UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Environmental Assessment for The Issuance of Scientific Research Permits for Research on Humpback Whales and Other Cetaceans

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Location: Pacific Ocean – primarily Alaska and Hawaii
Atlantic Ocean (Mobley permit only)

Abstract: The National Marine Fisheries Service (NMFS) proposes to issue eight five-year scientific research permits and one amendment to a five-year scientific research permit for takes of marine mammals in the wild, pursuant to the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 et seq.). Permit Nos. 14682, 10018-01, 13846, 14451, 14585, 14599, 14122, 14296, and 14353 would authorize varying combinations of research activities directed at cetacean species. Activities would include aerial surveys, vessel surveys for behavioral observations, photo-identification, underwater photography and videography, collection of sloughed skin and feces, sampling whale blows, passive acoustic recordings, export and re-import of parts, tags attached by suction cup or by implanting darts, barbs, or a portion of the tag into the skin and blubber, biopsy sample collection, and acoustic playbacks. Specific objectives for each permit vary, but all would continue long-term research on humpback whales and other cetacean species.

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CHAPTER 1 PURPOSE OF AND NEED FOR ACTION

1.1 DESCRIPTION OF ACTION

In response to receipt of requests from applicants, NMFS proposes to issue scientific research permits authorizing "takes"[1] by level A and B harassment[2] of marine mammals in the wild pursuant to the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 et seq.), the regulations governing the taking and importing of marine mammals (50 CFR Part 216), the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq*.), and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR Parts 222-226). The applicants, respective file numbers, and levels of harassment requested for each permit and amendment are:

Principal Investigator	File No.	Harassment
Whit Au, Ph.D.	14682	Level A & B
Rachel Cartwright	10018-01	Level B
Jim Darling	13846	Level A & B
Joseph Mobley, Jr.	14451	Level B
Adam Pack, Ph.D.	14585	Level A & B
Fred Sharpe	14599	Level A & B
Jan Straley	14122	Level A & B
Briana Witteveen	14296	Level A & B
Ann Zoidis	14353	Level A & B

1.1.1 Purpose and Need

The primary purpose of the permits is to provide an exemption from the take prohibitions under the MMPA and ESA to allow "takes" by level A and B harassment of marine mammals, including endangered species, for bona fide[3] scientific research. The need for issuance of the permits is related to NMFS's mandates under the MMPA and ESA. Specifically, NMFS has a responsibility to implement both the MMPA and the ESA to protect, conserve, and recover marine mammals and threatened and endangered species under its jurisdiction. The MMPA and ESA prohibit takes of marine mammals and threatened and endangered species, respectively, with only a few very

[1] Under the MMPA, "take" is defined as to "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect." [16 U.S.C. 1362(18)(A)] The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The term "harm" is further defined by regulations (50 CFR §222.102) as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering."

[2] "Harass" is defined by regulation (50 CFR §216.3) 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 a disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but does not have the potential to injure a marine mammal or marine mammal stock in the wild (Level B harassment)."

[3] The MMPA defines bona fide research as "scientific research on marine mammals, the results of which – (A) likely would be accepted for publication in a refereed scientific journal; (B) are likely to contribute to the basic knowledge of marine mammal biology or ecology; or (C) are likely to identify, evaluate, or resolve conservation problems."

specific exceptions, including for scientific research and enhancement purposes. Permit issuance criteria require that research activities are consistent with the purposes and policies of these federal laws and will not have a significant adverse impact on the species or stock.

1.1.2 Need for Proposed Research and Research Objectives

Under the ESA and MMPA, NMFS is responsible for the conservation and recovery of most endangered and threatened marine mammals. Scientific research is an important means of gathering valuable information about these species and is necessary to conserve them and promote their recovery. The purposes of research activities conducted by each of the applicants are:

Principal Investigator	File No.	Purpose
Whit Au, Ph.D.	14682	To investigate the population dynamics and behavior of cetaceans around Hawaii and the Pacific, to determine aspects of the behavior and use of the acoustic environment by large whales, and to determine the effects of noise on behavior of cetaceans around Hawaii.
Rachel Cartwright	10018-01	To broaden the action area of the currently authorized study on humpback whale female-calf behavior and habitat choice to include Alaskan waters, focused primarily in Chatham Straits, Frederick Sound, Sumner Strait, Lynn Canal and Icy Strait.
Jim Darling	13846	To study the social organization, behavior and communication of humpback whales in Hawaii (primarily off west Maui), and the population biology, ecology, and behavior of humpback and Eastern gray whales along the coastlines of Washington and Alaska.
Joseph Mobley, Jr.	14451	To investigate short and long-term changes in population size, habitat use, and behavior of cetaceans off the coast of eastern and western United States, Hawaii, Alaska, Guam, and the Mariana Islands.
Adam Pack, Ph.D.	14585	To continue long-term population studies of humpback whales and other cetacean species in the Eastern, Western and Central North Pacific Ocean, primarily Hawaii and Alaska.
Fred Sharpe	14599	To conduct research on the social complexity of Alaskan humpback whale bubble feeding to gain insight into the manner in which environmental and social factors shape this behavior.

Principal Investigator	File No.	Purpose
Jan Straley	14122	To study the biology of large whales in Alaskan waters to: (1) continue and expand a study of humpback whales; (2) study sperm whale movements, foraging behavior and depredation on longline fishing gear to reduce interactions; (3) study killer whale seasonal movements, foraging, migration patterns and depredation; (4) enhance the body of knowledge, stock structure and current status of gray, minke, fin, sei, blue, and North Pacific right whales; and (5) study killer whale predation events and collect dead parts from prey.
Briana Witteveen	14296	To conduct scientific research on cetaceans year-round in the Gulf of Alaska, with emphasis on examining prey use and foraging patterns of gray, fin, humpback, and killer whales and exploring the responses of humpback whales to acoustic deterrent devices.
Ann Zoidis	14353	To conduct scientific research on humpback and minke whales in Hawaiian waters to examine: (1) underwater activity budgets of humpback whales, including during non-daylight hours; (2) mother/calf/escort interactions, including sound production and vocal/behavioral responses to sounds by conspecifics; (3) habitat use; and (4) behavioral and/or acoustic reactions to passing vessel traffic.

1.2 OTHER EA/EIS THAT INFLUENCE SCOPE OF THIS EA

All of the applicants for new permits have been authorized to conduct similar research in the past; Dr. Cartwright's research in Hawaii is currently authorized under Permit No. 10018. The issuance of each of these permits and subsequent amendments was analyzed in one or more NEPA documents. The NEPA documents that contain analyses relevant to the proposed action include:

- *Environmental Assessment on the Effects of the Issuance of Eleven National Marine Fisheries Service Permitted Scientific Research Activities on Marine Mammal and Sea Turtle Species in the U.S. Territorial Waters and High Seas of the North Pacific Ocean (including the Gulf of Alaska and Bering Sea), Arctic Ocean (including the Chukchi Sea and Beaufort Sea), Southern Ocean (including waters off Antarctica), and Foreign Territorial Waters of Mexico (Gulf of California only), Canada, Russia, Japan and the Philippines* (NMFS 2004a).

  The EA described and analyzed the effects of collecting information on the biology, foraging ecology, behavior, and communication of a variety of marine mammal and sea turtle species using methods ranging from close approaches during aerial and vessel surveys for photo-identification to biopsy sampling and acoustic playbacks. A Finding of

No Significant Impact (FONSI) was signed June 30, 2004 based on the best available information suggesting that careful approaches to cetaceans, even repeated approaches, elicited only moderate to minimal reactions, and that most animals showed no observed change in behavior in response to biopsy sampling or tagging.

Applicants in the current action that were included in this analysis are:

Principal Investigator	Previous File No.
Jim Darling	753-1599
Joseph Mobley, Jr.	642-1536
Fred Sharpe	716-1705
Jan Straley	473-1700
Briana Witteveen (under Kate Wynne)	1049-1718
Ann Zoidis	1039-1699

- *Supplemental Environmental Assessment on the Effects of the Issuance of One National Marine Fisheries Service Permit Amendment for Scientific Research Activities on Humpback Whales on the Winter Breeding and Nursing Grounds of Hawaii* (NMFS 2005a).

  The SEA described and analyzed the effects of biopsy sampling humpback whale (*Megaptera novaeangliae*) calves less than six months of age and females accompanying such calves while on the Hawaiian winter breeding and nursing grounds. A FONSI was signed March 21, 2005.

  None of the applicants in the current action were part of this analysis, but the analysis of biopsy sampling this age class is relevant.

- *Supplemental Environmental Assessment on the Effects of the Issuance of Nine National Marine Fisheries Service Permit Actions for Scientific Research Activities on Marine Mammal Species in the U.S. Territorial Waters and High Seas of the Eastern, Central, and Western North Pacific Ocean, with a Primary Focus on the Waters Off Hawaii and from California Northward to Southeast Alaska (Including Gulf of Alaska and Aleutian Islands), and Including Foreign Territorial Waters of Japan* (NMFS 2005b).

  The SEA described and analyzed the effects of collecting information on the basic biology, ecology, and stock structure of ESA-listed large whale species, and several other non-listed cetacean and pinniped species using a subset of the original research methodologies, target species, and action area. A FONSI was signed September 16, 2005.

  Applicants in the current action that were included in this analysis are:

Principal Investigator	Previous File No.
Whit Au, Ph.D.	1000-1617
Adam Pack, Ph.D. (under Dolphin Institute)	1071-1770

- *Environmental Assessment on the Issuance of Two Scientific Research Permits for the Harrasment of Cetaceans in Hawaiian Waters* (NMFS 2008a).

  The SEA described and analyzed the effects of collecting information on the status, numbers, distribution, and life histories of cetacean species in Hawaiian waters using methods ranging from close approaches during vessel surveys for photo-identification and behavioral observation to biopsy sampling and acoustic playbacks (note that File No. 10018 did not include biopsy sampling or acoustic playbacks). A FONSI was signed on June 13, 2008.

  The applicant in the current action that was included in this analysis is:

Principal Investigator	Current File No.
Rachel Cartwright	10018

- *Supplemental Environmental Assessment On The Effects Of The Issuance Of One Of Eleven National Marine Fisheries Service Permitted Scientific Research Activities (Gulf Of Alaska) Janice Straley [File No. 473-1700-02]* (NMFS 2009).

  The SEA covered a major amendment to the permit and described and analyzed the effects of research on sperm whale depredation on a long-line fishery in Alaska and the effects of satellite tagging large whales and killer whales with dart tags. A FONSI was signed on February 12, 2009.

The applicant in the current action that was included in this analysis is:

Principal Investigator	Previous File No.
Janice Straley	473-1700-01

1.3 SCOPING SUMMARY

The purpose of scoping is to:

- identify the issues to be addressed,
- identify the significant issues related to the proposed action,
- identify and eliminate from detailed study the non-significant issues,
- identify and eliminate issues that have been covered by prior environmental review, and
- identify the concerns of the affected public and Federal agencies, states, and Indian tribes.

The Council on Environmental Quality's (CEQ) regulations implementing the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 et seq.) do not require that a draft EA be made available for public comment as part of the scoping process.

The MMPA and its implementing regulations governing issuance of special exception permits for scientific research (50 C.F.R. §216.33) require that, upon receipt of a valid and complete application for a new permit, NMFS publish a notice of receipt in the *Federal Register*. The notice summarizes the purpose of the requested permit and invites interested parties to submit written comments concerning the application. The applications were made available for public review and comment for 30 days (74 FR 58243; November 12, 2009) and provided to the Marine Mammal Commission (MMC) pursuant to 50 CFR §216.33 (d)(2). Comments received on the applications were considered as part of the scoping for this EA and are summarized here and attached in full as Appendix A.

Public comments were received from The Humane Society of the United States (HSUS) on applications to conduct research on humpback whales in Hawaii [File Nos. 14682 (Au), 10018 (Cartwright), 13846 (Darling), 14451 (Mobley), 14585 (Pack), and 14353 (Zoidis)]. HSUS expressed concern about the possible duplicative nature of the proposed research on humpback whales in Hawaii. Standard permit conditions that are included in all permits for research on marine mammals include requirements for coordination with other researchers to avoid unnecessarily duplicative research.

An additional comment was received from the public on File Numbers 14682, 10018, 13846, 14585, 14599, 14122 and 14296 suggesting the requests should be denied. The commenter thinks the researchers are causing injury and death to animals and does not feel the animals are being helped by the research. This comment was not considered to be substantive.

The MMC provided comments on specific applications, and recommended mitigation, monitoring, and research coordination conditions for inclusion in the permits. Some of the conditions recommended are standard permit conditions that are included in all permits for research on marine mammals, such as coordination with other researchers to avoid unnecessarily duplicative research. Others were specific to the type of research proposed, and included measures to minimize effects to mother/calf pairs. Many of the conditions are already part of the applicants' protocol; any conditions that are not specifically listed in the permits would be incorporated in the permits by reference to the application.

The MMC recommended that NMFS defer issuing the requested permits to conduct research on North Pacific right whales until it has completed the necessary analysis under the National Environmental Policy Act or has provided an adequate justification for not doing so. On October 17, 2005, NMFS issued a notice of intent to voluntarily prepare an EIS (70 FR 60285) for issuance of permits for research on Northern right whales, in order to consider long-range planning needs and efficiencies in the permitting process. In accordance with NEPA and its implementing regulations at 40 CFR Section 1506.1, nothing precludes NMFS from issuing permits in the interim while the EIS is being developed.

1.4 APPLICABLE LAWS AND NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

This section summarizes federal, state, and local permits, licenses, approvals, and consultation requirements necessary to implement the proposed action, as well as who is responsible for obtaining them. Even when it is the applicant's responsibility to obtain such permissions, NMFS is obligated under NEPA to ascertain whether the applicant is seeking other federal, state, or local approvals for their action.

1.4.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) was enacted in 1969 and is applicable to all "major" federal actions significantly affecting the quality of the human environment. A major federal action is an activity that is fully or partially funded, regulated, conducted, or approved by a federal agency. NMFS issuance of permits for research represents approval and regulation of activities. While NEPA does not dictate substantive requirements for permits, licenses, etc., it requires consideration of environmental issues in federal agency planning and decision making. The procedural provisions outlining federal agency responsibilities under NEPA are provided in the Council on Environmental Quality's implementing regulations (40 CFR Parts 1500-1508).

Through NOAA Administrative Order (NAO) 216-6, NOAA established agency procedures for complying with NEPA and the implementing regulations issued by CEQ. NAO 216-6 specifies that issuance of scientific research permits under the MMPA and ESA are categorically excluded from further environmental review, except under extraordinary circumstances.

NMFS must prepare an EA or EIS when a proposed action:

- is the subject of public controversy based on potential environmental consequences,
- has uncertain environmental impacts or unknown risks,
- establishes a precedent or decision in principle about future proposals,
- may result in cumulatively significant impacts, or
- may have an adverse effect upon endangered or threatened species or their habitats.

While issuance of scientific research permits is typically subject to a categorical exclusion, as described in NAO 216-6, NMFS is preparing an EA for this action to provide a more detailed analysis of effects to ESA-listed species. This Environmental Assessment is prepared in accordance with NEPA, its implementing regulations, and NAO 216-6.

1.4.2 Endangered Species Act

Section 9 of the ESA, as amended, and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption such as by a permit. Permits to take ESA-listed species for scientific purposes, or for the purpose of enhancing the propagation or survival of the species, may be granted pursuant to Section 10(a)(1)(A) of the ESA.

NMFS has promulgated regulations to implement the permit provisions of the ESA (50 CFR Part 222) and has produced OMB-approved application instructions that prescribe the procedures

necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the ESA.

Section 10(d) of the ESA stipulates that, for NMFS to issue permits under section 10(a)(1)(A) of the ESA, the Agency must find that the permit: was applied for in good faith; if granted and exercised will not operate to the disadvantage of the species; and will be consistent with the purposes and policy set forth in Section 2 of the ESA.

Section 2 of the ESA sets forth the purposes and policy of the Act. The purposes of the ESA are to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in section 2(a) of the ESA. It is the policy of the ESA that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA. In consideration of the ESA's definition of conserve, which indicates an ultimate goal of bringing a species to the point where listing under the ESA is no longer necessary for its continued existence (i.e., the species is recovered), exemption permits issued pursuant to section 10 of the ESA are for activities that are likely to further the conservation of the affected species.

Section 7 of the ESA requires consultation with the appropriate federal agency (either NMFS or the U.S. Fish and Wildlife Service) for federal actions that "may affect" a listed species or adversely modify critical habitat. NMFS issuance of a permit affecting ESA-listed species or designated critical habitat, directly or indirectly, is a federal action subject to these Section 7 consultation requirements. Section 7 requires federal agencies to use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. NMFS is further required to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of habitat for such species. Regulations specify the procedural requirements for these consultations (50 Part CFR 402)

1.4.3 Marine Mammal Protection Act

The MMPA prohibits takes of all marine mammals in the U.S. (including territorial seas) with a few exceptions. Permits for *bona fide* scientific research on marine mammals, or to enhance the survival or recovery of a species or stock, issued pursuant to section 104 of the MMPA are one such exception. These permits must specify the number and species of animals that can be taken, and designate the manner (method, dates, locations, etc.) in which the takes may occur. NMFS has sole jurisdiction for issuance of such permits and authorizations for all species of cetacean, and for all pinnipeds except walrus[4].

NMFS may issue a permit or authorization pursuant to section 104 of the MMPA to an applicant who submits with their application information indicating that the taking is required to further a bona fide scientific purpose. An applicant must demonstrate to NMFS that the taking will be

[4] The U.S. Fish and Wildlife Service has jurisdiction for walrus, polar bears, sea otters, and manatees.

consistent with the purposes of the MMPA and applicable regulations. If lethal taking of a marine mammal is requested, the applicant must demonstrate that a non-lethal method of conducting research is not feasible. NMFS must find that the manner of taking is "humane"[5] as defined in the MMPA. In the case of proposed lethal taking of a marine mammal from a stock listed as "depleted" NMFS must also determine that the results of the research will directly benefit the species or stock, or otherwise fulfill a critically important research need.

NMFS has promulgated regulations to implement the permit provisions of the MMPA (50 CFR Part 216) and has produced OMB-approved application instructions that prescribe the procedures (including the form and manner) necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the MMPA.

1.4.4 Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)

Under the MSFCMA Congress defined Essential Fish Habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH provisions of the MSFCMA offer resource managers means to accomplish the goal of giving heightened consideration to fish habitat in resource management. NMFS Office of Protected Resources is required to consult with NMFS Office of Habitat Conservation for any action it authorizes (e.g., research permits), funds, or undertakes, or proposes to authorize, fund, or undertake that may adversely affect EFH. This includes renewals, reviews or substantial revisions of actions.

