989), the Services consider many factors, when available, in making a negligible impact determination, including, but not limited to, the status of the species or stock relative to OSP (if known), whether the recruitment rate for the species or stock is increasing, decreasing, stable, or unknown, the size and distribution of the population, and existing impacts and environmental conditions. To specifically use PBR, along with other factors, to evaluate the effects of M/SI, we first calculate a metric for each species or stock that incorporates information regarding ongoing anthropogenic M/SI into the PBR value (*i.e.,* PBR minus the total annual anthropogenic mortality/serious injury estimate), which is called ''residual PBR'' (Wood *et al.,* 2012). We then consider how the anticipated potential incidental M/SI from the activities being evaluated compares to residual PBR. Anticipated or potential M/SI that exceeds residual PBR is considered to have a higher likelihood of adversely affecting rates of recruitment or survival, while anticipated M/SI that is equal to or less than residual PBR has a lower likelihood (both examples given without consideration of other types of take, which also factor into a negligible impact determination). In such cases where the anticipated M/SI is near, at, or above residual PBR, consideration of other factors, including those outlined above as well as mitigation and other factors (positive or negative), is especially important to assessing whether the M/SI will have a negligible impact on the stock. As described above, PBR is a conservative metric and is not intended to be used as a solid cap on mortality—accordingly, impacts from M/SI that exceed residual PBR may still potentially be found to be negligible in light of other factors that offset concern, especially when robust mitigation and adaptive management provisions are included.

Alternately, for a species or stock with incidental M/SI less than 10 percent of residual PBR, we consider M/SI from the specified activities to represent an insignificant incremental increase in ongoing anthropogenic M/SI that alone (*i.e.,* in the absence of any other take) cannot affect annual rates of recruitment and survival. In a prior incidental take rulemaking and in the commercial fishing context, this threshold is identified as the significance threshold, but it is more accurately an insignificance threshold outside commercial fishing because it represents the level at which there is no need to consider other factors in determining the role of M/SI in affecting rates of recruitment and survival. Assuming that any additional incidental take by harassment would not exceed the negligible impact level, the anticipated M/SI caused by the activities being evaluated would have a negligible impact on the species or stock. This 10 percent was identified as a workload simplification consideration to avoid the need to provide unnecessary additional information when the conclusion is relatively obvious; but as described above, values above 10 percent have no particular significance associated with them until and unless they approach residual PBR.

Our evaluation of the M/SI for each of the species and stocks for which mortality could occur follows. In addition, all mortality authorized for some of the same species or stocks over the next several years pursuant to our final rulemakings for the NMFS Southwest Fisheries Science Center and the NMFS Northwest Fisheries Science Center has been incorporated into the residual PBR.

We first consider maximum potential incidental M/SI for each stock (Table 6) in consideration of NMFS's threshold for identifying insignificant M/SI take (10 percent of residual PBR (69 FR 43338; July 20, 2004)). By considering the maximum potential incidental M/SI in relation to PBR and ongoing sources of anthropogenic mortality, we begin our evaluation of whether the potential incremental addition of M/SI through AFSC research activities may affect the species' or stock's annual rates of recruitment or survival. We also consider the interaction of those mortalities with incidental taking of that species or stock by harassment pursuant to the specified activity.

Summary of Estimated Incidental Take

Here we provide a summary of the total proposed incidental take authorization on an annual basis, as well as other information relevant to the negligible impact analysis. Table 15 shows information relevant to our negligible impact analysis concerning the total annual taking that could occur for each stock from NMFS' scientific research activities when considering incidental take previously authorized for SWFSC (80 FR 58982; September 30, 2015) and take proposed for authorization for NWFSC (81 FR 38516; June 13, 2016) and AFSC. Scientific research activities conducted by the SWFSC and/or NWFSC may impact the same populations of marine mammals expected to be impacted by IPHC survey activities occurring off of the U.S. west coast. We propose to authorize take by M/SI over the five-year period of validity for these proposed regulations as indicated in Table 15 below. For the purposes of the negligible impact analysis, we assume that all of these takes could potentially be in the form of M/SI; PBR is not appropriate for direct assessment of the significance of harassment.

For some stocks, a range is provided in the ''Total M/SI Authorization'' columns of Table 15 (below). In these cases, the worst case potential outcome is used to derive the value presented in the ''Estimated Maximum Annual M/SI'' column (Table 15, below). For example, we present ranges of 13–18 and 3–8 as the total take authorization proposed over five years for the eastern Pacific and California stocks of northern fur seal, respectively. These ranges reflect that, as part of the overall proposed take authorization for AFSC, a total of five takes of northern fur seals are expected to occur as a result specifically of IPHC longline operations. These five takes are considered as potentially accruing to either stock; therefore, we assess the consequences of the proposed take authorization for these stocks as though the maximum could occur to both. The ten total takes expected to potentially occur as a result of SWFSC and/or NWFSC survey operations could also occur to individuals from either stock. Similarly, we assume that IPHC survey operations specifically could result in incidental take of up to five harbor seals over the five years, and that these takes could occur for any stock of harbor seal (but that no more than one take would be expected from any given stock). Therefore, although only five takes are expected from IPHC activities, we assume that one take accrues to each of the 17 harbor seal stocks that may overlap with the IPHC surveys. For the NWFSC, we assumed that nine total takes of harbor seal could occur over five years, and that these takes could occur to either the California or Oregon/Washington coast stocks. Over five years, six total takes were expected to result from NWFSC/SWFSC survey operations within Washington inland waters—potentially occurring to any of the three stocks of harbor seals occurring in those waters. The value presented for ''Estimated Maximum Annual M/SI'' for each stock reflects these considerations. Similar considerations result in the ranges given for Steller sea lions (Table 15). This stock-specific accounting does not change our expectations regarding the combined total number of takes that would actually occur for each stock, but informs our stock-specific negligible impact analysis.

We previously authorized take of marine mammals incidental to fisheries research operations conducted by the SWFSC (see 80 FR 58982 and 80 FR 68512), and proposed to authorize take incidental to fisheries research operations conducted by the NWFSC (see 81 FR 38516). This take would occur to some of the same stocks for which we propose to authorize take incidental to AFSC fisheries research operations. Therefore, in order to evaluate the likely impact of the take by M/SI proposed for authorization in this rule, we consider not only other ongoing sources of human-caused mortality but the potential mortality authorized or proposed for authorization for SWFSC/NWFSC. As used in this document, other ongoing sources of human-caused (anthropogenic) mortality refers to estimates of realized or actual annual mortality reported in the SARs and does not include authorized or unknown mortality. Below, we consider the total taking by M/SI proposed for authorization for AFSC and previously authorized or proposed for authorization for SWFSC/NWFSC together to produce a maximum annual M/SI take level (including take of unidentified marine mammals that could accrue to any relevant stock) and compare that value to the stock's PBR value, considering ongoing sources of anthropogenic mortality (as described in footnote 4 of Table 15 and in the following discussion). PBR and annual M/SI values considered in Table 15 reflect the most recent information available (*i.e.,* final 2016 SARs).

TABLE 15—SUMMARY INFORMATION RELATED TO AFSC PROPOSED ANNUAL TAKE AUTHORIZATION, 2018–23

Species [1]	Stock	Proposed total annual Level B harassment authorization [2]	Percent of estimated population abundance	Proposed AFSC/IPHC total M/SI authorization, 2018–23 [3]	SWFSC/NWFSC total M/SI authorization	Estimated maximum annual M/SI [4]	PBR minus annual M/SI (%) [5]	Stock trend [6]
North Pacific right whale	ENP	2	6.5	0	0	0	n/a	?
Bowhead whale	Western Arctic	42	0.2	0	0	0	n/a	↑
Gray whale	ENP	5,579	26.6	0	0	0	n/a	→
Humpback whale	CNP	161	1.6	0	0	0	n/a	↑
	WNP	6	0.5	0	0	0	n/a	↑
Minke whale	Alaska	8	0.2 [8]	0	0	0	n/a	?
Sei whale	ENP	2	0.4	0	0	0	n/a	↑
Fin whale	Northeast Pacific	40	3.9 [8]	0	0	0	n/a	↑
Blue whale	ENP	1	0.1	0	0	0	n/a	→
Sperm whale	North Pacific	22	Unknown	2	0	0.4	?	?
Cuvier's beaked whale	Alaska	2	Unknown	0	0	0	n/a	?
Baird's beaked whale	Alaska	8	Unknown	0	0	0	n/a	?
Stejneger's beaked whale	Alaska	15	Unknown	0	0	0	n/a	?
Beluga whale	Beaufort Sea	3	0.0	1	0	0.2	510 (0.0)	↑ or →
	Eastern Chukchi Sea	3	0.1	1	0	0.2	177 (0.1)	?
	Eastern Bering Sea	939	4.9	0	0	0	n/a	?
	Bristol Bay	0	n/a	0	0	0	n/a	↑
	Cook Inlet	3	1.0	0	0	0	n/a	↓
Bottlenose dolphin	CA/OR/WA Offshore	0	n/a	1	11	2.8	9.4 (29.8)	?
Common dolphin	CA/OR/WA	0	n/a	1	15	3.6	8,353 (0.0)	↑
Pacific white-sided dolphin	NP	54	0.2	6	0	1.6	?	?
Risso's dolphin	CA/OR/WA	0	n/a	1	20	4.6	42.3 (10.9)	?
Killer whale	ENP Offshore	67	27.9	0	0	n/a	n/a	?
	West Coast Transient	13	5.3	0	0	n/a	n/a	↑
	AT1 Transient	2	28.6	0	0	n/a	n/a	↓
	ENP Gulf of Alaska, Aleutian Islands, and Bering Sea Transient.	14	2.4	0	0	n/a	n/a	→
	ENP Northern Resident	6	2.3	0	0	n/a	n/a	↑
	ENP Alaska Resident	24	1.0	2	0	0.4	23 (1.7)	↑
Short-finned pilot whale	CA/OR/WA	0	n/a	1	2	0.6	3.3 (18.2)	?
Harbor porpoise	Southeast Alaska	358	12.4 [8]	1	0	0.2	?	↓ or →
	Gulf of Alaska	650	2.1	2	0	0.8	?	?
	Bering Sea	1,746	3.6	1	0	0.4	?	?
Dall's porpoise	CA/OR/WA	0	n/a	1	8	2.2	171.7 (1.3)	?
	Alaska	5,343	6.4	14	0	3.4	?	?
Northern fur seal	Pribilof Islands/Eastern Pacific.	1,576	0.3	13–18	10	7.0	11,166 (0.1)	↓
	California	143	1.0	3–8		4.6	449.2 (1.0)	↑
California sea lion	United States	0	n/a	1	35	8.0	8,811 (0.1)	↑
Steller sea lion	Eastern U.S	914	2.2	7–12	19	7.4	2,390 (0.3)	↑
	Western U.S	3,526	6.9	13–18	0	4.6	79 (5.8)	? [7]
Bearded seal	Alaska (Beringia DPS)	1,727	0.6	2	0	0.8	7,819 (0.0)	?
Harbor seal	California	0	n/a	1	5–14	3.6	1,598 (0.2)	→
	OR/WA Coast	0	n/a	1	2–11	2.2	?	→
	Washington Inland Waters	0	n/a	1	6	1.6	?	→
	Clarence Strait	242	0.8	2	0	0.8	1,181 (0.1)	↑
	Dixon/Cape Decision	153	0.8	2	0	0.8	634 (0.1)	↑
	Sitka/Chatham Strait	965	6.5	3	0	1.0	483 (0.2)	↑
	Lynn Canal/Stephens Passage.	109	1.2	2	0	0.8	105 (0.8)	↓
	Glacier Bay/Icy Strait	69	1.0	2	0	0.8	65 (1.2)	↑
	Cook Inlet/Shelikof Strait	2,622	9.6	2	0	0.8	536 (0.1)	↑
	Prince William Sound	3,194	10.7	3	0	1.0	559 (0.2)	↓
	South Kodiak	3,809	19.8	2	0	0.8	186 (0.4)	↓
	North Kodiak	906	10.9	2	0	0.8	261 (0.3)	↑
	Bristol Bay	187	0.6	2	0	0.8	1,040 (0.1)	↑
	Pribilof Islands	29	12.5	2	0	0.8	7 (11.4)	→
	Aleutian Islands	301	4.7	2	0	0.8	83 (1.0)	↑
Spotted seal	Alaska	2,106	0.5	3	0	1.2	12,368 (0.0)	?
Ringed seal	Alaska	2,066	1.2 [8]	4	0	1.6	?	?
Ribbon seal	Alaska	1,404	0.8	2	0	0.8	9,781.2 (0.0)	?
Northern elephant seal	California Breeding	52	0.0	1	10	2.6	4,873.2 (0.1)	↑

Please see Tables 7, 10, 11, 12, and 14 and preceding text for details.