1.4.5 National Marine Sanctuaries Act

The NMSA (32 U.S.C. 1431 *et seq*.) authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance. The National Marine Sanctuary Program, operating under the NMSA and administered by NOAA's National Ocean Service (NOS) has the authority to issue special use permits for research activities that would occur within a National Marine Sanctuary. Obtaining special use permits is the responsibility of individual researchers. However, as a courtesy, the Office of Protected Resources consults with NOS when proposed research would occur in or near a National Marine Sanctuary.

1.4.6 Convention on International Trade in Endangered Species of Wild Fauna

CITES is an international agreement between governments with the goal of ensuring that international trade in specimens of wild animals and plants does not threaten their survival. All import, export, re-export and introduction from the sea of species covered by CITES has to be authorized through a licensing system. In the U.S., the Fish and Wildlife Service is the Management Authority for CITES. Obtaining CITES permits is the responsibility of individual researchers.

[5] The MMPA defines humane in the context of the taking of a marine mammal, as "that method of taking which involves the least possible degree of pain and suffering practicable to the mammal involved."

1.4.7 Animal Welfare Act

The AWA (7 U.S.C. 2131 – 2156) sets forth standards and certification requirements for the humane handling, care, treatment, and transportation of mammals. Enforcement of these requirements for non-federal facilities is under jurisdiction of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service. Each research facility is required to establish an Institutional Animal Care and Use Committee (IACUC) which reviews study areas and animal facilities for compliance with the AWA standards. The IACUC also reviews research protocols and provides written approvals for those that comply with AWA requirements. For federal research facilities, the head of the federal agency is responsible for ensuring compliance with the AWA requirements. It is the responsibility of the researcher to seek and secure IACUC reviews and approvals for their research.

CHAPTER 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the range of potential actions (alternatives) determined reasonable with respect to achieving the stated objective, as well as alternatives eliminated from detailed study. This chapter also summarizes the expected outputs and any related mitigation of each alternative. One alternative is the "No Action" alternative where the proposed permits and amendment would not be issued. The No Action alternative is the baseline for rest of the analyses. The Proposed Action alternative represents the research proposed in the submitted applications for eight permits and one permit amendment, with standard permit terms and conditions specified by NMFS.

2.1 ALTERNATIVE 1 – NO ACTION

Under the No Action alternative, Permit Nos. 14682, 13846, 14451, 14585, 14599, 14122, 14296, 14353, and the amendment to Permit No. 10018 would not be issued. This alternative would eliminate any potential risk to the environment from the proposed research activities. However, it would not allow the research to be conducted and the opportunity would be lost to collect information that would contribute to better understanding the species that NMFS is responsible for conserving and recovering under the ESA and MMPA.

This alternative would not affect any existing NMFS research permits or future requests for permits or amendments. Current research permits, including Permit No. 10018, would remain active and NMFS would continue to evaluate new permit requests as they are received, including requests from the applicants.

2.2 ALTERNATIVE 2 – PROPOSED ACTION (ISSUANCE OF PERMITS WITH STANDARD CONDITIONS)

Under the Proposed Action alternative, five-year research permits would be issued for activities proposed by the applicants for File Nos. 14682, 13846, 14451, 14585, 14599, 14122, 14296, and 14353, and an amendment would be issued for File No. 10018 that would be valid until the permit expires. All permits and the amendment would include terms and conditions standard to such permits as issued by NMFS.

The types of research proposed by each applicant are summarized in Table 1; general descriptions of cetacean research activities and the specifics of each permit request follow. The activities listed for each permit in Table 1 would not all be conducted on all species targeted by that researcher. The focus of most research, and therefore the maximum types of research activities, is on humpback whales. Specific species, take numbers, and activities for each application are listed in Appendices B-J.

Table 1. Summary of locations and research activities requested in each application. All activities are not requested for all target species in each permit.

	Location				Level B harassment										Level A harassment		
Applicant	***Hawaii***	***Alaska***	***Other Pacific Locations***	***Atlantic Ocean***	***Aerial Surveys***	***Vessel Surveys***	***Close Vessel Approach, Behavioral Observations, and Photo-ID***	***Underwater photo/video***	***Collect Breath Samples***	***Collect skin/fecal***	***Passive Acoustic Recording***	***Playback of Natural Sounds***	***Playback of Other Sounds***	***Export/Re-import***	***Suction Cup Tagging***	***Blubber Attachment Tagging***	***Biopsy***
Au No. 14682	X						X	X		X	X	X	X		X		X
Cartwright No. 10018-01	*	X					X				X						
Darling No. 13846	X	X	***		X		X	X			X	X		X	X	X	X
Mobley No. 14451	X	X	***	X	X	X	X	X			**						
Pack No. 14585	X	X	***				X	X		X	X				X		X
Sharpe No. 14599		X			X		X	X		X	X	X	X		X		
Straley No. 14122		X					X	**	X	X	X	X	X	X	X	X	X
Witteveen No. 14296		X				X	X				X		X		X		X
Zoidis No. 14353	X						X	X		X	X				X		

* Takes are currently authorized in Permit No. 10018.
** Recording would be stationary and does not require additional takes.
*** Requested locations include Pacific locations in addition to Hawaii and Alaska, and are detailed in the section on *Specific permit requests*.

General Activities

Generalized descriptions of activities proposed to be conducted on large whales and, in some cases, small cetaceans are provided below. Following these general descriptions is more specific information for each applicant's request.

Level B harassment of large whales and small cetaceans would occur during aerial surveys, vessel surveys, behavioral observations, photo-identification activities, underwater photography and videography, and playbacks. Sloughed skin or feces would be collected from the water using a

small net. This would only result in Level B harassment if a cetacean is within 100 yards of the vessel.

Aerial surveys
Aerial surveys would be conducted using fixed-wing or rotary-wing aircraft. Aerial surveys using fixed-wing aircraft would generally be conducted at an altitude of above 750 ft (244m), with descents to a minimum of 500 ft (152m) for species identification and photo-identification. Helicopters would fly at an altitude of 500 feet or above. Surveys would not be flown over pinniped haulout sites.

Vessel surveys
Vessel surveys using random routes or line-transect sampling methods would be used to collect data for estimating abundance of cetaceans. Vessels would typically be up to ~30m (~98.4 ft), but larger vessels would be used if necessary (Barlow and Forney (2007) used 52m, 53m, and 62m vessels for similar surveys).

During surveys, three to eight observers would rotate through at least three positions (port and starboard observers and a data recorder) during daylight hours, weather permitting (sea state of Beaufort 0-7 with minimal rain). The naked eye, 7x handheld, or 25x "bigeye" pedestal mounted binoculars would be used to locate marine mammals. The port observer would survey from 10º right to 90º left of the trackline and the starboard observer from 10º left to 90º right of the trackline. The recorder would scan the entire 180º area forward of the ship, focusing primarily on the trackline, using 7x reticled binoculars to confirm sightings.

The ship's global positioning system (GPS) unit or a handheld GPS would interface with a portable computer at the recorder's station. A standardized survey software program such as WinCruz would be used to collect standard line-transect information. The date, time, and position of the vessel would be automatically entered into the survey program every 5 min and whenever data are entered by the recorder. At the start of each trackline, observer positions and environmental conditions would be entered. Environmental conditions include sea state (Beaufort scale), swell height and direction, weather (rain, fog, no rain or fog, both rain and fog), horizontal and vertical positions of the sun, wind speed and visibility. Sighting information includes cue (blow, splash, animal), method (binocular type or naked eye), vertical distance (taken from reticles in the binoculars), angle relative to the ship's heading (from an angle ring on the binocular mount or an angle board), species, and group size (best, high, and low count).

When appropriate, the survey effort would be temporarily suspended to approach a group to facilitate species identification or group-size estimation or to conduct other activities such as photo-identification, acoustic recording, or biopsy sampling before returning to the line transect point where the vessel disengaged and continuing the survey.

Close vessel approach for photo-identification and behavioral observations
Vessels used for close approach would generally be less than 30 m in length; the majority of research would be conducted from vessels less than 20 m in length. For large whales, boat approaches would be within a whale's length from an individual (ca. 10-15 m for an adult-sized whale), although a whale might approach the boat closer than this distance. For small cetaceans, boat approaches would be within 5 m.

Focal animal or group follows would be conducted, during which the behavior of the animal(s) would be recorded, pod composition determined, and behavioral roles identified when possible. Photographs of the tail flukes, dorsal fin shape, and distinctive scars and body markings of each member of a group would be taken. When feasible, behaviors would be videotaped. Observations and photography of the animal(s) would be of variable duration depending on circumstances, behaviors, social dynamics, and weather and water conditions.

During close vessel approaches for all activities (level A and B harassment), disturbance to animals would be minimized by:

- Approaching at minimal speeds from behind or beside the group.
- Remaining parallel to the animals.
- Matching speed with the group.
- Minimizing changes in speed.
- Terminating activities if active avoidance is occurring.

Underwater photography and videography

Pole- or vessel-mounted camera
Underwater cameras would include devices ranging from a small pole mounted lipstick camera to larger vessel-mounted units that would be considered part of the vessel's superstructure. Very slow approaches or drifting in the vicinity of foraging animals would be conducted to within 5 m of animals to collect underwater video data.

Snorkelers
In Hawaii only, if the whales or small cetaceans under observation become stationary, mill, or are swimming slowly, a swimmer equipped with mask, snorkel, and fins and a still or video camera in an underwater housing would enter the water within approximately 20-30 meters of the targeted group. The swimmer would approach the animals quietly at the surface until they are a whale's length away (ca. 10-15m for an adult whale). Depending on the animal's behavior, a second swimmer equipped with an underwater camera would be deployed to obtain still photographs of key underwater displays, physical appearance, fluke photographs (if not obtainable from the surface), or affiliations. In some cases, a safety diver would be in the water. No more than two swimmers would be in the water at a time, unless specifically authorized by NMFS. The boat crew would stand by with engine idling to assist the swimmer(s) when video recording is complete.

The amount of time the swimmer is in the water would depend on the number of animals in a group and that group's behavior. For example, more time is generally spent with large competitive groups than small competitive groups. Also, a group that is stationary may provide more opportunities for obtaining data than a group that is traveling. Usually, a single deployment of a swimmer for in-water data collection lasts about 20 min. However, on occasion, a group that dives for long periods (e.g., 40 min) and that is stationary between dives may provide an opportunity of an hour or longer for obtaining data.

Scuba
Some divers would be equipped with SCUBA gear and an electric scooter and some swimmers would use new, light re-breathers for silent (no bubble) observation at depth over long periods. The research vessel would approach foraging whales to within 30 m to deploy two divers, who would then approach by swimming or with the aid of an electric scooter to within one whale body length. Sound pressure levels for these devices are not readily available, although the scooters used are likely to have direct drive propulsion, variable pitch propellers, and brush motors, and are estimated to be below 77 dB re 1 uPa-m. It is estimated that most encounters with whales would be relatively brief, typically less than a minute before whales swim away; encounters could last up to 15 minutes.

Passive acoustic recording
Hydrophones or hydrophone arrays would be used for acoustic recordings of large whales and small cetaceans. Generally, recordings would be of individuals already approached for behavioral observation, and the vessel would not approach closer than five meters when passively recording humpback vocalizations. Some individuals would be unintentionally approached for acoustic recording more than once in a day and in a season.

Acoustic Playbacks
Playbacks would be conducted to gain insight into the function of humpback whale sounds and to determine whether particular classes of sounds evoke a mild alerting response in some large whale and small cetacean species. Sounds that cause mild alert responses could be used in the future to avoid vessel collisions, seismic exploration activities, and gear entanglements. A variety of sound types would be broadcast to tagged and untagged animals to determine their behavioral reactions. Sound levels received by target species would not exceed 180 dB re: 1µPa, NMFS' current threshold for Level A harassment.

Playbacks would include:
- Sounds produced by cetaceans
- Blank tape or silent stimulus control sound
- Non-impulsive synthetic sounds
- Impulsive signals between 1 kHz-50 kHz

Specific descriptions for playback projects are located in the descriptions of File Nos. 14682 (Au), 13846 (Darling), 14599 (Sharpe), 14122 (Straley), and 14296 (Witteveen).

Level A harassment would occur during genetic sampling and suction cup and implant tagging activities. Level B harassment from vessel-based activities and underwater photography, as described above, would occur concurrently.

Genetic sampling

Skin swabbing
Skin would be collected by swabbing the dorsal or lateral surface of bowriding dolphins using a sterile strip of nylon kitchen scrub pad or Velcro attached to a metal pole. Samples collected would consist of small amounts of exfoliated skin with a maximum surface area of about 20 cm^2.

Biopsy
Skin and attached blubber tissue samples would be collected from large whales and small cetaceans using a small stainless steel biopsy dart ranging from 5-9 mm in diameter and 40-60 mm in length. Darts would be fitted with a flange or "stop" that regulates penetration depth of the bolt/dart and causes recoil after sampling. In no instance would the dart extend through the blubber to the muscle layer. Crossbows, most commonly with a draw of 68 kg (150 lbs), and veterinary rifles using either compressed air or blank charges with adjustable pressure would be used for sample collection. Flotation material secured to the shaft of the bolt/dart would allow it to float and be retrieved after sampling.

Vessels would approach to within 10-30 m of the target animal. Darts would be aimed at the upper back just below the dorsal fin. Biopsy samples would be collected from both sexes and all age classes except neonates; species and take numbers are specified in the take tables for each permit (Appendices B-J).

Bowriding dolphins would be sampled using a handheld extendable pole (6 to 10 feet long) with rubber tubing attached to a trigger that allows the pole to spring forward 2 to 3 feet. Biopsy tips would be screwed to the tip of the pole and consist of sterilized bolts approximately 7 mm in diameter and 3 cm in length and sheathed in rubber tubing to prevent penetration of the skin beyond about 10 mm. The tip would contain three backward-pointing barbs to retain the sample. The resulting sample would consist of a plug of epidermal skin and blubber about 6 mm in diameter and 10 mm in length, taken from the dorsal surface of the animal.

In addition to the mitigation measures described above for close approach, mitigation measures used during biopsy sampling include:

- Using a new sterile dart tip for each sample collected.
- When possible, individuals would be identified prior to sampling to avoid duplication.

Samples would be stored in 20% DMSO in saturated NaCl solution or 70% ethanol and/or stored at –20°C. Tissues remaining after analyses would be archived (by researchers or sent to NMFS' Southwest Fisheries Science Center for archival).

Tagging

Tags would be attached to large whales and small cetaceans via suction cup or implanted into the skin and blubber of animals, depending on the research objectives. Tags would contain a variety of components, depending on the objectives of the research, to record temperature, depth, sound, acceleration, position, and video. Exact dimensions and weights would vary with the generation of tag and the specific components included; examples of current tags are provided in Table 2. Tags would be attached dorsally just in front of or beside the dorsal fin so that the antenna would be exposed when the animal surfaces. The tags would weigh less than 2500 grams (approximately 5.5 lbs) in air and maybe potted in syntactic foam, making them slightly buoyant in water. Most tags would weigh less than 500 g (approximately 1.1 lbs).

Advancements in technology have consistently led to smaller and more effective tags, and this trend is expected to continue in the future. Tagging equipment would be updated as newer models become available, and careful consideration of the primary research objective would be given before finalizing the tag package and deployment system to ensure that the smallest, lightest package is deployed.

Tagging would usually be conducted from small boats (less than 25 m in length), and only in relatively calm seas (i.e., Beaufort 0-2). Tagging would not be conducted from the longline vessel (Permit No. 14122; Straley). Animals would be approached to within 2-15 m using the methods described under *Close vessel approach for photo-identification and behavioral observations*. Tags would be attached using a hand-held or cantilevered pole or deployed with a crossbow or airgun. Behavioral responses of tagged individuals and of other animals in the group would be observed and recorded. In some instances, a hydrophone would be placed in the water to monitor acoustic response to tagging.

Tagged animals would be followed by boat at distances between 5 and 500 meters, depending on the species (larger species would be followed from a greater distance) and objectives, to monitor behavior and/or to obtain a trackline of movements. When possible, tags would be retrieved after they release from the animal. Photographs would be taken of the site of tag attachment to evaluate skin condition. In some instances, whales would be tagged twice annually.

Table 2. Approximate dimensions of tag types. Sizes are subject to variation depending on tag generation and specific research.

Tag Type	**Dimensions**	**Weight***	**Attachment Method**	**Expected Attachment Duration**
VHF/TDR tags	9.5 cm long 2.5 cm diameter	42 g, positively buoyant with floatation	Suction cup	6-8 hours; maximum 72 hours
DTAGs	12 cm x 5 cm	300 g in air	Suction cup	6-8 hours; maximum 72 hours
Bioacoustic probes	19.3 cm long 3.25 cm diameter	66 g, positively buoyant with floatation	Suction cup	6-8 hours; maximum 72 hours
Acousonde tags	3.2 cm diameter 22.1 cm long	262 g in air; 86 g in seawater	Suction cup	6-8 hours; maximum 72 hours
Acousonde tags Model 3B, in development (dimensions subject to change)	20.2 cm long (includes floatation but not antenna) 7.9 cm wide 4.3 cm height (includes suction cup)	390 g in air	Suction cup	6-8 hours; maximum 72 hours
MANTA tags	20-42 cm long 4-5 cm diameter	positively buoyant with floatation	Suction cup	6-8 hours; maximum 72 hours
Crittercams	< 12 cm diameter < 35 cm long, including 15cm polyurethane flotation foam tail	< 2.5 kg	Suction cup	≤ 24 hours
Partially Implantable tags	< 2.5 cm wide 12 cm length (not including 18 cm antenna)	150-250 g	Implants up to 10 cm into blubber - "depth stop" limits penetration to < 10 cm	1-5 months
Barnacle/Limpet/Dart type tags	6.0 cm x 3.5 cm x 2.5 cm	50 g	Two barbed titanium or stainless steel darts implant < 10 cm into blubber	1-2 months

* Weight does not include floatation, housing, and attachments unless specified.

Suction cup attachments
Suction cup tags would be attached to large whales and small cetaceans. Suction cups would be approximately 8-10 cm in diameter. Only the suction cups would be in prolonged contact with the animal's skin. Tags would release from the animal when the natural suction of the cup diminishes, or when a magnesium cap that corrodes in salt water causes the release of the tag. Tags would be retrieved by researchers upon release. The animal's behavior, including breaching, rolling, or rubbing, may cause the tag to shed prematurely. The amount of time that a tag would remain on an animal varies, but would generally be less than 72 hours. Attachments would likely last closer to six to eight hours (Baird et al. 2000, Lerczak et al. 2000, Croll et al. 2001, Calambokidis 2003, Witteveen et al. 2008).