[1] For some species with multiple stocks, indicated level of take could occur to individuals from any stock (as indicated in table). For some stocks, a range is presented.

[2] Level B harassment totals include estimated take due to acoustic harassment and, for harbor seals and Steller sea lions, estimated take due to physical disturbance. Active acoustic devices are not used for data acquisition by IPHC; therefore, no takes by acoustic harassment are expected for stocks that occur entirely outside of Alaskan waters.

[3] As explained earlier in this document, gear interaction could result in mortality, serious injury, or Level A harassment. Because we do not have sufficient information to enable us to parse out these outcomes, we present such take as a pool. For purposes of this negligible impact analysis we assume the worst case scenario (that all such takes incidental to research activities result in mortality).

[4] This column represents the total number of incidents of M/SI that could potentially accrue to the specified species or stock as a result of NMFS's fisheries research activities 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 that may be captured in trawl gear in each of the three AFSC research areas; one to the total for each pinniped that may be captured in AFSC longline gear in the GOARA and BSAIRA; and one to the total for each pinniped that may be captured in IPHC longline gear. We also add one to the total of each small cetacean that may be captured in trawl gear in the GOARA and BSAIRA and one to the total of each small cetacean that may be captured in gillnet gear (GOARA only). This represents the potential that the take of an unidentified pinniped or small cetacean could accrue to any given stock captured in that gear in that area. 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.

[5] This value represents the calculated PBR less the average annual estimate of ongoing anthropogenic mortalities (*i.e.,* total annual human-caused M/SI, which is presented in the SARs) (see Table 3). In parentheses, we provide the estimated maximum annual M/SI expressed as a percentage of this value. For some stocks, a minimum population abundance value (and therefore PBR) is unavailable. In these cases, the proportion of estimated population abundance represented by the Level B harassment total and/or the proportion of residual PBR represented by the estimated maximum annual M/SI cannot be calculated.

[6] See relevant SARs for more information regarding stock status and trends. Interannual increases may not be interpreted as evidence of a trend. Based on the most recent abundance estimates, harbor seal stocks may have reached carrying capacity and appear stable. A time series of stock-specific abundance estimates for harbor porpoise shows either increasing or stable estimates, but it is not statistically valid to infer a trend.

[7] For western Steller sea lions, it is not appropriate to identify a single trend. Using data collected through 2015, there is strong evidence that non-pup and pup counts increased at ~2 percent per year between 2000 and 2015. However, there are strong regional differences across the range in Alaska, with positive trends east of Samalga Pass (~170° W) in the Gulf of Alaska and eastern Bering Sea and negative trends to the west in the Aleutian Islands. For more information, please see Muto *et al.* (2017).

[8] No official abundance estimate is provided for these stocks; however, we use the best available information regarding population abundance for comparison with the proposed total annual Level B harassment authorization. For the minke whale, surveys covering portions of the stock range provide a partial abundance estimate of 2,020 (CV = 0.73) + 1,233 (CV = 0.34) whales. For the fin whale, we use the minimum abundance estimate provided for a portion of the stock range (1,036 whales). Surveys in 2010–2012 provide an abundance estimate of 398 (CV = 0.12) + 577 (CV = 0.14) harbor porpoises in southeast Alaska. However, the resulting total of 975 is not corrected for observer perception bias and porpoise availability at the surface, which is particularly influential for estimates of porpoise abundance. Therefore, we apply a previously estimated correction factor of 2.96 (Hobbs and Waite, 2010) to this estimate for a provisional abundance estimate of 2,886. For the ringed seal, a partial abundance estimate (that does not account for availability bias) of 170,000 seals is given. For more information, please see the relevant SARs.

Analysis—The majority of stocks that may potentially be taken by M/SI (25 of 41) fall below the insignificance threshold (*i.e.,* 10 percent of residual PBR), while an additional 11 stocks do not have current PBR values and therefore are evaluated using other factors. We first consider stocks expected to be affected only by behavioral harassment and those stocks that fall below the insignificance threshold. Next, we consider those stocks above the insignificance threshold (*i.e.,* the offshore stock of bottlenose dolphin, Risso's dolphin, short-finned pilot whale, and the Pribilof Islands stock of harbor seal) and those without PBR values (harbor seal stocks along the Oregon and Washington coasts and in Washington inland waters; three stocks of harbor porpoise; sperm whale; Pacific white-sided dolphin; the Alaska stock of Dall's porpoise; and the ringed seal).

As described in greater depth previously (see ''Acoustic Effects''), we do not believe that AFSC use of active acoustic sources has the likely potential to cause any effect exceeding Level B harassment of marine mammals. We have produced what we believe to be precautionary estimates of potential incidents of Level B harassment. There is 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 AFSC operates. The procedure for producing these estimates, described in detail in ''Estimated Take Due to Acoustic Harassment,'' represents NMFS's best effort towards balancing the need to quantify the potential for occurrence of Level B harassment with this general lack of information. The sources considered here have moderate to high output frequencies, 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. We also produced estimates of incidents of potential Level B harassment due to disturbance of hauled-out pinnipeds that may result from the physical presence of researchers; these estimates are combined with the estimates of Level B harassment that may result from use of active acoustic devices.

Here, we consider authorized Level B take less than five percent of population abundance to be de minimis, while authorized Level B taking between 5–15 percent is low. A moderate amount of authorized taking by Level B harassment would be from 15–25 percent, and high above 25 percent. Of the 49 stocks that may be subject to Level B harassment, the level of taking proposed for authorization would represent a de minimis impact for 31 stocks and a low impact for an additional ten stocks. We do not consider these impacts further for these 41 stocks. The level of taking by Level B harassment would represent a moderate impact on one additional stock, the South Kodiak stock of harbor seals; and, therefore, we consider these potential impacts in conjunction with the level of taking by M/SI. The annual taking by M/SI projected for this stock equates to less than one percent of residual PBR; therefore we do not consider this stock further. The total taking by Level B harassment represents a high level of impact for three stocks (gray whale and the offshore and AT1 stocks of killer whale). We discuss these in further detail below. For an additional four stocks (sperm whale and Alaska stocks of three beaked whale species), there is no abundance estimate upon which to base a comparison. However, we note that the anticipated number of incidents of take by Level B harassment are very low (2–22 for these four stocks) and likely represent a de minimis impact on these stocks.

As described previously, there is some minimal potential for temporary effects to hearing for certain marine mammals, 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.,* Ellison *et al.,* 2012). Individuals may move away from the source if disturbed; but, because the source is itself moving and because of the directional nature of the sources considered here, there is unlikely to be even temporary displacement from areas of significance and any disturbance would be of short duration. 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 AFSC survey effort is widely dispersed in space and time, indicate that repeated exposures of the same individuals would be very unlikely. For these reasons, we do not consider the proposed level of take by acoustic disturbance to represent a significant additional population stressor when considered in context with the proposed level of take by M/SI for any species, including those for which no abundance estimate is available.

There are no additional impacts other than Level B harassment expected for the three stocks listed above for which Level B harassment is expected to be at a relatively high level, *i.e.,* the gray whale and offshore and AT1 stocks of killer whale (Level B harassment incidents equate to approximately 27, 28, and 29 percent of the stock abundances, respectively). It should be noted that the AT1 stock of transient killer whales has a critically low population abundance of seven whales.

Although the estimate of take by Level B harassment is at 29 percent, this represents only two estimated incidents of temporary and insignificant behavioral disruption, which would not be expected to affect annual rates of recruitment or survival for the stock. We do not discuss these three stocks further.

Similarly, disturbance of pinnipeds on haul-outs by researchers (expected for harbor seals and Steller sea lions in the GOARA and BSAIRA) are expected to be infrequent and cause only a temporary disturbance on the order of minutes. As noted previously, 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. When considering the individual animals likely affected by this disturbance, only a small fraction of the estimated population abundance of the affected stocks would be expected to experience the disturbance.

For Risso's dolphin, short-finned pilot whale, and the offshore stock of bottlenose dolphin, maximum total potential M/SI due to NMFS' fisheries research activity (SWFSC, NWFSC, and AFSC combined) is approximately 11, 18, and 30 percent of residual PBR, respectively. For example, PBR for Risso's dolphin is currently set at 46 and the annual average of known ongoing anthropogenic M/SI is 3.7, yielding a residual PBR value of 42.3. The maximum combined annual average M/SI incidental to NMFS fisheries research activity is 4.6, or 10.9 percent of residual PBR. The only known source of other anthropogenic mortality for these species is in commercial fisheries. For the Risso's dolphin and offshore stock of bottlenose dolphin, such take is considered to be insignificant and approaching zero mortality and serious injury. This is not the case for the short-finned pilot whale; however, the annual take from fisheries (1.2) and from NMFS's fisheries research (0.6) are both very low. There are no other factors that would lead us to believe that take by M/SI of 18 percent of residual PBR would be problematic for this species. Total potential M/SI due to NMFS' fisheries research activity is approximately 11 percent of residual PBR for the Pribilof Islands stock of harbor seals. However, there are no other known sources of anthropogenic M/SI for this stock or other known significant stressors; therefore, there is no indication that the take by M/SI of 11 percent of residual PBR would be problematic for this stock.

PBR is unknown for harbor seals on the Oregon and Washington coasts and in Washington inland waters (comprised of the Hood Canal, southern Puget Sound, and Washington northern inland waters stocks). The Hood Canal, southern Puget Sound, and Washington northern inland waters stocks were formerly a single inland waters stock. Both the Oregon/Washington coast and Washington inland waters stocks of harbor seal were considered to be stable following the most recent abundance estimates (in 1999, stock abundances were estimated at 24,732 and 13,692, respectively). However, a Washington Department of Fish and Wildlife expert (S. Jeffries) stated an unofficial abundance of 32,000 harbor seals in Washington (Mapes, 2013). Therefore, it is reasonable to assume that at worst, the stocks have not declined since the last abundance estimates. Ongoing anthropogenic mortality is estimated at 10.6 harbor seals per year for the coastal stock and 13.4 for inland waters seals; therefore, we reasonably assume that the maximum potential annual M/SI incidental to NMFS' fisheries research activities (2.2 and 1.6, respectively) is a small fraction of any sustainable take level that might be calculated for either stock.

As noted above, PBR is also undetermined for the sperm whale, Pacific white-sided dolphin, three stocks of harbor porpoise, Alaska stock of Dall's porpoise, and the ringed seal. We follow a similar approach as for harbor seals (see above) in evaluating the significance of the proposed M/SI by describing available information regarding population abundance and other sources of anthropogenic M/SI.

- Rice (1989) estimated that there were 930,000 sperm whales in the North Pacific following the conclusion of commercial whaling. However, this estimate included areas beyond the range of the U.S. North Pacific stock of sperm whales. Kato and Miyashita (1998) produced an estimate of 102,112 (CV = 0.155) sperm whales in the western North Pacific. However, this estimate is considered to be positively biased, and includes whales outside of Alaskan waters. Commercial fishing is the only other source of ongoing anthropogenic M/SI, which is estimated to be 3.7 whales per year. When considered in conjunction with the maximum total annual M/SI anticipated as a result of NMFS fisheries research activities (0.4), we expect that the resulting total annual M/SI (4.1) is a small fraction of any sustainable take level that might be calculated for the stock.
- Historically, the minimum population estimate for the Central North Pacific stock of Pacific white-sided dolphin was 26,880, based on the sum of abundance estimates for four separate survey blocks north of 45° N from surveys conducted during 1987–1990, reported in Buckland *et al.* (1993). This was considered a minimum estimate because the abundance of animals in a fifth block, which straddled the boundary of the two stocks for this species, was not included in the estimate for the North Pacific stock. In addition, much of the potential habitat for this stock was not surveyed between 1987 and 1990 (Muto *et al.,* 2017). Using this minimum abundance estimate in the PBR equation, assuming the default 4 percent productivity rate and a recovery factor of 0.5 (as recommended for stocks of unknown status), produces a PBR value of 268.8. There are no other sources of anthropogenic M/SI for this stock. The maximum total annual M/SI anticipated as a result of NMFS fisheries research activities (1.6) would represent 0.6 percent of residual PBR.
- For the Alaska stock of Dall's porpoise, no current estimate of minimum population abundance is available. However, an abundance estimate of 83,400 was estimated on the basis of data collected form 1987–1991 (Hobbs and Lerczak, 1993). Using this population estimate and its associated CV of 0.097, the minimum abundance would be 76,874. Using this estimate with the default productivity rate and the recovery factor for stocks expected to be within the OSP level (Buckland *et al.,* 1993), a PBR value of 1,537.5 may be calculated. Accounting for ongoing M/SI due to commercial fisheries, the maximum total annual M/SI anticipated as a result of NMFS fisheries research activities (3.4) would represent 0.2 percent of residual PBR.
- For the Bering Sea stock of harbor porpoise, a minimum abundance estimate of 40,039 was calculated by Hobbs and Waite (2010) on the basis of a partial abundance estimate, derived from 1999 aerial surveys of Bristol Bay. Although this estimate is formally considered outdated for use in calculating PBR values, we use it here in the same way as the Pacific white-sided dolphin and Dall's porpoise, addressed above. As for the Pacific white-sided dolphin, we use the default productivity rate and recovery factor for stocks of unknown status to calculate a PBR value of 400.4. Accounting for minimal fisheries mortality, the maximum total annual M/SI anticipated as a result of NMFS fisheries research

activities (0.4) would represent 0.1 percent of residual PBR.