Examples of these tags include:
- VHF/TDRs
- DTAGs
- Bioacoustic probes
- Acousonde tags
- MANTA tags
- Crittercams

VHF/Time-Depth-Recorders (TDRs):
VHF/TDRs record dive profiles for the focal animal, including position in the water column, maximum depth of dive, and ascent and descent rates. Time and depth would be recorded at intervals determined by the researcher.

DTAGs:
DTAGs are archival tags that were developed to monitor the behavior of marine mammals, and their response to sound, continuously throughout the dive cycle. The tag records audio, pitch, roll, heading, and depth continuously from a built-in hydrophone and suite of sensors. The sensors sample the orientation of the animal in three dimensions with sufficient speed and resolution to capture individual fluke strokes. Audio and sensor recording is synchronous so the relative timing of sounds and motion can be determined precisely (Johnson & Tyack 2003).

DTAGs weigh approximately 300 g in air and are attached to the whale with up to four silicone suction cups using a 12 m cantilevered carbon fiber pole or a handheld carbon fiber pole. With the use of the poles, the tag is delivered without encroaching over the flukes of the animal (Johnson & Tyack 2003). The tags are programmed to release from the animal by venting the suction cups at the end of the recording time if they are still attached. A VHF beacon in the tag aids in tracking and recovering the device.

Bioacoustic Probes:
Bioacoustic Probes ("BProbe") combine a hydrophone, behavioral sensors, a digital recorder, data storage, and a field-replaceable battery in a single, self-contained instrument. Attached to a free-ranging subject, the BProbe can measure the underwater sound environment experienced by that individual, as well as potentially associated changes in dive behavior. In addition to its primary mission as a tool for assessing the impact of noise on marine wildlife, the BProbe can be used to study vocalization behavior of the tagged subject.

BProbes collect acoustic samples with 16-bit resolution at up to 14 kHz bandwidths. They have incorporated VHF/TDRs that record with 12-bit resolution. The duration of attachment is dependent on the attachment method.

Acousonde:
The Acousonde, made by Acoustimetrics, a brand of Greeneridge Sciences, Inc. (www.acousonde.com), is a miniature, self-contained, autonomous acoustic/ultrasonic recorder designed for underwater applications. The Acousonde incorporates hydrophones as well as depth, attitude and orientation sensors, digital recording electronics, data storage, and a field-replaceable battery in a single sealed unit. The Acousonde replaces the Bioacoustic Probe, which was discontinued in 2007.

The Model B003A cylindrical Acousonde with a battery cap and A-size lithium battery weighs 262 g (in air) in a volume of 172 cc. This weight does not include flotation, attachment, or recovery gear specific to each permit. The "torpedo" shape is 3.2 cm in diameter and 22.1 cm long. It is negatively buoyant; in seawater the tag weighs approximately 86 g. The duration of attachment is dependent on the attachment method.

MANTA tags:
MANTA is a high-resolution, real-time 3-D tracking, data-telemetry, and data-logging system for large marine vertebrates. It allows environmental sampling at the animal (e.g., temperature, light, and sound) as well as real-time monitoring of animal responses to stimuli (Norris et al. 2005).

It is a multi-modal system that integrates several complementary technologies:

- Acoustic telemetry
- Radio-telemetry
- Data-acquisition and logging
- GPS and navigation sensors

Vocal events (i.e., animal calls) can be detected and potentially telemetered in real-time to a surface tracking station. Potential applications include monitoring noise events at animals' locations (e.g., seismic air-guns, sonar, and vessel noise) and monitoring animals' sub-surface behaviors and movements.

Crittercam:
Crittercam is a small recording unit capable of simultaneously recording video, audio, and additional parameters such as dive depth or swim speed (Marshall 1998). The most advanced versions (Gen 5) include a solid state video/sound capture and 3-D dive path data logging. The 5.7 model's dimensions are 25.4 cm length by 5.7 cm outer diameter. Crittercam is designed considering weight, pressure tolerance, robustness, and low hydrodynamic profile (Marshall 1998). Crittercam has been applied to a multitude of species, including sharks, bottlenose dolphins (*Tursiops truncatus*), harbor *(Phoca vitulina)* and Hawaiian monk seals (*Monachus schauinslandi*), and narwhals (*Monodon monoceros*). It has been successfully applied to adult balaenopterids. A description of Crittercams and how they have changed over time is available at: www.nationalgeographic.com/crittercam/about.html#e.

Blubber Implant Attachments
Satellite-linked transmitters would be used to quantify movement patterns and dive behavior of large whales. The transmitters send ultra-high frequency (UHF) radio signals to Argos receivers on five NOAA TIROS-N weather satellites. The signals are sent only when the whales come to the surface, and consist of a 750 ms phase-modulated transmission at 401.650 MHz.

Tags would be attached by implanting into blubber to varying degrees, depending on the species to be tagged and the desired duration of attachments. Attachment methods could include:

- Darts with backwards facing barbs (tag electronics external to animal).
- Sub-dermal attachments that spread out under the skin, mimicking barnacle attachment (tag electronics external to animal).
- Implanted or partially-implanted electronics packages.

Dart/Limpet/Barnacle Tags:
The dart/limpet type tag is an electronics package attached that is attached to the dorsal fin or the body just below the fin with two barbed darts that implant into the skin and/or blubber (Andrews et al. 2005). Barnacle tags would include sub-dermal attachments that spread out under the skin. For all types, the tag would remain external to the animal. These tags would be deployed from a crossbow or an air gun.

Partially Implantable Tags:
The implant tag is an electronics package that implants into the blubber of the dorsal flank, near the dorsal fin, with only the top (~2 cm) of the tag and the antenna remaining outside the whale. The tag would be similar to that used successfully on sperm whales (*Physeter macrocephalus;* Mate et al. 2007), but would be smaller, with a reduced level of penetration. A "depth stop" consisting of 2 lateral extensions would limit the penetration depth to no more than 10 cm, to ensure the tag would not penetrate the muscle layer. Implant tags would be deployed with an air-gun. Target whales would be greater than 15 m standard length.

In addition to the mitigation measures described above for close approach, mitigation measures used during tagging include:

- Attempts to tag an individual would be discontinued if that animal demonstrates a strong negative response to tagging.
- During any single encounter, no more than three tag deployment attempts per individual would be made.

Collection of marine mammal parts and Export/Re-Import of samples
Parts of dead marine mammals would be collected following a killer whale (*Orcinus orca*) predation event to identify the diet composition of transient killer whales in Alaska. Parts of marine mammals would be collected from the water using a skim net or sieve. It is possible that Steller's sea lions (*Eumetopias jubatus*) or other species would be incidentally harassed during the collection of prey samples, but they would not be intentionally approached.

Sloughed skin and feces would be collected from large whales and small cetaceans following certain surface activities (e.g., breaching, tail slapping). Sloughed skin would be collected from

the site of the surface activity only after the animals have moved greater than 100 yards from the location.

Skin that remains attached to suction cups after tagging would be collected.

These marine mammal parts and biopsy samples collected during research would be exported for analysis and remaining samples may be re-imported. The requested number of parts, specimens, or biological samples taken, salvaged and/or exported/re-imported is listed in Appendices B-J.

Specific permit requests

Information specific to each permit application and methods that differ from or are more detailed than those described in *General activities* are described below.

Au (File No. 14682)
Proposed research would take place between November and June annually for humpback whales, and throughout the year for other species.

The purpose of the research is to determine many aspects of the population dynamics and behavior of cetaceans around Hawaii. Genetic sampling, suction-cup tagging, acoustic recording, behavioral observation, photo-identification, and acoustic playbacks would be used to answer questions about population size, diving and feeding behaviors (including diurnal differences in these behaviors), local movement patterns, and use of acoustic signals. The research includes three discrete projects:

- Project 1: Population dynamics of marine mammals around Hawaii.
- Project 2: Noise, the acoustic environment, and the use of sound by whales around Hawaii.
- Project 3: Behavioral effects of sound on marine mammals around Hawaii.

Project 1: The overall objective of the project is to determine many aspects of the population dynamics and behavior of cetaceans around Hawaii, including genetic population structure and variability, dispersal patterns, social structure, and foraging and diving behavior in order to enhance effective management.

Activities conducted during Project 1, as described in *General Activities*, would include:

- Close approach for photo-identification and behavioral observation.
- Collection of feces.
- Genetic sampling by skin swabbing or biopsy sampling (if skin swabbing does not yield sufficient amounts of DNA).
- Suction-cup tagging.

Research activities for this project would focus on pantropical spotted dolphins (*Stenella attenuata*) and short-finned pilot whales (*Globicephela macrocephalus*); other species would also be targeted for research. Species and take numbers are specified in Appendix B.

Males and females of all ages and reproductive conditions would be approached for photo-identification and behavioral research. Males and females of all ages, except calves or females with calves, would be subject to genetic sampling or tagging. Biopsy sampling of adult humpback whales in the northwest Hawaiian Islands would be conducted.

Project 2: The overall objective of the project is to determine many aspects of the behavior and use of the acoustic environment by large whales. Data would provide information on how cetaceans use acoustics to coordinate and mediate behavior within a group environment, to understand how echolocation is used in foraging, and to determine the acoustic characteristics of the animals' sound production, especially when they dive to deep depths.

Activities conducted during Project 2, as described in *General Activities*, would include:

- Close approach for photo-identification and behavioral observation.
- Passive acoustic recording.
- Suction-cup tagging.

Research activities for this project would focus on humpback whales and two species of beaked whales (*Ziphius cavirostris* and *Mesoplodon densirostris*) as models; other species would also be targeted for research. Species and take numbers are specified in Appendix B.

Adult male and female whales would be targeted for research. For humpback whales, this would include tagging of mothers accompanying calves older than one month and tagging of calves older than one month.

Project 3: The overall objective of the project is to determine the effects of noise on the behavior of cetaceans around Hawaii and to research low-level sounds that could alert marine mammals and alter their behavior for potential future use as a mitigation tool. The specific objective is to determine types of low-level sounds that elicit mild alerting responses from marine mammals (e.g., submerged mammals surface or move short distances (about 500 m)).

Activities conducted during Project 3 would include:

- Close approach for photo-identification and behavioral observation, as described in *General Activities*.
- Controlled exposure to sound (playbacks), as described below.

This project would not focus on specific species, but no ESA-listed species would be targeted for playbacks. Species and take numbers are specified in Appendix B. Males and females of all ages and reproductive conditions would be targeted for playbacks. All animals within visual range during playback sessions would be counted as takes.

Playbacks would occur in U.S. waters of Hawaii and adjacent international waters throughout the year, except during humpback season in Hawaii (December to April). Playbacks would occur primarily off the leeward coasts of Oahu and the island of Hawaii, more than 2 miles from shore, and might be conducted in waters of the Hawaiian Islands Humpback Whale National Marine Sanctuary.

Playbacks would be conducted primarily from small boats (7 to 12 meters in length); larger vessels would occasionally be used, especially in offshore waters. A single vessel would be used for all aspects of the project (photo-identification, playbacks, and behavioral studies). At least two visual observers would be on the forward "bridge" of the vessel, with a minimum eye height of 10 feet. At this eye height, visual distance is approximately 4 miles. Observers would be equipped with 7x binoculars with a reticle scale. Distance to animals would be estimated by entering the reticle distance into WinCruz, a distance sampling program specifically designed for whale observations. Playbacks would not be conducted at sea states above Beaufort 5 or if rain or fog prohibits visual monitoring.

Target animals would be observed for at least 30 minutes prior to playback exposure. During this time photo-identification would be conducted and baseline behavioral data recorded. When possible, acoustic recording suction cup tags would be attached to some individuals, using the methods described under *Suction Cup Attachments,* prior to commencing playbacks. At the end of the 30 minute observation period, the vessel would be stopped and the engines shut down. At this point the transducer would be placed in the water and playbacks would commence. Behavioral observations would continue during playbacks.

Behavioral responses would be described and classified according to the behavioral disturbance scale of Southall et al. (2007). For species like spinner dolphins (*Stenella longirostris*) that travel in large groups, it may not be possible to focus on one focal animal. In this case, the general behavior of the group would be monitored. Observers would note orientation behaviors, changes in speed or direction, group distribution, inter-animal distance, distance between mothers and calves, startle responses, and aggression levels. Changes in vocal behavior would be monitored acoustically. For focal animals, respiration rate would also be monitored. After the final playback, the animals will be observed for at least 30 minutes to record behavior.

If non-target marine mammals are observed in the playback area, playbacks would immediately be suspended and would not resume until the research vessel is at least 2 miles from the location of the sighting. At this distance, sounds at the proposed levels would be attenuated to the point at which disturbance to non-target animals would be unlikely. The transducers proposed for use are highly directional; transmitted sound would be directed at the target animals. Visual observers would therefore focus their effort on the area of sound propagation during playback.

Playbacks would range in frequency from 1 to 50 kHz. The transducer, or source, depth would be 10 m. Playback cycles, also known as duty cycles, would last no more than 20 minutes; sound would be played no more than 60% of that time. For example, a sound would be played either for 12 minutes continuously or for one minute followed by thirty seconds of silence, repeated for 20 minutes. The 20 minute duty cycle would be repeated no more than once per hour, resulting in a 40 minute "rest" period. The playback duty cycle would be repeated for no more than one day.

Playbacks would be electronically generated; frequency and source level of all sounds would be precisely controlled. Playbacks would consist of pulse and nonpulse sounds described in Table 3. Sounds would be recorded *in situ* and the recordings then digitally filtered in the lab to ensure that all frequencies remain within the proposed range. Signals with unknown frequencies would be characterized before digital filtering.

Table 3. Types of sound and *in situ* frequency prior to digital filtering and playback. Sounds with unknown frequency ranges would be characterized before use.

Type of Sound		**Frequency range (kHz)**	**Sources**
Known Adverse Sounds	Hatsuonki (Oikami pipes)	Unknown	-
Natural Sounds	Killer whale calls/whistles	4.5 - 8.3	Thomsen *et al* 2000, Miller 2006
	Odontocete calls	1 - 20	Lammers *et al* 2003, Rasmussen *et al* 2006
	Mysticete calls	0.1 - 6	Au 2006
Anthropogenic sounds	Boat engines	broadband	-
	Helicopter sound	broadband	-
	Pile driving sound	broadband	-
	Emergency vehicle siren sound	1-4	Fidell *et al*1973

Playbacks would include playing recordings of:

- *Hatsuonki sounds* (commonly known as Oikami). Oikami are hollow steel pipes that are banged to produce underwater sound.
- *Transient killer whale calls*. Although killer whales are not known predators of all species proposed for playbacks, the lack of information on behavioral responses of cetaceans makes them a possible deterrent.
- *Whistles of odontocete species* played backwards and with added pure tone and low-high sine wave burst similar to the Nowacek sequence (Nowacek et al. 2004).
- *Calls of mysticete species*, with added tone bursts and low-high sine wave bursts similar to the Nowacek sequence (Nowacek et al. 2004).
- *Boat engines* of both low and high speed.
- *Helicopter sounds* recorded underwater.
- *Emergency vehicle siren* sounds.
- *Electronically produced chaotic sounds*. Randomly summed sine waveforms would be played for multiple one-second intervals. The lower and upper frequencies of these sounds would cover one octave range. Eight other frequencies within the octave band would be randomly chosen with a random number generator. A duration between 0.1 and 0.9 seconds would be randomly chosen for each frequency. One of the ten signals would be randomly chosen to have a one second duration. All ten signals would then be summed to produce a one second segment of a chaotic signal. Three such randomly generated segments would be used as the chaotic signal: Nowacek sequences of pure tone, FM down sweep and low-high sine wave burst, Gaussian random noise bursts of 3 seconds duration followed by a random duration of silence, followed by a noise burst of another 3 seconds, and then repeated.

The proposed playbacks would not expose animals to a received sound pressure level (SPL) in excess of 160 dB. The source level (SL) would be moderated at the transducer based on distance

to the target animals using the equation for transmission loss due to spherical spreading, TL = 20log10(r). A highly directional transducer would be used to play the sounds, resulting in high losses of sound out of the direct beam of the transducer, decreasing the possibility of sound exposure to animals not within the direct beam. As animals move closer to the boat, SL would be lowered to maintain received levels (RL) of less than 160 dB.

At sea, estimated or calculated distances from an animal are generally inexact. SL categories have been created based on distance to ensure that animals are not exposed to RL of more than 160 dB for pulsed sounds and 120 dB for nonpulse sounds (Table 4). The SL that would be used (referred to as "used SL" in Table 4) would be based on the distance from the transducer to target animals. Researchers intend to conduct playbacks on animals that are between 50 and 100 m from the boat.

Table 4. Source Level (SL) categories to maintain Received Level (RL) at or below 160 dB (pulsed source) or at or below 120 dB (nonpulse source). *Max SL* indicates the maximum SL it is *possible* to operate at for that distance from the animals while maintaining a RL of 160 or 120 dB. *Used SL* indicates the maximum SL which would be used when animals are within that distance. *RL at animal/group* indicates the RL at the animals.

Distance (m)	**Max SL for Pulse Sounds (160 dB)**	**Used SL (db)**	**RL at animal/ group (dB)**	**Max SL for Nonpulse Sounds (120 dB)**	**Used SL (dB)**	**RL at animal/ group (dB)**
1	160	160	160	120	120	120
10	180	160	140	140	130	110
25	188	170	142	148	140	112
50	194	170	136	154	140	106
75	198	180	142	158	150	112
100	200	180	140	160	150	110
250	208	190	142	168	160	112
500	214	190	136	174	160	106
750	218	190	132	178	170	112
1000	220	190	130	180	170	110
1500	224	190	126	184	180	116
2000	226	190	124	186	180	114
2500	228	190	122	188	180	112
3000	230	190	120	190	180	110
3500	231	190	119	191	180	109

Measures described by the applicant to minimize disturbance to animals include:

- Attempts to tag humpbacks would be abandoned if mothers or calves display disturbance to vessel approach.
- Efforts to tag or biopsy sample a group of animals would be terminated if strong negative reactions are displayed by:
    - Any humpbacks.
    - Five spinner dolphins.

    - Three individuals of other authorized species.
- Researchers would coordinate with other researchers on the water to avoid harassing the same animals.
- During playbacks:
    - If behavioral responses within a group approach a response score of 7 (Southall et al. 2007), playbacks would be attenuated by 20 dB. A response score of 7 includes extensive or prolonged aggressive behavior, moderate separation of females and dependent offspring, a clear anti-predator response, severe and/or sustained avoidance of the sound source, or moderate cessation of reproductive behavior (Southall et al. 2007).
    - If behavior with a response score of 7 continues for more than 10 minutes after attenuation of the sound source, playbacks with that group would cease for the day.
    - If any individual animal has a strong adverse reaction to the playbacks or ship approach, playbacks and approach would be halted immediately for the group.
- Source Levels for playbacks would start at low levels before increasing to the maximum levels indicated in Table 4.

<u>Cartwright (File No. 10018-01)</u>
The proposed research would expand the applicant's current study of humpback whale female-calf behavior and habitat choice to add humpback whales in Alaskan waters to the currently authorized humpback whales on the breeding grounds of the Central North Pacific stock. Collecting data from the Alaskan feeding grounds of this stock would allow data to be compiled with that collected on the breeding grounds (Hawaii) to provide a comprehensive description of the ontogeny of humpback whale calves across their natal year. The study would also examine habitat choice in female-calf pairs by attempting to identify favored feeding regions and determine how over-riding bathymetric or biological parameters define preferred habitat for female-calf pairs on the feeding grounds.

The proposed activities would occur in Alaska's Inside Passage, including Chatham Strait and adjacent bodies of water, and potentially extending on occasion into Frederick Sound, Stephen's Passage, Sumner Straits, Icy Straits and Lynn Canal.

Research would focus on humpback whales; Pacific white-sided dolphins *(Lagenorhynchus obliquidens)*, harbor porpoises *(Phocoena phocoena)*, Dall's porpoises *(Phocoenoides dalli)*, and killer whales (non-Southern Resident) would be targeted for research on an opportunistic basis. Species and take numbers for all activities are specified in Appendix C. Males and females of all ages and reproductive conditions would be targeted for close approach to conduct photo-identification, behavioral observation, and passive acoustic recording. Most calves encountered on the feeding grounds of Alaska are more than 6 months old (i.e., not newborns).

Activities that would occur under the proposed modification are described in *General Activities* and would include:
- Close vessel approach for photo-identification and behavioral observation.
- Passive acoustic recording.

Measures described by the applicant to minimize disturbance to animals include:

- Research activities would be suspended if there is indication that the same individuals would be disrupted from foraging on a repetitive basis.
- Research activities would not occur if other vessels are in the immediate or auditory vicinity of whales.
- Researchers would consult with other researchers in Alaska to: avoid harassing the same animals, explore collaborations, contribute to the cumulative research in the area, and share photo-identification images.

Darling (File No. 13846)

The proposed permit would continue long-term research designed to contribute to understanding the social organization, behavior, and communication of whales.

The proposed activities would occur in Hawaii, primarily off west Maui, and along coastlines of Washington and Alaska. In Hawaii, activities would occur from November 1 - May 15. During the peak season (Dec 15 – Apr 15) activities would occur daily. In Alaska and Washington the sampling season is primarily summer (May 15 - Oct 30), however some sampling would occur throughout the year. During field sessions that may be a month or two long sampling would be daily; otherwise sampling would be weekly or monthly.

Research would focus on humpback and gray whales (*Eschrichtius robustus*); other species would be incidentally harassed during research. Species and take numbers are specified in Appendix D. Males and females of all ages and reproductive conditions would be targeted for research; only adult and juvenile humpbacks would be biopsy sampled and only adult humpbacks would be tagged. Small vessels (5-20m) would be used for all activities.

Activities that would occur under the proposed permit, as described in *General Activities,* would include:

- Aerial surveys.
- Close vessel approach for photo-identification and behavioral observation.
- Underwater photography and videography.
- Passive acoustic recording.
- Suction cup tagging.
- Blubber attachment tagging (dart types only).
- Biopsy sampling.
- Export of samples.
- Acoustic playbacks, as detailed below.

Specific details or variations from activities described in *General Activities* are described here.

Gray and humpback whales in the U.S. Pacific Northwest would be approached for photo-identification and behavioral observation only when those whales are followed into U.S. waters during studies around Vancouver Island, Canada. Humpback whales that feed off the west coast of Vancouver Island straddle the Canadian/U.S. border in Straits of Juan De Fuca between Vancouver Island and Olympic Peninsula and Haro Straits between Victoria, BC and San Juan Island, WA.

Humpback whales in Alaska and Hawaii would be subject to all Dr. Darling's proposed activities.

Close approaches for behavioral observation would be made using 6-8m vessels, underwater observers, small planes, or helicopters. Surface observations would include:

1. Focal follows where a specific whale or social group (e.g., singer or mother with calf) is followed for set period of time (e.g., two hours) and during that time its movements, associates, and behavior are documented.
2. Periods of documenting behavior prior to, during, and after playbacks. The boat would slowly follow the whales from a distance of approximately 30-80 m.

Photogrammetry would be conducted from the vessel. Measurements would be made after approaching whales from directly behind (at a 90 degree angle from the tail) to a distance 50-80 m and taking a photograph, just as with photo-identification. Three photographs would be obtained from each individual. Analysis involves photogrammetic ratios to determine the width of the tail. This allows individuals to be placed in an age class: juvenile or adult.

Acoustic Playbacks

Whale songs or social sounds would be played to various social groups in Alaska and Hawaii and behavioral responses would be documented. Social groups include:

- Singers.
- Lone non-singing adults.
- Adult pairs of male and female.
- Females with calf and male escort.
- Females.

Sounds would be broadcast through a small underwater speaker (Lubell LL-9162 Underwater Acoustic Transducer) suspended over the side of the vessel. Humpback songs and social sounds would be projected at levels as close to the volume and quality of a real singer as possible. The playback system would be calibrated so precise levels of sound can be projected. The source broadcast level would depend on the distance of the whales from the transducer. The best estimate of maximum source levels from singers is approximately 187 dB (W. Au pers. comm. to J. Darling 2003). At this source level, the received level for a conspecific about 90 ft. (two whale lengths) away would be 158 dB. All playbacks would be initiated more than 100 ft from the target animals. If whales approach the sound source, the maximum received level would be no more than 187 db. Each session would consist of a maximum of two playbacks and would last no more than 60 minutes, with many complete in 30 min.

At least two vessels would be present during playbacks. One vessel would deploy the playback equipment, another would approach the target animal and observers would listen to the playback via hydrophone. Playbacks would be conducted relatively early (Jan.) and late (Apr.) in the season when there is a reduced density of whales and activity in the region. All whales in the vicinity of the target whale would be documented from a third vessel and hillside observer, or a helicopter hovering at 1,000 ft., to determine if other whales are present in a 1 km square around the playback.

Following playbacks, target whales would be observed for varying amounts of time, depending on whether the subjects are singers or groups that include a female. If singers approach the playback boat, their behavior would be monitored until the singer departs (generally 15-45 minutes). If singers do not approach the boat or react to playback, they would be observed for a minimum of 30 minutes after playback.

Female groups would be monitored for a minimum of one hour prior to playbacks; when possible they would be monitored for the same amount of time after playback.

Tagging
The following suction-cup and implant tags, described in *General Activities*, would be used to investigate relative movement patterns of humpback whales: Crittercam, Acousonde, Dtag, and Andrews dart tag. Whenever possible suction cup tags would be used; dart tags would be used to address longer-term movements, such as the geographic relationship of individual whales over a period of days and weeks.

Measures described by the applicant to minimize disturbance to animals during research activities include:

- Playbacks would not be conducted if there is indication the target whales are disturbed or otherwise in the midst of interactions whereby one could not distinguish between a reaction to the playback and a reaction to ongoing natural events. Trials would be aborted if other whales enter the vicinity of target whales.
- Use of specific types of tags would be terminated if any evidence arises that the tag type harms the animals.

<u>Mobley (File No. 14451)</u>
The proposed research would investigate short- and long-term changes in population size, habitat use, and behavior of marine mammals in the Pacific and Atlantic Oceans, particularly with regard to the impact of anthropogenic sound in the ocean.

The proposed activities would take place annually in U.S. waters of Hawaii, Alaska, both coasts of the U.S., and in The Bahamas, Guam, and the Northern Mariana Islands.

In the Atlantic, the permit would authorize takes in all waters of the Gulf of Mexico and off the east coast of the U.S. Activities would occur primarily at designated instrumented training ranges and adjacent waters, but may also occur outside these ranges, for example in more broadly designated Navy operational areas (OPAREAS), military special use airspace complexes, the Atlantic Fleet Active Sonar Training (AFAST) study area, or any of the waters under the responsibility of Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic).

Activities would occur during active U.S. Navy and military exercises, immediately before and after such exercises, as well as during inactive periods between exercises.

Instrumented ranges, OPAREAS, and complexes ranging across waters of AL, CT, DE, FL, GA, LA, MA, MD, ME, MS, NC, NH, NJ, NY, RI, SC, TX, and VA include, but would not be limited to:

- Boston.
- Narragansett Bay.
- Atlantic City.
- Virginia Capes (VACAPES).
- Charleston (CHASN).
- Cherry Point.
- Jacksonville (JAX).
- Key West.
- Atlantic Undersea Test and Evaluation Center (AUTEC).
- Gulf of Mexico (Western GOMEX offshore TX, and Eastern GOMEX offshore LA, MS, AL and western FL).
- Naval Sea Systems Command (NAVSEA) Naval Surface Warfare Center (NSWC) at Panama City, FL.

The Cherry Point, Jacksonville, Key West, AUTEC, and VACAPES OPAREAS include fully instrumented ocean training ranges that may more frequently host major training exercises compared to other OPAREAS. These include Fleet Area Control And Surveillance Facility Virginia Capes (FACSFAC VACAPES), Fleet Area Control and Surveillance Facility Jacksonville (FACSFAC Jacksonville), AUTEC (also known as NATO FORACS AUTEC, or NFA), South Florida Testing Facility (SFTF) at Fort Lauderdale, and the planned Undersea Warfare Training Range (USWTR) for which the Department of the Navy in summer 2009 issued a Record of Decision planning to develop this range within the Jacksonville OPAREA.

In the Pacific, the permit would authorize takes in all waters offshore of Alaska, Washington, Oregon, California, the Main and Northwest Hawaiian Islands, and Guam and the Mariana Islands. Activities would occur primarily at designated instrumented training ranges and adjacent waters, but may also occur outside these ranges, for example in more broadly designated Navy operational areas (OPAREAS), military special use airspace complexes, or any of the waters under the responsibility of Naval Facilities Engineering Command Pacific (NAVFAC Pacific).

Activities would occur during active U.S. Navy and military exercises, immediately before and after such exercises, as well as during inactive periods between exercises.

Instrumented ranges, OPAREAS, and complexes ranging across waters of AK, WA, OR, and northern CA include, but would not be limited to:

- Gulf of Alaska.
- Whidbey Island.
- Pacific Northwest (PACNW).

These OPAREAS support subsurface training and also have fully instrumented ocean training ranges that may host major training exercises. These include Northwest Training Range Complex (NWTRC) including the Nanoose Bay ranges off the eastern shore of Vancouver Island, the Naval

Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Division Keyport, as well as the Southeast Alaska Acoustic Measurement Facility (SEAFAC) in Ketchikan, AK.

Instrumented ranges, OPAREAS, and complexes ranging across waters of southern California include, but would not be limited to:

- Southern California Offshore complex (SOCAL).
- Point Mugu complex.

These OPAREAS and complexes range across waters offshore of San Diego, Orange, Los Angeles, Ventura, Santa Barbara, San Luis Obispo, Monterey, and Santa Cruz counties. The OPAREAS support subsurface (i.e., submarine) training and also have fully instrumented ocean training ranges that may more frequently host major training exercises. These include the Southern California Offshore Range (SCORE), San Clemente Island Underwater Range (SCIUR) of the San Clemente Island Range Complex (SCIRC), the Outer Sea Test Range (OSTR), and the Anti-Submarine Warfare Range (SOAR).

Instrumented ranges, OPAREAS, and complexes ranging across waters of HI include, but would not be limited to:

- Hawaiian OPAREA.
- Hawaiian Range Complex (HRC).

Subsurface training and instrumented training ranges include those of Fleet Area Control and Surveillance Facility [FACSFAC] Pearl Harbor, the Pacific Missile Range Facility (PMRF) in waters off Kauai, Barking Sands Tactical Underwater Range (BARSTUR), Barking Sands Underwater Range Expansion (BSURE), and Large Area Tracking Range (LATR).

In addition, activities occurring in the waters of the Main and Northwest Hawaiian Islands would continue the investigation of long-term population trends of cetaceans in Hawaiian waters, including the Hawaiian Islands Humpback Whale National Marine Sanctuary and Papahanaumokuakea Marine National Monument. Aerial and vessel surveys related to these activities would not necessarily overlap with research on the effects anthropogenic noise in Hawaiian waters.

Instrumented ranges, OPAREAS, and complexes ranging across waters of Guam and the Mariana Islands include, but would not be limited to:

- Marianas Complex.

Species and take numbers for each location are specified in Appendix E. Males and females of all ages and reproductive conditions would be targeted for close approach and photo-identification.

Directed research would involve a combination of activities, as described in *General Activities*, involving only Level B harassment, including:

- Aerial surveys.
- Vessel surveys.
- Close vessel approach for behavioral observation and photo-identification.
- Underwater photography/videography.

Individuals would be taken more than once in a day but in a different manner, i.e., an individual may be photographed from both aerial and surface vessel platforms. Up to three close approaches would occur per animal per day over each season. The observational research would take place aboard a vessel or a fixed- or rotary-wing aircraft. Aerial surveys would be conducted at an altitude of 800 ft (244m), and would descend to 500 ft (152m) only if required for species identification of smaller delphinids.

The research involves a comprehensive list of target species; it is not expected that non-target cetacean species would often be encountered. If non-target species are encountered, they would be avoided, especially in the case of critically endangered species such as the Hawaiian monk seal or North Atlantic right whale *(Eubalaena glacialis).*

Measures described by the applicant to minimize disturbance to animals include:

- Every effort would be made not to separate animal(s) from a group.
- Telephoto lenses and binoculars would be used to obtain quality photographs and video from a distance.
- Animals would be monitored at all times and if an animal or animals appear to be in serious distress, the operation would be halted.
- During shoreline aerial surveys in Hawaiian waters where Hawaiian monk seals could potentially be hauled out, the aircraft would fly at least 100 yds (91.4m) away from shorelines at an altitude of at least 800 ft (244m) to avoid harassment.

<u>Pack (File No. 14585)</u>
The proposed research would continue long-term studies of the behavior and biology of North Pacific humpback whales ongoing since 1975, and would investigate the behavior and biology of humpbacks focusing on several objectives that either build on current databases or address new areas of inquiry.

The proposed activities for humpback whales would take place annually:

- Around all of the main Hawaiian Islands during the winter/spring humpback season, from approximately December 1 through May 30.
- Along the rim of the North Pacific from California northward to Southeast Alaska and then westward through the Gulf of Alaska, Aleutian Islands, and regions of the upper western Pacific. Activities in Southeastern Alaska would focus on humpback whales in Frederick Sound and its adjoining passages and straits from approximately June 1 to November 30.

Dr. Pack's research activities would focus on humpback whales; other cetacean species would opportunistically be targeted for research in the above described study areas year-round. Humpback whales would be targeted for Level A and B take activities; other species would be targeted for only Level B take activities. Species and take numbers are specified in Appendix F. Male and female humpbacks of all ages and reproductive conditions would be targeted for close approach, photo-identification, and biopsy sampling; however attempts would be made to avoid biopsy sampling neonate calves as defined by Cartwright and Sullivan (2009) (e.g., calf length is less than 3.7m, calf is very light in body pigmentation, calf's dorsal fin is flopped over, calf is still being supported heavily by its mother). Only non-calf humpback whales would be tagged.

Directed research would involve a combination of activities, as described in *General Activities,* including:

- Close vessel approach for behavioral observation and photo-identification.
- Underwater photography/videography and videogrammetry (described below).
- Passive acoustic recording.
- Collection of sloughed skin, feces, and tissue from floating carcasses.
- Suction cup tagging.
- Biopsy sampling.

Specific details or variations from activities described in *General Activities* are described here.

Target species would be approached using one or two small (< 7m) outboard boats for behavioral observation, photo-identification, and passive acoustic recordings. Observations would typically last from one to three hours, but would be terminated earlier if target animals are actively avoiding the vessels. Animals would be monitored for a minimum of 15 minutes prior to and following all activities. A hydrophone (Cetacean Research Technology customized hydrophone or equivalent) or vertical hydrophone array would be deployed to a depth of 25m or less to verify that singing is occurring, and for obtaining song recordings for subsequent analyses. Once the singer is located, the boat would be positioned within 100m of the singer and shut down, and the hydrophone (or array) would be deployed over the side or bow of the boat to record signals. For the array, hydrophones would be spaced approximately 1.5 to 7m apart on a bar perpendicular to the optical axis of the camera. Recordings on average would take 40-90 min.

If target whales are stationary, up to two swimmers equipped with mask, snorkel, fins, and digital cameras would enter the water as described in *General Activities.* One swimmer would carry a hand-held high-frequency (200-400 kHz) sonar device (Speedtech Depthmate), used to measure the distance from camera lens to whale. NMFS does not anticipate take of marine mammals to result from exposure to active sources that operate at or above frequencies of 200 kHz, so the activity is not considered in this EA.

The applicant would also attempt to develop a dual laser method of determining distance from snorkeler to whale that may provide more reliable distance measurements. Dual blue-green lasers (450-550 nm) would be affixed to or be carried adjoining the camera body. The distance between each laser beam would be fixed at the camera. The beam would be triggered and directed on the body of the whale during filming or photography to provide a scale on the whale's body. Size of the whale would later be determined from the images or video. To test the accuracy and reliability of videogrammetry using laser technology, the traditional videogrammetric technique using the hand-held sonar device would occur concurrently.

The amount of time swimmers remain in the water would be dependent on the number of whales in a group and the group's behavior. Normally, swimmers would be in the water with a group for approximately 20 minutes; on occasion, circumstances may provide an opportunity of an hour or longer for obtaining behavioral and length measurement records.

Crittercam tags would be deployed from a 6-7m outboard boat when the boat is approximately 5m

from the whale (i.e., the maximum extension length of the attachment pole). Crittercam tags would be deployed on all social roles in competitive groups, on whales in dyads, on escorts in mother-calf groups, and on single males that potentially may join a group with a female (e.g., lone singers). Crittercams would be deployed from the bow of the vessel with a suction cup device using a retractable pole. Air would be actively evacuated from the suction cup shouldering the Crittercam package by directing air from a SCUBA tank on board the vessel through flexible tubing past the nozzle on the suction cup, producing a Venturi effect vacuum that evacuates air from the cup, firmly emplacing the Crittercam system. Once the suction cup is secured, the Crittercam would be released from the attachment pole.