- For the Gulf of Alaska stock of harbor porpoise, an minimum abundance estimate of 25,987 was calculated by Hobbs and Waite (2010) on the basis of an abundance estimate derived from 1998 aerial surveys of the western Gulf of Alaska. Using the default productivity rate and recovery factor for stocks of unknown status to calculate a PBR value of 259.9. Accounting for relatively significant ongoing fisheries mortality, the maximum total annual M/SI anticipated as a result of NMFS fisheries research activities (0.8) would represent 0.4 percent of residual PBR.
- A negatively biased minimum abundance estimate of 896 was calculated for the southeast Alaska stock of harbor porpoise on the basis of 2010–2012 aerial surveys (Muto *et al.,* 2017). The estimate is negatively biased because it does not account for observer perception bias and porpoise availability at the surface. However, use of a widely accepted correction factor (2.96) provides a minimum abundance estimate of 2,652 and a corresponding PBR value of 26.5. This PBR value is less than estimated annual ongoing mortality due to commercial fisheries (34). However, the maximum total annual M/SI anticipated as a result of NMFS fisheries research activities (0.2) represents a minimum potential take of one animal over the 5-year period and would represent an insignificant incremental addition to the total annual M/SI (0.6 percent).
- Although NMFS does not provide a formal PBR value for the ringed seal, Muto *et al.* (2017) provide a minimum abundance estimate of 170,000 seals in the U.S. sector of the Bering Sea. This is not considered a reliable estimate for the stock because it does not account for seals in the Chukchi and Beaufort Seas. However, as this is a conservative minimum abundance estimate, we use the corresponding PBR value of 5,100 given by Muto *et al.* (2017). Accounting for minimal ongoing M/SI due to commercial fisheries, as well as ongoing subsistence harvest of ringed seals, the maximum total annual M/SI anticipated as a result of NMFS fisheries research activities (1.6) would represent 0.04 percent of residual PBR.

In summary, our negligible impact analysis 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 and physical disturbance of pinnipeds consist of, at worst, temporary and relatively minor modifications in behavior; (3) the predicted number of incidents of potential mortality are at insignificant levels for a majority of affected stocks; (4) consideration of additional factors for Risso's dolphin, short-finned pilot whale, the offshore stock of bottlenose dolphin, and the Pribilof Isalnds stock of harbor seal do not reveal cause for concern; (5) total maximum potential M/SI incidental to NMFS fisheries research activity for southeast Alaska harbor porpoise, considered in conjunction with other sources of ongoing mortality, presents only a minimal incremental additional to total M/SI; (6) available information regarding stocks for which no current PBR estimate is available indicates that total maximum potential M/SI is sustainable; and (7) 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 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.

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 monitoring and mitigation measures, we preliminarily find that the total marine mammal take from the proposed activities will have a negligible impact on the affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Section 101(a)(5)(A) of the MMPA for specified activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

Please see Table 15 for information relating to this small numbers analysis. The total amount of taking proposed for authorization is less than five percent for a majority of stocks, and the total amount of taking proposed for authorization is less than one-third of the stock abundance for all stocks.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Impact on Availability of Affected Species for Taking for Subsistence Uses

In order to issue an LOA, NMFS must find that the specified activity will not have an ''unmitigable adverse impact'' on the subsistence uses of the affected marine mammal species or stocks by Alaskan Natives. NMFS has defined ''unmitigable adverse impact'' in 50 CFR 216.103 as an impact resulting from the specified activity that:

(1) Is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by:

(i) Causing the marine mammals to abandon or avoid hunting areas;

(ii) Directly displacing subsistence users; or

(iii) Placing physical barriers between the marine mammals and the subsistence hunters; and

(2) Cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

As described in this preamble, the AFSC has requested authorization of take incidental to fisheries research activities within Alaskan waters. The proposed activities have the potential to result in M/SI of marine mammals as a result of incidental interaction with research gear, and have the potential to result in incidental Level B harassment of marine mammals as a result of the use of active acoustic devices or because of the physical presence of researchers at locations where pinnipeds may be hauled out. These activities also have the potential to result in impacts on the availability of marine mammals for subsistence uses. The AFSC is aware of this potential and is committed to implementing actions to avoid or to minimize any such effects to Alaska Native subsistence communities. The AFSC addresses the potential for their proposed research activities to impact subsistence uses on the following factors:

Actions That May Cause Marine Mammals To Abandon or Avoid Hunting Areas

Some AFSC fisheries research efforts use high-frequency mapping and fish-finding sonars to assess abundance and distribution of target stocks of fish. The high frequency transient sound sources operated by the AFSC are used for a wide variety of environmental and remote-object sensing in the marine environment. These acoustic sources, which are present on most AFSC fishery research vessels, include a variety of single, dual, and multi-beam echosounders, sources used to determine the orientation of trawl nets, and several current profilers. Some of these acoustic sources are likely to be audible to some marine mammal species. Among the marine mammals, most of these sources are unlikely to be audible to whales and most pinnipeds, whereas they may be detected by odontocete cetaceans (and particularly high frequency specialists such as harbor porpoise). There is relatively little direct information about behavioral responses of marine mammals, including the odontocete cetaceans to these devices, but the responses that have been measured in a variety of species to audible sounds suggest that the most likely behavioral responses (if any) would be localized short-term avoidance behavior (See ''Potential Effects of Specified Activities on Marine Mammals and their Habitat''). As a general conclusion, while some of the active acoustic sources used during AFSC fisheries research surveys are likely to be detected by some marine species (particularly phocid pinnipeds and odontocete cetaceans), the sound sources with potential for disturbance would be temporary and transient in any particular location as the research vessels move through an area. Any changes in marine mammal behavior in response to the sound sources or physical presence of the research vessel would likely involve temporary avoidance behavior in the vicinity of the research vessel and would return to normal after the vessel passed. Given the small number of research vessels involved and their infrequent and inconsistent presence in any given area from day to day, it is unlikely that the proposed activity would cause animals to avoid any particular area.