The tagging event would last less than 20 seconds from the attempt to deploy the tag to the release of tag from the deployment pole. The duration of an encounter during which tagging takes place (including preliminary assessment of the group, determining possible candidate whales, habituation of the group to the boat, and actual deployment) would vary with group size, speed, and behavior, and would range from approximately 30 minutes to 2 or more hours. Following deployment, the research boat would attempt to remain within visual range of the group to record surface behavior, continue to collect identification photographs, conduct videogrammetry to determine body length of whales in group, conduct biopsy sampling to determine sex of group members, possibly deploy a Crittercam on another whale in the group, and retrieve the Crittercam. Crittercam would remain attached from 8 to 24 hours, and would be pre-programmed to release at a particular time. Crittercam is positively buoyant, and after the seal is broken will float to the surface.

The Crittercam system would incorporate an internal VHF transmitter connected to an external antenna (Telonics MK-8 HP model). A brief (1 sec) pulsed signal (150.000-150.000 MHz band) would be transmitted while Crittercam is at the surface. If the Crittercam cannot be located visually at the surface, it can be located and retrieved using the VHF signal (32-km range). NMFS does not anticipate take of marine mammals to result from exposure to active sources that operate at or above frequencies of 200 kHz, so the VHF transmitter is not considered in this EA.

Each biopsy dart tip containing a tissue sample would be stored on ice in a sterile plastic bag for transport back to the lab. In the lab, samples would be subdivided as needed for analyses.

<u>Sharpe (File No. 14599)</u>
The proposed research would continue the study of sophisticated hunting tactics including long term bonding, division of labor, task specialization and bubble tool use by humpback whales. Results would be used to characterize this social complexity and gain insight into the manner in which environmental and social factors shape this behavior. Killer whales (excluding Southern Resident whales) would be approached for photo-identification on an opportunistic basis.

The proposed activities would occur annually in the waters of Southeast Alaska primarily from mid-May to mid-October.

Directed research would involve a combination of activities, as described in *General Activities*, including:

- Aerial surveys.

- Close vessel approach for behavioral observation and photo-identification.
- Underwater photography using pole- or vessel-mounted cameras and SCUBA divers.
- Passive acoustic recording.
- Collection of feces.
- Suction cup tagging.
- Acoustic playbacks, as detailed below.

Research would also include vertical and side scan sonar profiling, as described below.

Species and take numbers are specified in Appendix G. Humpback whales of both sexes and all ages and reproductive status would be targeted for research. This would include calves estimated to be older than 6 months, cows in a variety of reproductive stages, including mid-term females (approximately four to eight months pregnant), and lactating females with calves less than nine months of age. Killer whales of all ages and both sexes would be approached for photo-identification only.

Specific details or variations from activities described in *General Activities* are described here.

All research activities will be conducted from vessels ranging in length from 4 to 18 m. Approaches would typically be no closer than 30m, except when deploying tags, and would be made by measured graduated approaches from behind. For photo-identification and recording behavioral data, images are obtained using video camera (25X zoom lens) and 300 mm digital single-lens-reflex (SLR) cameras.

Vertical and Side Scan Sonar Profiling
The sonar would be used to estimate prey biomass and track underwater movement of whales. The sonar transducer would be mounted to the research vessel and would be used at the maximum possible distance to minimize disturbance to prey and foraging whales. Since individuals may be pursuing/chasing prey up to the surface, sonar activities would occasionally occur within one body length of a whale. Sonar would be operated at frequencies from 30 to 800 kHz.

Underwater Photo/Video Using Pole- or Vessel-Mounted and SCUBA
Approaches to whales by vessel and SCUBA would be conducted using the methods described in *General Activities* and as above. The applicant estimates that most encounters with whales would be relatively brief, typically less than a minute. However, if an individual was feeding in a restricted area, encounters could last up to 15 minutes. Pole cam images may be obtained as close as 5m to animals and 1m to bubble structures.

Suction Cup Tagging
Crittercam tags would be attached to whales using the methods described in *General Activities.* Tags would be deployed with a 5 m pole as close as 2 m to whales. A vacuum hose might be used to assist in adhesion of suction cups. The mean time of attachment is estimated to be 8 hours, and tag deployments would be programmed to not exceed 24 hours.

Acoustic Playbacks
The objective of playbacks is to gain insight into the function of humpback whale sounds by broadcasting sounds and noting the behavioral reactions of animals. Several sounds types would be played to humpbacks, including:

- Alaskan humpback whale feeding calls.
- Alaskan humpback whale social sounds.
- Hawaiian humpback whale winter song.
- Hawaiian humpback whale social sounds.
- Synthetic sounds (non-impulsive).
- Blank tape or silent stimulus control sound.

The order of sound presentation would be randomized and the monitoring team would be naïve to the specific status of the playbacks. Each playback trial would last 55 minutes:

1) The first 25 minutes would involve a pre-test passive observation period to document baseline behaviors.
2) The second 5 minutes would involve the playback stimulus.
3) The final 25 minutes would involve a post-test phase monitoring of animal activity.

A baseline of normal behaviors would be established for individual whales during the pre-test monitoring period so that each animal could serve as its own control in determining when a response to the playback occurs. The playbacks would be broadcast at a depth of 20 m at an SL not to exceed 170-dB re: 1uPa. No playbacks would be broadcast to animals closer than 100m. Animal position would be determined using a computer algorithm which integrates 1) vessel position obtained using a GPS unit, 2) distance to the whale(s) acquired with an optical range finder, and 3) a compass bearing obtained by sighting from the research vessel to the animal(s).

Individuals would be monitored up to 1.5 nautical miles from vessels and up to 3 nautical miles from shore stations.

Measures described by the applicant to minimize effects to animals include:

- Aerial observations of individual whales would not exceed 15 minutes, and would be suspended if the whale(s) exhibited any adverse reactions such as the onset of surface percussive activity, underwater exhalations, lateral tail movements, premature dives or similar disturbance behaviors.
- No more than 8 helicopter hover episodes would occur per day per individual or group.
- Helicopters would include lighter models (such as Eurocopter AS35OBA or MDH 500D) that decrease the amount of noise and rotor wash.
- Prop guards would be used on all close approach vessels.
- No individuals or groups would be subject to more than one playback on a given day. Every attempt would be made to limit the total number of playbacks during the season to any given whale to 15.
- Playbacks would not be conducted to large feeding groups.
- Playbacks would be suspended if the whale(s) exhibited any adverse reactions such as the onset of surface percussive activity, underwater exhalations, lateral tail movements, premature dives or similar disturbance behaviors.

- Attempts to attach tags would be discontinued if any whale exhibits a strong adverse reaction to the presence of the tag or vessel, e.g., breaching, tail lobbing, underwater exhalation, or disassociation from the pod.

Straley (File No. 14122)
The proposed research would continue the study of biology of large whales in Alaskan waters.

The proposed activities would take place annually in Alaskan waters including, but not limited to, the waters along the outer continental shelf edge in the Gulf of Alaska, Prince William Sound and the inside waters of Southeastern Alaska from approximately 54-63 N latitude and 133-160 W longitude.

Directed research would involve a combination of activities, as described in *General Activities*, including:

- Close vessel approach for behavioral observation and photo-identification.
- Underwater photography/videography.
- Passive acoustic recording.
- Suction cup tagging.
- Blubber attachment tagging.
- Biopsy sampling.
- Collection of sloughed skin and feces.
- Collection of prey parts.
- Export of parts.
- Acoustic playbacks, as detailed below.

Research activities would also include modifications to long-line fishing (sperm whale depredation studies) and collection of blow samples from humpback whales, as described below.

Specific details or variations from activities described in *General Activities* are described here.

Humpback, killer, and sperm whales would be targeted for Level B harassment activities, biopsy sample collection, attachment of suction cup or implant tags, and acoustic playbacks; minke *(Balaenoptera acutorostrata)*, gray, blue *(Balaenoptera musculus)*, North Pacific right *(Eubalaena japonica)*, sei *(Balaenoptera borealis)*, and fin *(Balaenoptera physalus)* whales would opportunistically be targeted for Level B harassment activities, biopsy sample collection, and attachment of suction cup or implant tags. Fishing modification activities would focus on sperm whales only. Species and take numbers are specified in Appendix H. All age and sex classes would be targeted in all aspects of this research, with the following exceptions: females and their calves less than approximately six months would not be suction cup or satellite tagged or subject to acoustic playbacks.

Cameras Attached to Longline Gear
Permit No. 14122 would include video cameras mounted on demersal longlines under normal fishing operations to identify and record sperm and killer whales at depth interacting with fishing gear.

Fishing Modifications
Activities would typically be conducted from 20-30 ft vessels equipped with 50-200hp outboard motors; vessels 14 to 80 feet long would also be used. Working with the Southeast Alaska Sperm Whale Avoidance Project (SEASWAP), the applicant expects to work with 20 longline deployments/hauls annually. SEASWAP is a group of fishermen, managers and scientists (including the applicant) investigating sperm whale depredation (i.e., removing fish from commercial fishing gear) on the sablefish longline fishery in Alaska. The study began in 2003 aiming to reduce sperm whale depredation and the resulting economic hardship it presents for fishermen, as well as to reduce the risk of entanglement to sperm whales. The applicant would continue this pioneering study to investigate what acoustical clues sperm whales are using as attractants to the fishing vessels and how they are actually feeding off the longlines. A goal of SEASWAP is to better understand sperm whale distribution and behavior in the Gulf of Alaska and make recommendations to fishermen on how they may modify their fishing practices to reduce depredation on their catch (i.e., increase catch rates).

Modifications to fishing behavior would be used to determine cues sperm whales use to locate vessels and how whales remove fish from longline fishing gear to reduce this behavior. Normal fishing operations would be directed to deliberately activate the hydraulic system, fisheries sonar, and engines during times when fishing gear is not being hauled from the water. The applicant would take advantage of fishing operations that would occur with or without Permit No. 14122 to study sperm whale behavioral responses to potential cues.

During normal fishing operations, a longliner would arrive in a deployment area and immediately begin deploying longline gear on the ocean floor. The vessels would then either depart the area or loiter in the vicinity in neutral gear. After 3-17 hours the vessel would then travel to one end of the longline, marked by a surface flag, turn on its hydraulic system, and begin hauling the line to the surface. Once hooks arrive on the surface, the fishing vessel would generally engage and disengage its engine in an attempt to adjust the angle at which the fishing line is emerging from the water, with a goal of keeping the line as vertical as possible. At the same time the vessel would be running its echosounder. Thus under normal operations up to four distinct acoustic signals would be generated simultaneously: hydraulic system, cavitation bubble clouds from engine cycling operations, engine sounds, and the echosounder.

The cavitation sounds from a fishing vessel range from 100 Hz to 4 kHz, with a sound exposure level rate of 110 dB re: 1 uPa^2 at a source depth of 2 m in water column, and a duty cycle of approximately 10% (Thode et. al. 2007). Previous work has documented from zero to ten sperm whales near the vessel during the haul, with fewer present at the set or soak. The length of a haul (retrieving caught fish) depends on the amount of gear in the water, but generally lasts from three to six hours.

The modifications to normal vessel operations that would occur under Permit No. 14122 are:

- Upon arrival, fishing vessels would deploy autonomous passive acoustic recording devices to monitor all subsequent acoustic activity in the area. Recording devices would be attached to the vertical anchor lines of the longline or on their own buoyed line. The deployment of this gear generally takes one to two hours. The recorders would remain in the water prior to and after all fishing activities have been completed.

- The vessel operator would be requested to activate various systems in sequential fashion before the haul, to isolate the effects of various cues on animals' acoustic behavior. These activities would take place over times varying from eight hours to 30 minutes before the start of a haul. Specifically, the vessel operator would be asked to suspend then activate the echosounder, then after two minutes activate the hydraulics, then two minutes after that cycle the engines in a manner that simulates an active haul. After three to ten such engine cyclings the deliberate manipulation of the engine controls would cease.

During the proposed activities, an observer would be present on the fishing vessel to monitor whale behavior before, during, and after fishing operation modifications and to photo-identify individuals. Individuals would not be approached more than three times per year.

Tagging Activities
For tag deployment, whales would be approached to 3 to 10m using small vessels, not from the longline vessel.

Bioacoustic and Crittercam tags would be attached via suction cup, and are expected to remain attached to whales for 2-18 hours. Individual whales would be suction cup tagged up to two times annually.

Tagged whales would be tracked to monitor post tagging effects and to obtain a trackline of movements for as long as whales and sea state permit. Monitoring would include photographing the attachment site to evaluate tag attachment to the body (skin condition) and tag movement and observing whale behavior. Approaches for photography and behavioral observation would be from a distance of 75 feet or more from the whale. Tracklines would be determined after the whale dives and the boat moves to the dive location to record position.

Satellite-linked transmitters would also be used in conjunction with the Service Argos satellite system to determine whale movements and behavior. “Barnacle/limpet tags” would be used on all species, as described in *General Activities*, and are expected to remain attached for 1-2 months. “Implant tags” would only be used on sperm and humpback whales, and only after an attempt to attach the barnacle/limpet tag has been made and has proven to be unsuccessful in achieving attachment durations in excess of 1 month. Individual whales would be satellite tagged up to two times annually.

Playback Activities
Various acoustic signals would be directed at sperm, killer, and humpback whales in order to determine whether particular classes of sounds evoke a mild alerting response. All playbacks would be deployed from an autonomous playback device with a self-contained power supply and electronics that permit it to be deployed without external connections to a power or signal source. Signals between 1 kHz-50 kHz would be played, with signal durations between 1-5 seconds. Playback operations would occur in two-hour bursts, during which playbacks would only be conducted 40% of time.

The playback device would be:

- Deployed during the day from the bow of a fishing vessel or skiff for real-time visual and/or acoustic monitoring during playback activities. Playbacks would be broadcast at

levels of up to 170 dB re 1uPa @ 1 m (rms pressure), and would only be broadcast when visual observers are available, or

- Attached to open-water buoys or fishing anchorlines, independent of any surface vessel, at depths of 20 meters or less. Playbacks would be broadcast at levels no greater than 160 dB re 1 uPa @ 1m (rms pressure) to ensure that target and non-target animals would not be exposed to received levels greater than 160 dB. Playbacks would be broadcast at any time of day and monitored by autonomous passive acoustic recorders, which would document the signals being broadcast and record the presence of acoustically active animals during playbacks. Fishing vessels with visual observers would be present (generally within 200 to 1,000 m) to observe behaviors.

Playback signals:
A review of previous literature on playback experiments and acoustic harassment device tests finds that most "alert" signals to date consist of narrowband pulses or FM sweeps. The signals selected for broadcast under Permit No. 14122 represent a blend of signals used in previous experiments to establish consistency between studies, as well as signals of interest to the current effort. Note that while some signals are described as "transient" or "tonals" in the table, all playback signals would be broadcast for only 1-5 seconds per signal, with 3 seconds of silence in between.

Table 5 lists signals proposed to be broadcast during playbacks, including frequency range, source level, signal duration, and a reference that describes previous use of the signal. Transient source levels are expressed in terms of both SPL and sound exposure level (SEL) (Madsen et al. 2006; Southall et al. 2007), while tonal sounds are expressed in terms of rms level only. Note that SEL levels are given only for a single "pulse" or "nonpulse"; cumulative SEL is not provided here. Signal parameters that will be randomized during the playback are designed by the symbol 'R' followed by the range of the parameter in brackets (e.g., R[2-4] sec interval). During playback these parameters would be selected from a uniform distribution.

Table 5. Signals proposed for broadcast under Permit No. 14122.

Signal characteristic	Frequency range (Hz)	Goal source level (GSL)	Duration/ Interval	Reference
Airgun, high-pass filtered above 2 kHz	2-25 kHz (approximate)	170 dB, if whale is ≥ 10m, 160 dB re 1uPa rms if ≤ 10m	2.5 msec and 400 msec/R [1-4] sec interval	JIP 3-D calibration, Tashmukhambetov et al. 2008
Tonal	2-50 kHz, 10 evenly spaced frequencies	170 dB, if whale is ≥ 10m, 160 dB re 1uPa rms if ≤ 10m	R[0.5-3] sec/R [5-20] sec	Kastelein et al. 2001, Kastelein et al. 2006a, 2006b
Logarithmic FM sweep	R[1-4.5] kHz start R[4.5-10] kHz end R[upsweep/ downsweep]	170 dB, if whale is ≥ 10m, 160 dB re 1uPa rms if ≤ 10m	[1-5] sec/ [3-5] sec	Nowacek et al. 2004
Sperm whale "slow click"	1-15 kHz	170 dB, if whale is ≥ 10m, 160 dB re 1uPa rms if ≤ 10m	20 msec/ r[0.1-1] sec	SEASWAP fieldwork, Mathias et al. 2009
White noise bursts	2-50 kHz broadband	170 dB, if whale is ≥ 10m, 160 dB re 1uPa rms if ≤ 10m	R[10-30 msec] /R[0.25-2] sec	SEASWAP fieldwork
"Silence"	0	0	0	
Transient killer whale whistles and pulsed calls from NE Pacific	1-20 kHz	170 dB, if whale is ≥ 10m, 160 dB re 1uPa rms if ≤ 10m	Varies/ 5 sec	Deecke et al. 2005
Humpback whale feeding call	Loud, relatively low-frequency, uniform pulses between 1 and 10 kHz	155 dB re 1up at 1m, and will not be broadcast to animals closer than 100m	Varies/ 30 sec interval	Baker 1985, Straley unpublished data

All playbacks would be monitored by an HTI 96 min hydrophone placed one meter from the playback device, and recorded on a separate autonomous recorder. The playback device would also internally log the time and playback level of each signal broadcast. After 5 minutes the device would automatically start the playback session. The total playback duration would be 48 minutes within a 12 hour period.

During playbacks conducted from the vessel:

1. The playback device would randomly select whether to broadcast "signal" or "silence", with a 10% chance of the latter. During a "silence" playback the device input file would consist of a set of binary zeros, but any incidental noises or pops made by the playback device would still be generated, although none are expected. If "signal" is selected, one of seven signals would be chosen with equal probability. Any random parameters needed to synthesize the signal would be selected from a uniform distribution.
2. The device would broadcast the playback sequence at 20 dB below goal source level (GSL) for 2 minutes.
3. A 60 second period of silence would follow the playback sequence, during which the device could be deactivated remotely.
4. The playback sequence would be repeated at a 10 dB greater source level, using the same values for the random parameters that were selected for the first 2 minute sequence.
5. The cycle would continue to repeat until the GSL is attained.
6. A 5 minute period of silence, during which the device can be shut down remotely,
7. The playback device would randomly select "signal" or "silence", and the process would begin again.

If any observer notes signs of major disturbance, e.g., breaching, tail slaps, or underwater bubble cloud releases, the "disable" signal would be sent to the acoustic playback device to halt the trial.

During playbacks conducted from buoys or fishing gear all playback signals and protocols described above would remain the same, except:

1. The device would be deployed to depths of 20 meters or less.
2. The playback device would be programmed to start the playback schedule at a future time (hours to days later).
3. Playback periods would be programmed to coincide with the expected presence of an observing vessel within 4 km of the playback device.

Individuals would be not be taken by playback more than two times each year. During a playback encounter an individual would not be approached for any other permitted activity.

Blow samples from humpback whales

Blow samples would be collected to study the microbial communities of the respiratory system of free-swimming whales and to provide DNA material for individual identity. Microbial communities may provide a proxy to follow population health as well as being a tool to look at social relationships between whales by examining the patterns of shared microbial communities between whales. Additionally, blow samples would be evaluated if sufficient DNA material is present for genetic analysis as this may provide a non-invasive alternative to biopsy sampling.

Blow samples, or exhaled breath condensate (EBC), would be collected with a frame composed of a 40cm x 35cm clear Perspex sheet (4 mm width) with smooth, rounded edges. Eight 6cm and eight 0.8cm circles would be cut from the sheet to reduce the weight, decrease resistance to the wind, increase maneuverability, and provide multiple attachment points for a variety of simultaneous collection media including: Petri dish, cotton gauze, nylon, microbial swabs, and agar plates, which are secured over the collection frame. In this manner, only one approach would be required to collect replicate samples from an individual and ensure statistical power.

Individual whales would be approached to within 10 m from behind and the boat maneuvered so the wind pushes the blow sample towards the sampling device. The collection device would be attached to a 6-10m aluminum pole which would be extended towards the exhaled blow of the whale.

Samples would be collected from individuals no more than once per year. This activity would be combined with tagging activities that also require close approach for attachment using a long pole.

Biopsy sampling
Individuals would be biopsy sampled up to four times annually except North Pacific right whales, which would only be sampled once annually. Multiple biopsies over time are necessary to assess diet for foraging studies across seasons and changes in prey and habitat over time.

Measures described by the applicant to minimize effects to animals include:

- Coordination with other researchers in Alaska to avoid harassing the same whales.
- If a whale approaches the vessel, the engine would be placed in neutral to let the whale pass. Changes in engine speed and gear changes would be minimized within a 1/4 mile of any whale in the vicinity of the vessel.
- If disturbance is evident (i.e., changes in behavior, stress vocalizations, abrupt shifts in direction of movement, apparent displacement) the approach would be terminated. If a serious adverse reaction occurs in direct connection with a proposed activity, the activity would cease.
- Researchers would not disturb feeding killer whales, but would search the area for remains of prey left after killer whales depart.
- The controlled experiment to direct fishing operations would occur once per deployment of fishing gear.
- If a whale becomes entangled during deployment of scientific instrumentation during directed fishing operation modifications, the line would be cut and all research activity stopped.
- An individual would be not be intentionally tagged more than twice per year.
- Portions of satellite tags that would be inserted into whales would be thoroughly disinfected before attachment. The parts of the tag that are implanted into the whale and are in contact with whale tissue would be constructed of medical grade stainless steel, titanium, or other material proven to be biocompatible.
- If inter-species interactions are observed, playbacks would cease to avoid incidental harassment to non-target animals.
- If signs of "major disturbance" (e.g., repeated breaching, tail slaps, and underwater bubble cloud releases) are observed, the playback device would be disabled remotely.

- Proposed research would not occur in Steller sea lion rookeries and haul-outs or right whale habitat. Non-target marine mammals would be avoided.
- No mothers and calves under six months would be subject to acoustic playback studies.

Witteveen (File No. 14296)
The proposed research would address predator-prey interactions and foraging overlap in the Gulf of Alaska's (GOA) near-coastal waters. Researchers would use a combination of techniques to concurrently assess prey availability and monitor the distribution and foraging behavior of resident and transitory cetaceans sharing common prey resources, and to explore the fine-scale responses of whales to point-source noise generated by acoustic deterrent devices.

Research activities would be conducted year-round during open water surveys; the majority of effort would occur from May to October. All surveys would be conducted from small- to medium-sized vessels less than 25m in length powered by either inboard diesel or outboard gas motors. Surveys are designed to find aggregations of whales and would not follow a set route.

Directed research would involve a combination of activities, as described in *General Activities*, including:
- Close vessel approach for photo-identification and behavioral observation.
- Collection of prey parts.
- Biopsy sampling.
- Suction-cup tagging.
- Acoustic playbacks, as described below.

Photo-identification and biopsy sampling would focus on humpback, fin, killer, and gray whales; other cetacean species would be targeted for research on an opportunistic basis. Only humpback and fin whales would be tagged. Species and take numbers for all activities are specified in Appendix I. Males and females of all ages and reproductive conditions would be targeted for close approach, photo-identification, and biopsy sampling; mothers and calves would not be tagged. Most calves encountered on the feeding grounds of Alaska are more than 6 months old (i.e., not newborns).

Parts of dead marine mammals would be collected following a killer whale predation event to identify the diet composition of transient killer whales in Alaska. Researchers would observe and acoustically record feeding killer whales from a distance. Prey remains would be collected after killer whales depart the area.

Photo-identification and biopsy sample collection would be conducted using the methods described in *General Activities*. Whales would not be biopsied more than once unless they cannot be identified in the field. All efforts would be made to minimize multiple biopsies of the same whale.

Fin and humpback whales would be approached and tagged with acoustic time depth tags (ATDT) attached by suction cup for foraging studies; humpback whales would also be tagged with archival (Acousonde) tags attached by suction cup for research on acoustic deterrents. The applicant has a past success rate of 25 to 35% (1 in 3 or 4 attempts) while tagging; the proposed number of takes

for tagging includes both successful and unsuccessful attempts. No animal would be knowingly approached for tagging attempts more than 4 times. The applicant would not intentionally tag the same animal more than once a year; multiple tag attachments are possible, though highly unlikely, over the life of the permit.

In foraging and acoustic deterrent studies, two vessels would be used for each tagging event.

Foraging studies: One vessel (~7-8m) would be used to photo-identify and observe target whales, perform focal follows and monitor tagged whales, and aid in tracking tagged whales through VHF signals should visual contact be lost. A smaller vessel (~3-5m) would be used to attach the tag. After successful tag attachment, a focal follow of the tagged whale would be initiated to observe surface behaviors and habitat use and to allow for successful tag recovery. Tags would be equipped with a radio transmitter (VHF); therefore focal follows would be conducted with telemetric assistance from a distance of 100-500 yards to minimize effects to behavior.

Acoustic deterrent studies: The observing and tagging vessel (~3-5m) would be used to photo-identify target animals and, once the tag is attached, would observe and monitor the tagged whale. A second vessel (~8-10m) would be used to activate a suite of acoustic deterrent devices, all of which are currently legally used by commercial fisherman to deter cetaceans from entanglement in fishing gear. Acousticians at Greenridge Sciences, Inc. would characterize the sounds generated by the devices. Prior to tagging whales the signal frequency, spectral characteristics, and attenuation rate of the deterrents would be quantified; the effectiveness of deterrents that generate sounds within the assumed hearing range of humpback whales (20 Hz to 24k Hz; Au *et al.* 2006) would then be tested. The acoustic deterrent devices to be tested include:

- Commercial pingers.
- Bottle rockets.
- Large chains banging on a metal skiff.
- Pulling seine nets taut.
- Changes in outboard motor RPMs.

Once a tag is successfully attached, tagged whales would be tracked and monitored for approximately 1 hour in order to establish dive patterns and behavior. While the whale tracking vessel continues to monitor behavior, the second vessel would activate acoustic deterrent devices for a period of five seconds at varying distances (approximately 500, 300, and 100 m) from the whales. Only one acoustic device would be tested at a time and testing would be initiated approximately 1 minute into a whale's dive. Each tagged whale would be exposed to a given deterrent device for a maximum total of 15 seconds (three exposures at five seconds each) during three surface intervals, or approximately 20-25 minutes. A minimum of three dive cycles would separate testing of different deterrents.

The Acousonde tag would record the sound of the acoustic deterrent device, as received at the whale, while simultaneously recording changes in the whales' swim direction, pitch, and speed. Abrupt changes in these parameters immediately after acoustic deterrent device deployment would signify a response to the sound. Researchers would continue to monitor the whale until "normal" pre-exposure behavior is observed, for a maximum of one hour post-exposure time.

Given the minimum pre-test, test, and post-test dive times, an individual whale would only be exposed to 15 seconds of sound generated by a single deterrent during a two hour period. A second deterrent would be tested in a similar manner if the tag remains attached following the post-test dive intervals and the whale has not shown negative effects to previous exposures.

Measures described by the applicant to minimize effects to animals include:

- Mother/calf pairs would be cautiously approached.
- Mother/calf pairs would not be approached when resting or suckling.
- Efforts would be made not to separate mother/calf pairs.
- If non-target species are observed, they would not be approached within 100 yards and research operations would be halted until non-target species have left the area.
- Equipment used in biopsy sampling and tagging would be cleaned and disinfected between uses.
- If disturbance is evident from a whale (e.g., changes in behavior, stress vocalizations, abrupt shifts in direction of movement) an approach episode would be terminated.
- Bottle rockets would never be aimed at whales, rather directly off the side of the vessel, and would never be fired when within one body length of any animal.
- The applicant would communicate extensively with other researchers to minimize duplication of efforts. The applicant is not aware of other researchers currently conducting research of this nature within the study area.

Zoidis (File No. 14353)

The proposed research would build on previous research conducted on humpback whales in Hawaiian waters by determining activity budgets/diel patterns and potential impacts of passing vessel traffic, investigating social sound production and responses between conspecifics. The research would have an emphasis on social sounds between mothers and calves. Using new, in-depth methods would lead to more comprehensive and focused findings (i.e. night-time data, mother/calf/escort data, etc.). Tagging mothers and calves, and escorts where possible, would add a new, previously uninvestigated perspective to the literature. Minke whales would be approached for photo-identification studies.

Research activities for humpback whales would be conducted for five field seasons during the months of January, February, and March in the four-island area off of Maui, Hawaii both within waters of the Hawaiian Island Humpback Whale National Marine Sanctuary (HIHWNMS) and in other adjacent waters. Minke whale photo-identification research would occur in February and March of each year off the islands of Hawaii, mainly off Kauai. All surveys would be conducted from small vessels less than 20m in length.

During vessel surveys, a combination of the following activities would occur:

- Close vessel approach for photo-identification and behavioral observation.
- Underwater photography/videography.
- Passive acoustic recording.
- Suction-cup tagging.

Humpback whales would be targeted for all activities. Minke whales would be targeted for photo-identification and behavioral observation only. Species and take numbers for all activities are

specified in Appendix J. Humpback whales of both sexes and all ages, except neonates and their mothers, would be targeted activities. Male and female minke whales of all ages would be approached for level B harassment.

Target animals would be approached and all activities would occur using the methods described in *General Activities*. Animals would be observed for a minimum of 15 minutes before other activities take place. All types of suction cup tags described in *General Activities* would be used but only one tag would be attached to a whale at a time.

Measures described by the applicant to minimize effects to animals include:

- Individual humpbacks would not be taken more than 3 times per day by close approach, and not more than once per day if harassment is apparent (e.g., change of behavior, obvious reactions, etc.).
- No animal would be taken more than three times per field season.
- Animals would be approached at a slow speed and obliquely (rather than direct movement towards them) to allow them to continue their activities, and to not overtake or disturb.
- Researchers would cease approach after suitable identification photographs have been obtained topside and after their 30 minute underwater video time allotment is complete or as soon as a tag has been deployed.
- Researchers would avoid multiple approaches of the same groups of whales on a given day.
- Researchers would not work any humpback whale mother/calf group that does not seem "at ease" with an approach or that does not remain in rest mode. The applicant has years of experience working these types of pods, and is well acquainted with the duration of the rest bouts and any concomitant signs of harassment.
- Activities would be suspended if researchers determine that activities result in any disruption of normal whale activities.
- Researchers would not travel in front of or too close to, or block any intended path for pairs or small groups of whales that are attempting to stay together.
- Researchers would be especially prudent and cautious when approaching any mother/calf pods, assess behavior prior to close approach, and have stationed experienced observers looking for any indication of take. They would avoid separating or coming between a mother/calf pair.
- An experienced collection team would conduct research.
- Researchers would coordinate activities with other researchers and avoid unnecessary duplication and harassing the same pods.
- Researchers would attempt to tag the calf first, then the mother if possible.
- Researchers would slowly and cautiously approach locations where females with calves are resting at depth and attempt to tag the calf when it surfaces to breathe.
- Researchers would abandon tagging efforts if resting behavior is disrupted for more than a few minutes, or if there is any risk to mother/calf nursing or bonding behaviors.
- Tagging efforts would not be conducted on the same animal more than once per month.
- Equipment that would be in contact with a whale would be sterilized.
- Tags would be designed with a tag-release mechanism to allow detachment of the tag body after tracking is terminated (also necessary for tag retrieval).

- Research and development into reducing the effects of the tag and attachment techniques would be ongoing throughout the research effort and would be based on feedback from the tagging and deployment results and from other researchers.

Permit Duration

For the proposed action, the permits would be valid for five years from the date of issuance, and would expire on the date specified in the permit; the amendment would be valid until the permit expires. NMFS would consider issuing a single one-year extension of each permit if the permit holder submits a request in writing before the expiration of the permit and in sufficient time for processing prior to expiration. The request to extend the permit would be considered a modification, pursuant to NMFS regulations at 50 CFR §222.306, and as such would have to be accompanied by full justification and supporting information, and formatted in accordance with NMFS permit application instructions. As with any modification to a permit, the extension of the permit duration would be subject to the same issuance criteria as the original application, including the requirements that the taking will not operate to the disadvantage of the species and will be consistent with the purposes and policies of the ESA.

If granted, a one-year extension of the permits would only allow "takes" of marine mammals that were not used in the last year of the permit; these remaining takes would be carried forward into a sixth permit year. The extension would not change any other terms or conditions of the permit. NMFS does not consider a one-year extension of this nature to represent a substantial change to the proposed action that involves changes in environmental impacts. As such, NMFS would not prepare a supplemental EA for the one-year extension unless there were significant new circumstances or information relating to environmental impacts (e.g., a change in the status of the target species, listing of new threatened or endangered species in the project area).

CHAPTER 3 AFFECTED ENVIRONMENT

This chapter presents baseline information necessary for consideration of the alternatives, and describes the resources that would be affected by the alternatives, as well as environmental components that would affect the alternatives if they were to be implemented. The effects of the alternatives on the environment are discussed in Chapter 4.

The proposed activities would occur in U.S. and international waters of the Pacific Ocean, primarily around Hawaii and in Southeast Alaska. Activities would also occur off the northwest coast of the U.S. One permit [Mobley, File No. 14451] would authorize activities in the Atlantic Ocean in all waters of the Gulf of Mexico and off the east coast of the U.S.

3.1 SOCIAL AND ECONOMIC ENVIRONMENT

Economic and social factors are listed in the definition of effects in the NEPA regulations. However, the definition of human environment states that "economic and social effects are not intended by themselves to require preparation of an EIS." An EA must include a discussion of a proposed action's economic and social effects when these effects are related to effects on the natural or physical environment. The social and economic effects of the Proposed Action mainly involve the effects on the people involved in the research, as well as any industries that support the research, such as charter vessels, and suppliers of equipment needed to accomplish the research. There are no significant social or economic impacts of the Proposed Action related to significant natural or physical environmental effects, so no further analyses were completed.

3.2 PHYSICAL ENVIRONMENT

3.2.1 National Marine Sanctuaries

All holders of NMFS's scientific research permits conducting work within a National Marine Sanctuary are required to obtain appropriate authorizations from and coordinate the timing and location of their research with NOAA's National Marine Sanctuaries Program (NMSP) to ensure that the research would not adversely impact marine mammals, birds or other animals within the sanctuaries. In addition, permit actions including those in the proposed action are sent to the NMSP for review if research is to occur in sanctuary waters.

Under the proposed action, vessel surveys and aerial surveys including both Level A and B harassment might occur in or above the following National Marine Sanctuaries during activities conducted under File Nos. 14682, 13846, 14451, 14585, and 14353:

- **Hawaiian Islands Humpback Whale National Marine Sanctuary**, designated on November 4, 1992, is actually a series of five marine protected areas distributed across the Main Hawaiian Islands. The total area of the sanctuary is approximately 1,400 square miles. Encompassing about half of the total sanctuary area, the largest contiguous portion of the sanctuary is delineated around Maui, Lana`i and Moloka`i. The four smaller portions are located off the north shore of Kaua`i, off Hawai`i's Kona coast, and off the

north and southeast coasts of O`ahu. These areas provide habitats for various species of marine life, including marine mammals, coral reefs and associated fauna, sharks, and invertebrates. Most notably, the Sanctuary is home to a population of humpback whales during the winter months each year. Approximately 2,000-5,000 humpback whales migrate from their Alaskan feeding grounds to the Hawaiian Islands to mate and give birth in its protected, warm waters. The Sanctuary also holds cultural significance to Native Islanders and is active in conducting many projects, such as restoration of the Native Hawaiian Fishpond, named Ko`ie`ie Loko I`a.

- **Papahānaumokuākea Marine National Monument** (formerly Northwestern Hawaiian Islands), established on June 15, 2006, is the largest marine protected area in the world. The Monument is made up of many small islands and atolls of the Hawaiian chain that are located northwest of the main Hawaiian Islands (*e.g.*, French Frigate Shoals, Midway, and Kure). The Monument covers 105,564 square nautical miles of both marine and terrestrial habitat (with approximately 3,910 square nautical miles being coral reef habitat). The Monument is home to over 7,000 marine species, including the threatened green sea turtle *(Chelonia mydas)* and endangered Hawaiian monk seal. There are also 1,700 endemic species found within the Monument that cannot be found anywhere else in the world (*e.g.*, Nihoa, Laysan Finch).

Vessel surveys and aerial surveys limited to only Level B harassment might occur in or above the following National Marine Sanctuaries for File Nos. 13846 and 14451:

- **Olympic Coast National Marine Sanctuary** was designated in 1994 and covers over 3300 square miles (2500 nm^2) of ocean waters off Washington State's peninsula coastline. More species of whales, dolphins, and porpoises spend time in these waters and more varieties of kelp are found here than anywhere else in the world. Twenty-nine species of marine mammals inhabit these sanctuary waters.