Most AFSC fisheries research activities occur well away from land and, in cases where they do approach land, include mitigation measures to minimize the risk of disturbing pinnipeds hauled out on land. Any incidental disturbance of pinnipeds on haul-outs would likely be infrequent and result in temporary or short term changes in behavior. This sporadic and temporary type of disturbance is not likely to result in a change in use or abandonment of a known haul-out.

AFSC fisheries research activities generally are highly transient and short term (*e.g.,* several hours to a day in any one location) in duration and take place well out to sea, far from coastal or ice pack subsistence hunting activities. It is possible, albeit unlikely, for these fisheries research sound sources to interact with migratory species hunted for subsistence such that there could be short term alterations in migratory pathways. However, as described in the AFSC Communication Plan (Appendix B of AFSC's application), the AFSC will work with subsistence users to identify important areas for marine mammals and subsistence hunters early in the planning process as well as in real time to identify the potential for overlap between migratory pathways, key hunting regions and seasons, and proposed fisheries research. This communication should lead to avoidance of any issues of displacement of marine mammals and their prey.

Activities That May Directly Displace Subsistence Users

AFSC fisheries research primarily utilizes ocean-going ships generally suited for offshore work. These vessels are not designed to work in or near sea ice where much of the subsistence harvest of pinnipeds occurs; thus research activities are most likely to occur outside of periods when this type of hunting occurs. Due to the desire to avoid disturbing pinnipeds hauled out on land, these ships largely avoid nearshore routes that might otherwise put them in the path of seal hunters.

Bowhead whale hunts may occur near sea ice in the spring or in open water in the fall. AFSC fisheries research is only conducted during the open water season in the Arctic so there is no risk of potential interference with subsistence hunts in the spring. However, AFSC fisheries research vessels may be present in whale hunting areas in the fall and could potentially interfere with subsistence activities. The communications plan is designed to minimize the risk of any such interference by advance planning and communication between AFSC scientists and subsistence hunting organizations (*e.g.,* Alaska Eskimo Whaling Commission) and real-time communication between AFSC research vessels as they approach subsistence areas and nearby coastal community contacts. The AFSC is committed to alter its research plans to address any concerns about potential interference and to avoid any such interference in the field.

AFSC fisheries research vessels make port calls in established harbors and ports, thus reducing the chances for interaction with the transit of hunters to and from coastal villages to nearby hunting regions. As described in the Communication Plan provided as Appendix B of AFSC's application, in those rare cases where a research vessel may need to anchor offshore from a subsistence community, AFSC personnel will, within the limits of maritime safety, direct the ship to a predetermined location in coordination with the local subsistence community so as to avoid interfering with those activities.

Activities That May Place Physical Barriers (Vessels and Gear) Between the Marine Mammals and the Subsistence Hunters

The AFSC uses a variety of towed nets and sampling gear to conduct its fisheries and ecosystem research. However, current operational guidelines designed to reduce incidental catch of marine mammals include measures that direct activities away from marine mammals near the research vessel (move-on rule). These measures will reduce the possibility for placing any barriers between subsistence hunters and their marine mammal prey. As outlined in the Communication Plan, AFSC will not deploy such research gear when subsistence hunters have been visually observed in the area.

AFSC fisheries research will also strive to avoid working in any areas when migrating species are present in the immediate vicinity. Per the Communication Plan, the AFSC will coordinate both in advance and in real time with known marine mammal hunting communities within the immediate vicinity of research to avoid any interactions between hunting activity and fisheries research vessels or gear.

The AFSC has provided a draft Communication Plan as Appendix B to their application, and we invite comment on that document. The AFSC is committed to conduct its proposed activities in ways that do not affect the availability of marine mammals to subsistence hunters. The AFSC will implement standard operational procedures and mitigation measures to minimize direct impacts on marine mammals and will work with Alaska Native organizations and coastal communities to develop effective communication protocols to minimize the risk of potential interference with subsistence activities. The AFSC will thus work to ensure that its research activities do not negatively impact the availability of marine mammals to Alaska Native subsistence users.

Based on the description of the specified activity, the measures described to minimize adverse effects on the availability of marine mammals for subsistence purposes, and the proposed mitigation and monitoring measures, we have preliminarily determined that there will not be an unmitigable adverse impact on subsistence uses from AFSC's proposed activities.

Adaptive Management

The regulations governing the take of marine mammals incidental to AFSC fisheries research survey operations 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 this proposed rule are designed to provide OPR with monitoring data from the previous year to allow consideration of whether any changes are appropriate. OPR and the AFSC 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 AFSC 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.

Endangered Species Act (ESA)

There are multiple marine mammal species listed under the ESA with confirmed or possible occurrence in the proposed specified geographical regions (see Table 3). The proposed authorization of incidental take pursuant to the AFSC's specified activity would not affect any designated critical habitat. OPR has initiated consultation with NMFS's Alaska Regional Office under section 7 of the ESA on the promulgation of five-year regulations and the subsequent issuance of LOAs to AFSC under section 101(a)(5)(A) of the MMPA. This consultation will be concluded prior to issuing any final rule.

Request for Information

NMFS requests interested persons to submit comments, information, and suggestions concerning the AFSC 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 authorizations. 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. NMFS is the sole entity that would be subject to the requirements in these proposed regulations, and NMFS is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. 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 Paperwork Reduction Act (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 PRA unless that collection of information displays a currently valid OMB control number. These requirements have been approved by OMB under control number 0648–0151 and include applications for regulations, subsequent LOAs, and reports.

List of Subjects in 50 CFR Part 219

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

Dated: July 24, 2018.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

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

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

■ 1. The authority citation for part 219 continues to read as follows:

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

■ 2. Add subpart F to part 219 to read as follows:

Subpart F—Taking Marine Mammals Incidental to Alaska Fisheries Science Center Fisheries Research

Sec.

Subpart F—Taking Marine Mammals Incidental to Alaska Fisheries Science Center Fisheries Research

§ 219.51 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the National Marine Fisheries Service's (NMFS) Alaska Fisheries Science Center (AFSC) and those persons it authorizes, including the International Pacific Halibut Commission (IPHC) or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the areas outlined in paragraph (b) of this section and that occurs incidental to research survey program operations.

(b) The taking of marine mammals by AFSC may be authorized in a Letter of Authorization (LOA) only if it occurs within the Gulf of Alaska, Bering Sea and Aleutian Islands, Chukchi Sea and Beaufort Sea, or is conducted by the IPHC in the Bering Sea and Aleutian

Islands, Gulf of Alaska, or off the U.S. West Coast.

§ 219.52 Effective dates.

Regulations in this subpart are effective from [EFFECTIVE DATE OF FINAL RULE] through [DATE 5 YEARS AFTER EFFECTIVE DATE OF FINAL RULE].

§ 219.53 Permissible methods of taking.

Under LOAs issued pursuant to § 216.106 of this chapter and § 219.57, the Holder of the LOA (hereinafter ''AFSC'') may incidentally, but not intentionally, take marine mammals within the area described in § 219.51(b) by Level B harassment associated with use of active acoustic systems and physical or visual disturbance of hauled-out pinnipeds and by Level A harassment, serious injury, or mortality associated with use of hook and line gear, trawl gear, and gillnet gear, provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

§ 219.54 Prohibitions.

Notwithstanding takings contemplated in § 219.51 and authorized by a LOA issued under § 216.106 of this chapter and § 219.57, no person in connection with the activities described in § 219.51 may:

(a) 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 § 219.57;

(b) Take any marine mammal not specified in such LOA;

(c) Take any marine mammal specified in such LOA in any manner other than as specified;

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

(e) Take a marine mammal specified in such LOA 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.

§ 219.55 Mitigation requirements.

When conducting the activities identified in § 219.51(a), the mitigation measures contained in any LOA issued under § 216.106 of this chapter and § 219.57 must be implemented. These mitigation measures shall include but are not limited to:

(a) *General conditions:* (1) AFSC shall convey relevant mitigation, monitoring, and reporting requirements to the IPHC, as indicated in the following subparts.

(2) AFSC 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. AFSC shall convey this requirement to IPHC.

(2) AFSC 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. AFSC shall convey this requirement to IPHC.

(3) AFSC 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. AFSC shall convey this requirement to IPHC.

(4) When deploying any type of sampling gear at sea, AFSC 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. AFSC shall convey this requirement to IPHC.

(5) AFSC shall implement handling and/or disentanglement protocols as specified in the guidance that shall be provided to AFSC survey personnel. AFSC shall convey this requirement to IPHC.

(6) AFSC shall not approach within 1 km of locations where marine mammals are aggregated, including pinniped rookeries and haul-outs.

(7) AFSC shall adhere to a final Communication Plan. In summary and in accordance with the Plan, AFSC shall:

(i) Notify and provide potentially affected Alaska Native subsistence communities with the Communication Plan through a series of mailings, direct contacts, and planned meetings throughout the regions where AFSC fisheries research is expected to occur;

(ii) Meet with potentially affected subsistence communities to discuss planned activities and to resolve potential conflicts regarding any aspects of either the fisheries research operations or the Communication Plan;

(iii) Develop field operations plans as necessary, which shall address how researchers will consult and maintain communication with contacts in the potentially affected subsistence communities when in the field, including a list of local contacts and contact mechanisms, and which shall describe operational procedures and actions planned to avoid or minimize the risk of interactions between AFSC fisheries research and local subsistence activities;

(iv) Schedule post-season informational sessions with subsistence contacts from the study areas to brief them on the outcome of the AFSC fisheries research and to assess performance of the Communication Plan and individual field operations or cruise plans in working to minimize effects to subsistence activities; and

(v) Evaluate overall effectiveness of the Communications Plan in year four of any LOA issued pursuant to § 216.106 of this chapter and § 219.57.

(b) *Trawl survey protocols:* (1) AFSC shall conduct trawl operations as soon as is practicable upon arrival at the sampling station.

(2) AFSC shall initiate marine mammal watches (visual observation) at least 15 minutes prior to beginning of net deployment, but shall also conduct monitoring during any pre-set activities including trackline reconnaissance, CTD casts, and plankton or bongo net hauls. 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) AFSC shall implement the move-on rule mitigation protocol, as described in this paragraph. If one or more marine mammals are observed and are considered at risk of interacting with the vessel or research gear, or appear to be approaching the vessel and are considered at risk of interaction, AFSC shall either remain onsite or move on to another sampling location. If remaining onsite, the set shall be delayed. If the animals depart or appear to no longer be at risk of interacting with the vessel or gear, a further observation period shall be conducted. If no further observations are made or the animals still do not appear to be at risk of interaction, then the set may be made. If the vessel is moved to a different section of the sampling area, the move-on rule

mitigation protocol would begin anew. If, after moving on, marine mammals remain at risk of interaction, the AFSC shall move again or skip the station. Marine mammals that are sighted shall be monitored to determine their position and movement in relation to the vessel to determine whether the move-on rule mitigation protocol should be implemented. AFSC may use best professional judgment in making these decisions.

(4) AFSC 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, AFSC shall take the most appropriate action to avoid marine mammal interaction. AFSC may use best professional judgment in making this decision.

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

(6) AFSC shall implement standard survey protocols to minimize potential for marine mammal interactions, including maximum tow durations at target depth and maximum tow distance, and shall carefully empty the trawl as quickly as possible upon retrieval.

(7) Whenever surface trawl nets are used in southeast Alaska, AFSC must install and use acoustic deterrent devices, with two pairs of the devices installed near the net opening. AFSC must ensure that the devices are operating properly before deploying the net.

(c) *Longline survey protocols:* (1) AFSC shall deploy longline gear as soon as is practicable upon arrival at the sampling station. AFSC shall convey this requirement to IPHC.

(2) AFSC shall initiate marine mammal watches (visual observation) no less than 30 minutes (or for the duration of transit between set locations, if shorter than 30 minutes) prior to both deployment and retrieval of 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. AFSC shall convey this requirement to IPHC.