Vessel surveys and aerial surveys limited to only Level B harassment might occur in or above the following National Marine Sanctuaries for File No. 14451 only:

- **Channel Islands National Marine Sanctuary** (1,658 square miles (1,253 nm^2)) was designated in September 1980 and is located 25 miles (22 nm) off the coast of Santa Barbara, California. The sanctuary encompasses the waters surrounding Anacapa, Santa Cruz, Santa Rosa, San Miguel and Santa Barbara Islands, extending from mean high tide to 7 miles (6 nm^2) offshore. Thirty four species of marine mammals including whales, dolphins, seals, sea lions and southern sea otters (*Enhydra lutris)* and 60 species of marine birds have been sighted sighted in the sanctuary.

- **Cordell Bank National Marine Sanctuary** (526 square miles (397 nm^2), of[f] the northern California coast, was designated in 1989. The Cordell Bank is the dominant feature of the sanctuary and is approximately 9 miles long and 5 miles wide. Deep light penetration combined with upwelling nutrients leads to high productivity and abundant forage species such as krill. With this huge amount of krill this area is an important summer feeding ground for humpback whales, blue whales, pacific salmon and bottom fishes. There are 25 species of marine mammals and more than 47 species of seabirds found in this sanctuary.

- **Florida Key's National Marine Sanctuary** is known worldwide for its extensive offshore coral reefs and is the United States' only living barrier coral reef. This sub-tropical region also sustains many other interdependent habitats including mangrove islands, seagrass meadows, hard-bottom regions, patch reefs, and bank reefs. These habitats act as nurseries and feeding grounds for a variety of marine life as well as rookeries for sea birds. This complex marine ecosystem is also the foundation for commercial and recreational industries that are vital to south Florida's economy, and includes 400 underwater historical sites. The waters immediately surrounding most of the 1,700 islands that make up the Florida Keys have been designated as a national marine sanctuary since 1990. The sanctuary extends 220 miles in a northeast to southwest arc between the southern tip of Key Biscayne, south of Miami, to beyond, but not including, the Dry Tortugas Islands.

- **Flower Garden Banks National Marine Sanctuary** is located over 100 miles off the coasts of Texas and Louisiana and harbors the northernmost coral reefs in the United States. The Sanctuary, covering 42 square nautical miles, is comprised of three banks: East Flower Garden, West Flower Garden and Stetson and serves as a regional reservoir of shallow water Caribbean reef fishes and invertebrates. The coral reefs rise to within 66 ft of the water surface. This unique coral reef community has been developing for the last 10,000 to 15,000 years on top of salt domes that originated from layers of salt deposits in a once shallow sea 160 to 170 million years ago. The Banks harbor 21 species of coral, over 80 algal species, 250 macroinvertebrates, and 200 fish as well as three species of sea turtles, though the loggerhead *(Caretta caretta)* is the only resident sea turtle.

- **Gerry E. Studds Stellwagen Bank National Marine Sanctuary**, at the mouth of Massachusetts Bay between Cape Cod and Cape Ann, covers 842 square miles and extends to 80 m deep. It is of special importance because of its historical, economical, biological, and ecological significance. This sanctuary is also important to the local economy, particularly regarding its use by the shipping, fishing, and wildlife watching industries. The area serves as a refuge, feeding ground, and migratory path along the eastern coast of North America for endangered North Atlantic right whales. In addition, Stellwagen Bank is important habitat for a variety of marine species including endangered leatherback *(Dermochelys coriacea)*, Kemp's ridley *(Lepidochelys kempii)*, and loggerhead sea turtles, endangered humpback whales and finback whales, as well as harbor porpoises, Atlantic white-sided dolphins *(Lagenorhynchus acutus)*, harbor seals, and gray seals *(Halichoerus grypus)*, numerous fish species, forty species of sea birds, and a variety of invertebrates.

- **Gray's Reef National Marine Sanctuary**, located 17.5 nm (32 km) off the coast of Georgia, protects 17 square miles of open ocean that is home to a wide variety of marine life, as well as the "Bone yard," which has provided scientists with relics and fossils possibly dating back 20,000 years. Its sea floor is considered a "live bottom," where rocky ledges and limestone outcroppings are densely covered by sessile marine invertebrates, interspersed with sandy areas. In addition to being a known foraging and resting ground of loggerhead sea turtles and a right whale calving ground, Gray's Reef is important habitat for over 150 species of fish. Gray's Reef is a common recreational resource for fishing, boating, and diving; however, commercial industries are prohibited.

- **Gulf of the Farallones National Marine Sanctuary** was designated in 1981 and encompasses 1,255 square miles (948 nm^2) off the northern and central California coast. Spring and early summer upwellings of cold, nutrient-rich waters create a highly productive ocean environment rich in plankton and other forage species. The Sanctuary supports an abundance of species (e.g., 33 species of marine mammals and 15 species of breeding seabirds). One fifth of California's harbor seals also breed within the sanctuary.

- **Monitor National Marine Sanctuary** protects the wreck of the famed Civil War ironclad *USS Monitor*. In 1974 the wreck was listed on the National Register of Historic Places. Since its designation as our nation's first marine sanctuary in 1975, the *Monitor* has been the subject of intense investigation. Located 16 miles off the North Carolina coast in 73 m of water, biologists are studying how the *Monitor* acts as a living artificial reef for marine life.

- **Monterey Bay National Marine Sanctuary** was designated in 1992 and is the largest marine sanctuary in the National Marine Sanctuary Program. This sanctuary encompasses the waters of Monterey Bay and the adjacent Pacific Ocean off the central California coast covers over 5,300 square miles (4,024 nm^2) and is inhabited by 26 species of marine mammals, 94 species of seabirds, and 4 species of sea turtles.

3.2.2 Other Marine Protected Areas

There are also other marine conservation areas that occur within the proposed action area. As the proposed action does not take place on shore or in estuarine habitats, this EA only considers those marine conservation areas that fall within the scope of the proposed action. Additionally, all holders of NMFS' scientific research permits conducting work within these designated areas are required to contact the respective agency to obtain any additional authorizations required by that agency. The following outlines the main conservation areas where proposed activities may occur.

Under the proposed action, vessel surveys and aerial surveys including both Level A and B harassment conducted under File Nos. 10018-01, 13846, 14451, 14585, 14599, 14122, and 14296 have the potential to occur in or above:

<u>Glacier Bay National Park and Preserve</u>
Glacier Bay National Park and Preserve commands a glacier-crowned, maritime wilderness that stretches northward from Alaska's inside passage to the Alsek River, encircling a magnificent saltwater bay. The 3.3 million acre park derives its name and much of its biological and cultural significance from this great bay, which harbors spectacular tidewater glaciers and a unique assemblage of marine and terrestrial life. To the south and east, the landscape fragments into the timbered islands and winding fjords of the Alexander Archipelago and the Tongass National Forest. To the west, the Park's pristine outer coast opens to the Gulf of Alaska. Marine waters make up nearly one fifth of the park. Humpback whales are the subject of intensive, ongoing research in the park and surrounding waters of Icy Straits. Each summer 15-20 humpback whales regularly feed in park waters, concentrating in the lower part of the bay. Special regulations

affecting vessel speed limits and travel routes in certain areas go into effect when large concentrations of whales are in the park.

3.2.3 Essential Fish Habitat

EFH has been designated for many of the fish species within the action area. Details of the designations and descriptions of the habitats are available in the Pacific Fishery Management Plans. Activities that have been shown to affect EFH include disturbance or destruction of habitat from stationary fishing gear, dredging and filling, agricultural and urban runoff, direct discharge, and the introduction of exotic species.

3.2.4 Designated Critical Habitat

The ESA provides for designation of "critical habitat" for listed species and includes physical or biological features essential to the conservation of the species. Critical habitats may require special management considerations or protection. Critical habitat designations affect only federal agency actions or federally funded or permitted activities.

<u>Hawaiian Monk Seal Critical Habitat</u>
Critical habitat for Hawaiian monk seals was designated on May 26, 1988 (53 FR 18990). This designated area consists of all beach areas, sand spits, and islets, including all beach crest vegetation to its deepest extent inland, lagoon waters, inner reef waters, and ocean waters out to a depth of 20 fathoms around the following: Kure Atoll, Midway Islands (except Sand Island and its harbor), Pearl and Hermes Reef, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island.

<u>Steller Sea Lion Critical Habitat</u>
Steller sea lion critical habitat includes a 20 nautical mile buffer around all major haulouts and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas. The majority of Steller sea lion critical habitat is in Alaska, but there are also two rookeries in Oregon and three in California. NMFS has implemented a complex suite of fishery management measures designed to minimize competition between fishing and the endangered population of Steller sea lions in critical habitat areas. Those management measures are the Steller sea lion protection measures.

<u>Southern Resident Killer Whale Critical Habitat</u>
Critical habitat for Southern Resident killer whales was designated on November 29, 2006 (71 FR 69054). Critical habitat includes three specific marine areas of Puget Sound, Washington, and includes all waters relative to a contiguous shoreline delimited by the line at a depth of 20 feet (6.1 m) relative to extreme high water in each of the following areas: (1) *Summer Core Area:* All U.S. marine waters in Whatcom and San Juan counties; and all marine waters in Skagit County west and north of the Deception Pass Bridge (Highway 20). (2) *Puget Sound Area:* All marine waters in Island County east and south of the Deception Pass Bridge (Highway 20), and east of a line connecting the Point Wilson Lighthouse and a point on Whidbey Island; all marine waters in Skagit County east of the Deception Pass Bridge (Highway 20); all marine waters of Jefferson County east of a line connecting the Point Wilson Lighthouse and a point on Whidbey Island, and north of the Hood Canal Bridge (Highway 104); all marine waters in eastern Kitsap County east of the Hood Canal Bridge (Highway 104); all marine waters (excluding Hood Canal) in Mason

County; and all marine waters in King, Pierce, Snohomish, and Thurston counties. (3) *Strait of Juan de Fuca Area:* All U.S. marine waters in Clallam County east of a line connecting Cape Flattery, Washington, Tatoosh Island, Washington, and Bonilla Point, British Columbia; all marine waters in Jefferson and Island counties west of the Deception Pass Bridge (Highway 20), and west of a line connecting the Point Wilson Lighthouse and a point on Whidbey Island.

North Pacific Right Whale Critical Habitat

In April 2008, the North Pacific right whale was listed as a separate, endangered species and NMFS designated critical habitat for this species. The same two areas designated as critical habitat for the northern right whale in 2006 (71 FR 38277) - within the Gulf of Alaska and within the Bering Sea - were designated as critical habitat for the North Pacific right whale (73 FR 19000).

Steller's Eider and Spectacled Eider Critical Habitat

Critical habitat for the Alaska breeding population of Steller eider (*Polysticta stelleri*) includes breeding habitat on the Yukon-Kuskokwin Delta and four units in the marine waters of southwest Alaska, including the Kuskokwim Shoals in northern Kuskokwim Bay, and Seal Islands, Nelson Lagoon, and Izembek Lagoon on the north side of the Alaska Peninsula. Critical habitat for the Spectacled eider (*Somateria fischeri*) includes areas on the Yukon-Kuskokwim Delta, in Norton Sound, Ledyard Bay, and the Bering Sea between St. Lawrence and St. Matthew Islands.

3.2.5 Areas of Biological or Ecological Importance to North Atlantic Right Whales

Under Permit No. 14451 research would occur in the following areas along the U.S. East Coast considered to be of biological or ecological importance to the North Atlantic right whale.

Great South Channel (GSC)

The GSC is a large funnel-shaped bathymetric feature at the southern extreme of the Gulf of Maine between Georges Bank and Cape Cod, Massachusetts. The channel is bordered on the west by Cape Cod and Nantucket Shoals, and on the east by Georges Bank. The average depth is 175m with a maximum depth to about 200m to the north. The V-shaped 100-m isobath effectively delineates the steep drop-off from Nantucket Shoals and Georges back to the deeper basins. On the southwestern fringe of the GSC lies the GSC Sliver Restricted Area, a region established as a Marine Managed Area in 1977. Both the GSC and the Sliver Region are subjected to fisheries management and lie within the Mandatory Ship Reporting System boundaries.

The GSC is one of the most used cetacean habitats off the northeastern United States (Kenney & Winn 1986). The late winter/early spring mixing of warmer shelf waters with the cold Gulf of Maine water funneled through the channel causes a dramatic increase in faunal productivity in the area (Sherman et al. 1987). This increase in zooplankton fauna, the main food source for baleen whales, attracts an abundance of mysticetes to the GSC region. Three "high-use" shipping corridors and numerous fisheries operate within the GSC, making ship-strikes and fishing gear entanglements major threats to baleen whale survival in this region.

Cape Cod Bay

CCB is a large embayment on the U.S. Atlantic Ocean off the state of Massachusetts that is bounded on three sides by Cape Cod and the Massachusetts coastline from Plymouth, MA, south.

To the north, CCB opens to Massachusetts Bay and the Gulf of Maine. CCB has an average depth of about 25 m (82 ft) and a maximum depth of about 65 m (213 ft). The deepest area of CCB is in the northern section, bordering Massachusetts Bay.

The general water flow is counter-clockwise, running from the Gulf of Maine south into the western half of CCB, over to eastern CCB, and back into the Gulf of Maine through the channel between the north end of Cape Cod (Race Point) and the southeast end of Stellwagen Bank, a submarine bank that lies just north of Cape Cod. Flow within the bay is driven by density gradients caused by freshwater river run-off from the Gulf of Maine (Franks and Anderson 1992; Geyer et al. 1992) and by a predominantly westerly wind.

Thermal stratification occurs in the bay during the summer months. Surface water temperatures typically range from 0 to 19°C throughout the year. Salinity is fairly stable at around 31-32 ppt. Much of the bottom is comprised of unconsolidated sediments, with finer sediments occurring in the deeper waters (Davis 1984). In shallow areas, or where there is sufficient current, sediments tend to be coarser.

The late winter/early spring zooplankton fauna of CCB consists primarily of copepods, represented predominantly by two species, *Arcartia clausi* and *A. tonsa*. Samples taken in the daytime indicated greater densities of copepods at greater depths. The copepod *C. finmarchicus* is found throughout inshore CCB waters at densities of 100 individuals per cubic meter from April through June (Mayo and Marx 1990). Mayo and Marx (1990) found that the density of surface zooplankton samples collected in the path of feeding right whales during mid-winter was significantly higher than for the samples taken where whales were absent (median = 3,904 organisms/m^3). The threshold value below which feeding by northern right whales is not likely to occur in CCB is approximately 1,000 organisms/m^3 (Mayo and Marx 1990). CCB, like the GSC, is a primary feeding ground for the right whales, most likely because of the high densities of zooplankton species found there.

Southeastern United States (SEUS)

The South Atlantic Bight (also referred to as the SEUS) extends roughly from Cape Hatteras, North Carolina, to West Palm Beach, Florida. These waters average about 30 m in depth with a maximum depth of about 60 m. The deepest waters occur along the coast of Florida, just south of Cape Canaveral. Right whales migrate through the northern portion of the South Atlantic Bight on their way to and from the calving grounds off the Georgia and northern Florida coast.

The South Atlantic Bight contains three large cape areas: Raleigh Bay, Onslow Bay, and Long Bay (Milliman and Imamura 1992). The dominant bathymetric features are the continental shelf, the continental slope, and the Blake Plateau. The continental shelf slopes gently from the coast to approximately the 50 m (164 ft) isobath; where it drops off to the 200 m (656 ft) isobath. The continental slope is steeply angled and extends approximately from the 200 m (656 ft) to the 700 m (2,297 ft) isobath. The slope is widest off Jacksonville, FL (30°N). The Gulf Stream flows along the Florida-Hatteras Slope over the Blake Plateau's western flank (DoN August 2002).

The substrate composition of the SEUS ranges from mixed fine sand and gravel near the coast to an increasingly higher percentage of calcium carbonate material at greater depths. There are also

traces of gravelly sand, sand and clay, and fine-grained sand and silt found in deeper waters. Continental slope sediments in the SEUS area are primarily composed of silt and clay. The inner part of the Blake Plateau contains a minimal amount of sediments due to the sweeping action of the Gulf Stream. The Plateau is also covered by a thick layer of phosphoritic sediments and a thin layer of carbonate sands (DoN August 2002).

Seasonal water temperatures and salinity for this area are higher than in northern waters. The SEUS is considered a transition zone, where waters change from hosting subtropical marine communities to temperate marine communities. Large, cyclic changes in abundance and dominance of plankton species occur seasonally and annually. Annual variation may be so great that short-term monitoring studies may not be sensitive enough to assess the temporal variability of the plankton community. The recorded preferred food of the northern right whale, *C. finmarchicus*, does not occur in these waters, and the area is not considered a foraging area for northern right whales. The SEUS is believed to be the primary calving and nursery ground for the species.

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 Targeted Species

Many cetacean species would be targeted for study in the proposed action, including some ESA-listed or MMPA-depleted species, and these species are considered part of the affected biological environment. Specific species that would be taken during the proposed action and types of takes requested for each permit are listed in Appendices B-J. A brief description of the species targeted for research under the proposed action is below, summarized from NMFS Stock Assessment Reports; additional information on the status of these species can be found in the Stock Assessment Reports and in the NMFS Recovery Plans for these species. All marine mammal stocks/species listed under the ESA are also considered depleted under the MMPA.

Research activities in the proposed action for these species would range from photo-identification and behavioral observation to biopsy sampling and tagging. (See Appendices B-J for information on specific takes requested by permit.)

3.3.1.1 ESA Listed Species Directly Targeted for Research

ESA-listed species directly targeted for research in each permit are summarized in Table 6 and described below.

Table 6. ESA-listed species targeted for study in the proposed action, by permit, location, and level of harassment.

Species	Permit No.	Hawaii	Alaska	Other Pacific	Atlantic	Level B harassment	Level A harassment
Humpback whale	Au No. 14682	X				X	X
	Cartwright No. 10018-01	*	X			X	
	Darling No. 13846	X	X			X	X
	Mobley No. 14451	X	X	X	X	X	
	Pack No. 14585	X	X	X		X	X
	Sharpe No. 14599		X			X	X
	Straley No. 14122		X			X	X
	Witteveen No. 14296		X			X	X
	Zoidis No. 14353	X				X	X
Blue whale	Mobley No. 14451	X	X	X	X	X	
	Pack No. 14585	X				X	
	Straley No. 14122		X			X	X
	Witteveen No. 14296		X			X	X
Fin whale	Mobley No. 14451	X	X	X	X	X	
	Pack No. 14585	X				X	
	Straley No. 14122		X			X	X
	Witteveen No. 14296		X			X	X
Sei whale	Mobley No. 14451	X	X	X	X	X	
	Pack No. 14585	X				X	
	Straley No. 14122		X			X	X
	Witteveen No. 14296		X			X	X
Sperm whale	Mobley No. 14451	X	X	X	X	X	
	Pack No. 14585	X	X	X		X	
	Straley No. 14122		X			X	X
	Witteveen No. 14296		X			X	X
North Pacific right whale	Pack No. 14585	X	X	X		X	
	Straley No. 14122		X			X	X
	Witteveen No. 14296		X			X	X
Gray whale (Western North Pacific stock)	Mobley No. 14451			X		X	

* Takes are currently authorized in Permit No. 10018.