(3) AFSC shall implement the move-on rule mitigation protocol, as described in this paragraph. If one or more marine mammals are observed in the vicinity of the planned location before gear deployment, and are considered at risk of interacting with the vessel or research gear, or appear to be approaching the vessel and are considered at risk of interaction, AFSC shall either remain onsite or move on to another sampling location. If remaining onsite, the set shall be delayed. If the animals depart or appear to no longer be at risk of interacting with the vessel or gear, a further observation period shall be conducted. If no further observations are made or the animals still do not appear to be at risk of interaction, then the set may be made. If the vessel is moved to a different section of the sampling area, the move-on rule mitigation protocol would begin anew. If, after moving on, marine mammals remain at risk of interaction, the AFSC shall move again or skip the station. Marine mammals that are sighted shall be monitored to determine their position and movement in relation to the vessel to determine whether the move-on rule mitigation protocol should be implemented. AFSC may use best professional judgment in making these decisions. AFSC shall convey this requirement to IPHC.

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

(5) If deployment or retrieval operations have been suspended because of the presence of marine mammals, AFSC may resume such operations when practicable only when the animals are believed to have departed the area. AFSC may use best professional judgment in making this decision. AFSC shall convey this requirement to IPHC.

(d) *Gillnet survey protocols:* (1) AFSC shall conduct gillnet operations as soon as is practicable upon arrival at the sampling station.

(2) AFSC shall conduct marine mammal watches (visual observation) prior to beginning of net deployment. Marine mammal watches shall be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular).

(3) AFSC shall implement the move-on rule mitigation protocol. If one or more marine mammals are observed in the vicinity of the planned location before gear deployment, and are considered at risk of interacting with research gear, AFSC shall either remain onsite or move on to another sampling location. If remaining onsite, the set shall be delayed. If the animals depart or appear to no longer be at risk of interacting with the gear, a further observation period shall be conducted. If no further observations are made or the animals still do not appear to be at risk of interaction, then the set may be made. If the vessel is moved to a different area, the move-on rule mitigation protocol would begin anew. If, after moving on, marine mammals remain at risk of interaction, the AFSC shall move again or skip the station. Marine mammals that are sighted shall be monitored to determine their position and movement in relation to the vessel to determine whether the move-on rule mitigation protocol should be implemented. AFSC may use best professional judgment in making these decisions.

(4) AFSC shall maintain visual monitoring effort during the entire period of time that gillnet 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, and appear to be at risk of interaction with the gear, AFSC shall pull the gear immediately. AFSC may use best professional judgment in making this decision.

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

(6) AFSC must install and use acoustic deterrent devices whenever gillnets are used. AFSC must ensure that the devices are operating properly before deploying the net.

§ 219.56 Requirements for monitoring and reporting.

(a) AFSC shall designate a compliance coordinator who shall be responsible for ensuring compliance with all requirements of any LOA issued pursuant to § 216.106 of this chapter and § 219.57 and for preparing for any subsequent request(s) for incidental take authorization. AFSC shall convey this requirement to IPHC.

(b) *Visual monitoring program:* (1) Marine mammal visual monitoring shall occur prior to deployment of trawl, longline, and gillnet gear, respectively; throughout deployment of gear and active fishing of research gears (not including longline soak time); prior to retrieval of longline gear; and throughout retrieval of all research gear. AFSC shall convey this requirement to IPHC.

(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. AFSC shall convey this requirement to IPHC.

(c) *Training:* (1) AFSC 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. AFSC may determine the agenda for these trainings.

(2) AFSC 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) AFSC shall convey these training requirements to IPHC.

(d) *Handling procedures and data collection:* (1) AFSC must develop and implement standardized marine mammal handling, disentanglement, and data collection procedures. These standard procedures will be subject to approval by NMFS's Office of Protected Resources (OPR). AFSC shall convey these procedures to IPHC.

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

(3) AFSC 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. AFSC shall convey this requirement to IPHC.

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

(e) *Reporting:* (1) AFSC shall report all incidents of marine mammal interaction to NMFS's Protected Species Incidental Take database, including those resulting from IPHC activities, within 48 hours of occurrence and shall provide supplemental information to OPR upon request. Information related to marine mammal interaction (animal captured or entangled in research gear) must include details of survey effort, 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.

(2) Annual reporting: (i) AFSC shall submit an annual summary report to OPR not later than ninety days following the end of a given year. AFSC shall provide a final report within thirty days following resolution of comments on the draft report.

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

(A) Annual line-kilometers surveyed during which the EK60, ME70, ES60, 7111 (or equivalent sources) were predominant and associated pro-rated estimates of actual take;

(B) Summary information regarding use of all longline, gillnet, and trawl gear, including number of sets, tows, etc., specific to each gear;

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

(D) A written evaluation of the effectiveness of AFSC 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;

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

(F) A summary of all relevant training provided by AFSC and any coordination with NMFS' Alaska Regional Office.

(3) AFSC shall convey these reporting requirements to IPHC and shall provide IPHC reports to OPR subject to the same schedule.

(f) Reporting of injured or dead marine mammals:

(1) In the unanticipated event that the activity defined in § 219.51(a) of this chapter clearly causes the take of a marine mammal in a prohibited manner, AFSC personnel engaged in the research activity shall immediately cease such activity until such time as an appropriate decision regarding activity continuation can be made by the AFSC Director (or designee). The incident must be reported immediately to OPR and the Alaska Regional Stranding Coordinator, NMFS. OPR will review the circumstances of the prohibited take and work with AFSC to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The immediate decision made by AFSC regarding continuation of the specified activity is subject to OPR concurrence. 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 (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, 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) In the event that AFSC 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 (*e.g.,* in less than a moderate state of decomposition), AFSC shall immediately report the incident to OPR and the Alaska Regional Stranding Coordinator, NMFS. The report must include the information identified in paragraph (f)(1) of this section. Activities may continue while OPR reviews the circumstances of the incident. OPR will work with AFSC to determine whether additional mitigation measures or modifications to the activities are appropriate.

(3) In the event that AFSC 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 § 219.51(a) of this chapter (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), AFSC shall report the incident to OPR and the Alaska Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. AFSC shall provide photographs or video footage or other documentation of the stranded animal sighting to OPR.

(4) AFSC shall convey these requirements to IPHC.

§ 219.57 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, AFSC 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, AFSC 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, AFSC must apply for and obtain a modification of the LOA as described in § 219.58.

(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.

§ 219.58 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under § 216.106 of this chapter and § 219.57 for the activity identified in § 219.51(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 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 § 219.57 for the activity identified in § 219.51(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 AFSC 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 AFSC'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 LOAs issued pursuant to § 216.106 of this chapter and § 219.57, 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.

§§ 219.59–219.60 [Reserved]

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