All permits would target the following endangered species for research:

<u>Humpback whale</u> *(Megaptera novaeangliae):* The humpback whale is a mid-sized baleen whale that occurs throughout the world's oceans, generally over continental shelves, shelf breaks, and around some oceanic islands (Balcomb and Nichols 1978; Whitehead 1987). Humpback whales exhibit seasonal migrations between warmer temperate and tropical waters in winter and cooler

waters of high prey productivity in summer. Humpback whales exhibit a wide range of foraging behaviors, and feed on many prey types including small schooling fishes, krill, and other large zooplankton.

Humpback whale reproductive activities occur primarily in winter. They become sexually mature at age four to six. Female humpback whales are believed to become pregnant every two to three years. Cows nurse their calves for up to 12 months. The age distribution of the humpback whale population is unknown, but the portion of calves in various populations has been estimated at about 4 to 12 percent (Chittleborough 1965; Herman et al. 1980; Whitehead 1982; Bauer 1986; Clapham and Mayo 1987). Sources and rates of natural mortality are generally unstudied, but potential sources of mortality include parasites, disease, predation (killer whales, false killer whales, and sharks), biotoxins, and ice entrapment.

NMFS is conducting a status review of humpback whales under the ESA to ensure that the listing classification of the species is accurate. The status review will be based on the best available scientific and commercial data.

The four recognized stocks (based on geographically distinct winter ranges) of humpback whales in the United States are: the Gulf of Maine stock, the eastern North Pacific stock, the central North Pacific stock, and the western North Pacific stock.

Gulf of Maine stock: The Western North Atlantic population of humpback whales includes relatively discrete sub-populations which feed during summer in the waters of the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Katona and Beard 1990). Other North Atlantic feeding grounds occur off Iceland and northern Norway (Christensen et al. 1992). In the winter, whales from all six feeding areas (including the Gulf of Maine) mate and calve primarily in the West Indies, where spatial and genetic mixing among sub-populations occurs (Clapham et al. 1993; Katona and Beard 1990; Stevick et al. 1998). Humpback whales also use the Mid-Atlantic as a migratory pathway and apparently as a feeding area, at least for juveniles. Since 1989, observations of juvenile humpbacks in that area have been increasing during the winter months, peaking January through March, particularly in the vicinity of the Chesapeake and Delaware Bays (Swingle et al. 1993). Biologists theorize that non-reproductive animals may be establishing a winter feeding range in the Mid-Atlantic because they are not participating in reproductive behavior in the Caribbean.

Data suggests that up to 11,570 whales may reside within the entire North Atlantic (Palsbøll et al. 1997). In the Gulf of Maine, the best population estimate is 847 whales with a PBR of 1.1 whales annually (Waring et al. 2009). Barlow and Clapham (1997) estimated a rate of population increase of at 6.5 percent for this stock. Although the most recent abundance estimates indicate continued population growth, the size of the Gulf of Maine humpback whale stock may be below the optimum sustainable population in the U.S. Atlantic EEZ.

The total level of human-caused mortality and serious injury is unknown, but may be slowing recovery of the population. The main sources of human-caused serious injury and mortality are entanglement in fishing gear and vessel collisions. On average three animals are seriously injured or killed as a result of fishery interactions and another 1.4 whales due to vessel collisions annually.

The total level of U.S. fishery-caused mortality and serious injury is unknown, but reported levels are more than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant or approaching zero mortality and serious injury rate.

North Pacific stocks: Their summer range includes coastal and inland waters from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Tomlin 1967; Johnson and Wolman 1984). Humpback whales also summer throughout the central and western portions of the Gulf of Alaska, including Prince William Sound, around Kodiak Island, and along the southern coastline of the Alaska Peninsula. Japanese scouting vessels continued to observe high densities of humpback whales near Kodiak Island during 1965–1974 (Wada 1980). In Prince William Sound, humpback whales have congregated near Naked Islands, in Perry Passage, near Cheega Island, in Jackpot, Icy and Whale Bays, in Port Bainbridge and north of Montague Islands between Green Island and the Needle (Hall 1979, 1982; von Ziegesar 1984; von Ziegesar and Matkin 1986). The few sightings of humpback whales in offshore waters of the central Gulf of Alaska are usually attributed to animals migrating into coastal waters (Morris et al. 1983), although use of offshore banks for feeding is also suggested (Brueggeman et al. 1987).

Winter breeding areas are known to occur in Hawaii, Mexico, and south of Japan. Around the Hawaiian Islands, humpback whales are most concentrated around the larger islands of Maui, Molokai, Lanai, and Kahoolawe. Newborn and nursing calves with cows are seen throughout the winter and comprise 6 to 11 percent of all humpbacks sighted during aerial surveys. Humpbacks from the Mexican wintering grounds are found with greatest frequency on the central California summering ground (NMFS 1991). In the western Pacific, humpbacks have been observed in the vicinity of Taiwan, Ogasawara Islands, and Northern Mariana Islands (NMFS 1991).

Population estimates for the entire North Pacific increased from 1,200 in 1966 to 6,000-8,000 in 1992. More recently, photo-identification results from SPLASH, an international collaborative research program on the abundances, population structure, and potential human impacts on humpback whales in the North Pacific involving more than 50 research groups and 300 researchers, estimated the abundance of humpback whales in the North Pacific to be just under 20,000 animals (Calambokidis et al. 2008). The population is estimated to be growing six to seven percent annually (Carretta et al. 2008). The SPLASH study collected data from all known wintering and feeding areas for humpback whales in the North Pacific, and the data suggest the likely existence of missing wintering areas that have not been previously described. Humpback whales that feed off the Aleutians and in the Bering Sea were not well represented on any of the sampled wintering areas and must be going to one or more unsampled winter locations (Calambokidis et al. 2008).

Three management units of humpback whales are recognized within the North Pacific: the eastern North Pacific, the central North Pacific stock, and the western North Pacific stock.

Eastern North Pacific stock: The eastern North Pacific stock is referred to as the winter/spring population in coastal Central America and Mexico which migrates to the coast of California to southern British Columbia in summer/fall (Steiger et al. 1991; Calambokidis et al. 1993). The best available abundance estimate for this stock is 1,391 whales and appears to be increasing in

abundance (Carretta et al. 2008). The estimated annual mortality and injury due to entanglement (2.6 whales/yr), other anthropogenic sources (zero), plus ship strikes (zero) in California exceeds the PBR allocation of 2.5 whales annually for U.S. waters.

Central North Pacific stock: The central North Pacific humpback whale stock is referred to as the winter/spring population of the Hawaiian Islands which migrates to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodiak (Baker et al. 1990; Perry et al. 1990; Calambokidis et al. 1997). Population estimates vary for this stock, but likely contains approximately 4,000 whales (Calambokidis et al. 1997). The stock appears to be increasing, but it is not possible to assess the rate of increase or set a PBR level for this stock. It is impacted by fishery interactions (3.2 whales seriously injured or killed annually) and ship strikes (1.8 animals/year).

Western North Pacific stock: The western North Pacific Stock is referred to as the winter/spring population of Japan and probably migrates to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966; Nishiwaki 1966; Darling 1991). This population is estimated to include 394 individuals and the PBR is undetermined. No population trend is available for this stock. Fisheries interactions result in an annual mortality rate of 0.2 whales.

Permit Nos. 14451, 14585, 14122, and 14296 would target the following endangered species for research:

Blue whale *(Balaenoptera musculus):* The blue whale is a cosmopolitan species of baleen whale. Maximum reported body length is about 27 m. As is true of other baleen whale species, female blue whales are somewhat larger than males. Blue whales have a long body and comparatively slender shape; a broad, flat rostrum; a proportionately smaller dorsal fin than other baleen whales; and a mottled gray color pattern that appears light blue when seen through the water.

The primary and preferred diet of blue whales is krill. Although other prey species, including fish and copepods, have been mentioned in the scientific literature, they likely do not contribute significantly to the diet of blue whales.

Scientists have yet to discern many details regarding the life history of the blue whale. The best available science suggests that the gestation period is approximately 10 to 12 months and that blue whale calves are nursed for about 6 to 7 months (NMFS 1998). Most reproductive activity, including mating and birthing, takes place during the winter. Weaning probably occurs on, or en route to, summer feeding areas. The average calving interval is probably 2 to 3 years. The age at sexual maturity is thought to be 5 to 15 years (Mizroch et al. 1984; Yochem and Leatherwood 1985).

Blue whales inhabit sub-polar to sub-tropical latitudes. Poleward movements in spring allow the whales to take advantage of high zooplankton production in summer. Movement toward the subtropics in the fall allows blue whales to use less energy while fasting, avoid ice entrapment in some areas, and engage in reproductive activities in warmer waters of lower latitudes. Although

the species is often found in coastal waters, generally blue whales are thought to occur more offshore than humpback whales, for example.

Blue whales are found in oceans worldwide and are separated into populations by ocean basin in the North Atlantic, North Pacific, and Southern Hemisphere. They follow a seasonal migration pattern between summering and wintering areas, but some evidence suggests that individuals remain in certain areas year-round. Although the extent of knowledge concerning distribution and movement varies by area, and migratory routes are not well known, in general, distribution is driven largely by food requirements.

Western North Atlantic stock: Blue whales in the North Atlantic are found from the subtropics to Baffin Bay and the Greenland Sea. Blue whales are most frequently sighted in the waters off eastern Canada, with the majority of recent records from the Gulf of St. Lawrence, where they are present throughout most of the year. They are most common during the summer and fall feeding seasons and typically leave by early winter to avoid ice entrapment. Although they are rare in the shelf waters of the eastern United States, blue whales occasionally have been sighted off Cape Cod, Massachusetts. This region may represent the current southern limit of the blue whales' feeding range. In addition, some evidence suggests that blue whales occasionally stray into the Gulf of Mexico and the Caribbean, but they are less common in these waters. Some scientists believe blue whales in the North Atlantic occur in relatively discrete feeding populations (Sigurjónsson and Gunnlaugsson 1990), whereas other evidence suggests blue whales may comprise one panmictic population (Clark 1994).

Based on data regarding individuals found only in the Gulf of St. Lawrence, the current minimum population estimate for the western North Atlantic stock is 308 whales. Insufficient data are available to determine population trends and no PBR level is available for this stock. A 1998 reported mortality of a blue whale may be due to ship strike however, the cause of death was not conclusive. No other serious injuries or mortalities have been reported.

Eastern North Atlantic stock: No current estimate is available for the number of blue whales in eastern North Atlantic waters. However, some data have been collected for blue whales in Icelandic waters. As of autumn 1997, 32 individuals had been photo-identified in Icelandic waters. Additional studies have suggested that the population in Icelandic and neighboring waters may be in the high hundreds (Gunnlaugsson and Sigurjónsson 1990; Sigurjónsson and Gunnlaugsson 1990) or greater than 1,000 (Christensen et al. 1992).

Sightings data off the west and southwest coasts of Iceland suggest the population has been increasing at about five percent per year since the late 1960s (Sigurjónsson and Gunnlaugsson 1990).

Despite differences in pre-exploitation estimates and the lack of estimates for current population abundance, it is clear that blue whale stocks in the western, eastern, and central North Atlantic were severely depleted by the time that legal protection was introduced in 1955.

North Pacific stocks: The blue whale's range encompasses much of the North Pacific Ocean, from Kamchatka to southern Japan in the west, and from the Gulf of Alaska and California south, to at

least Costa Rica in the east. The species is found primarily south of the Aleutian Islands and the Bering Sea. Whaling and sighting data suggest the existence of at least five subpopulations of blue whales, with an unknown degree of mixing among them.

For management purposes under the MMPA, blue whales inhabiting U.S. waters in the North Pacific are divided into two stocks: Western and Eastern. Based on acoustic and whaling data, it is believed that the Eastern stock winters in waters off Mexico to Costa Rica, and feeds during summer off the U. S. West Coast and to a lesser extent in the Gulf of Alaska and in central North Pacific waters. The Western stock appears to feed in summer southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska (Watkins et al. 2000; Stafford 2003); in winter they migrate to lower latitudes in the western Pacific and less frequently in the central Pacific, including Hawaii (Stafford et al. 2001). Insufficient data is available to evaluate the current abundance or population trends of blue whale stocks in the western North Pacific.

Blue whales accompanied by young calves have been observed often in the Gulf of California from December through March, indicating that at least some calves may be born in or near the Gulf (Sears 1990). Therefore, this area is probably an important calving and nursing area for the species.

The best estimate of blue whale abundance in the eastern North Pacific is 1,368 animals with an annual PBR of one whale per year. Along the California coast blue whale abundance has been increasing during the past 2 decades (Calambokidis et al. 1990; Barlow 1994; Calambokidis 1995). Because this apparent increase is too large to be accounted for by population growth alone, it is assumed that a shift in distribution has occurred. Although the population in the North Pacific is expected to have grown since protection began in 1966, the possibility of continued unauthorized takes, incidental ship strikes and mortality, and serious injury in fishing gear makes this trend uncertain.

Blue whales were significantly depleted by commercial whaling activities worldwide. The reported take of North Pacific blue whales by commercial whalers totaled 9,500 between 1910 and 1965 (Ohsumi and Wada 1972). Approximately 3,000 of these were taken from the west coast of North America from Baja California, Mexico to British Columbia, Canada (Rice 1974; Tonnessen and Johnsen 1982; Rice 1992; Clapham et al. 1997). The primary threats currently facing blue whales are vessel strikes and fisheries interactions but also include anthropogenic noise, natural mortality, vessel disturbance, habitat degradation, and competition for prey resources.

Changes in distribution

Evidence suggests the distribution and migratory patterns of blue whales may have changed in at least four areas: northern Norway, southern Japan, eastern Aleutian Islands, and northern California.

In northern Norway (i.e., Finnmark, Bear Island, and Svalbard) the paucity of sightings during recent surveys along the coast where blue whales were common in the late 1800s and early 1900s, may suggest that the historic distribution has changed (Christensen et al. 1992). However, it could also indicate depletion of the population by whaling.

In the western North Pacific, the lack of blue whales off southern Japan today may also suggest that the distribution of these animals has changed or that the animals of this region have been extirpated. South of the eastern Aleutian Islands, relatively large concentrations of blue whales were documented in the 1970s but the species appears rare there today, suggesting that illegal and unreported whaling depleted the population (Stewart et al. 1987; Forney and Brownell 1997).

Off northern California (e.g., Farallon Islands, Moss Landing, and Trinidad), the recent appearance of numerous blue whales is noteworthy in light of their rarity in these regions prior to the late 1970s. Calambokidis (1995) concluded that such changes in distribution reflect a shift in feeding from the more offshore euphausiid, *Euphausia pacifica*, to the primarily neritic euphausiid, *Thysanoëssa spinifera*. More recently, some Californian animals have been observed returning to waters of southern Alaska and British Columbia to feed (Calambokidis et al. 2009).

Fin whale *(Balaenoptera physalus):* Fin whales are the second-largest species of whale, with animals in the Northern hemisphere having a maximum length of about 22 m. Fin whales show mild sexual dimorphism, with females measuring longer than males by 5 to 10 percent. Adults can weigh 40 to 80 tons. Fin whales have a sleek, streamlined body with a V-shaped head. They have a tall, falcate dorsal fin, located about two-thirds of the way back on the body, that rises at a shallow angle from the animal's back. The species has a distinctive coloration pattern: the back and sides of the body are black or dark brownish-gray, and the ventral surface is white.

Fin whales can be found in social groups of 2 to 7 whales and in the North Atlantic are often seen feeding in large groups that include humpback whales, minke whales, and Atlantic white-sided dolphins (Jefferson et al. 2008). Fin whales are large, fast swimmers and the killer whale is their only non-human predator.

During the summer, fin whales feed on krill, small schooling fish (e.g., herring, capelin, and sand lance), and squid by lunging into schools of prey with their mouth open, using their throat pleats to gulp large amounts of food and water, filtering out food particles using baleen plates on each side of the mouth. Fin whales fast in the winter while they migrate to warmer waters.

Little is known about the social and mating systems of fin whales. Similar to other baleen whales, long-term bonds between individuals are rare. Males become sexually mature at 6 to 10 years old; females at 7 to 12 years old. Physical maturity is attained at approximately 25 years for both sexes. After 11 to 12 months of gestation, females give birth to a single calf in tropical and subtropical areas during midwinter. Newborn calves are approximately 6 m long and weigh 2 tons. Fin whales can live 80 to 90 years.

Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes, and less commonly in the tropics. They occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally.

Commercial whaling for this species ended in the North Pacific Ocean in 1976, in the Southern Ocean in 1976-77, and in the North Atlantic Ocean in 1987. Fin whales are still hunted in Greenland and subject to catch limits under the IWC's aboriginal subsistence whaling scheme.

Other current threats include reduced prey abundance due to overfishing, habitat degradation, disturbance from low-frequency noise and the possibility that illegal whaling or resumed legal whaling will cause removals at biologically unsustainable rates. Of all species of large whales, fin whales are most often reported as hit by vessels (Jensen and Silber 2003).

Fin whales occur in all major oceans worldwide and seasonally migrate between temperate and polar waters (Perry et al. 1999). In the North Pacific, the International Whaling Commission (IWC) recognizes two stocks of fin whales, the east China Sea stock and the rest of the North Pacific (Donovan 1991). For management purposes under the MMPA, four stocks of fin whales are recognized in U.S. waters: the California/Oregon/Washington stock, the Northeast Pacific (Alaska) stock, the Hawaii stock, and the western North Atlantic stock.

Western North Atlantic stock: The fin whale is ubiquitous in the North Atlantic, occurring from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic ice pack (NMFS 2006). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of North Atlantic right and humpback whales. Based on acoustic recordings from hydrophone arrays, however, Clark (1995) reported a general southward flow pattern of fin whales in the fall from the Labrador/Newfoundland region, past Bermuda, and into the West Indies. In general, fin whales are found from Cape Hatteras, North Carolina northward. Overall distribution may be based on prey availability. Based on stranding data, fin whales are believed to calve in the Mid-Atlantic (Hain et al. 1992). Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments. The best abundance estimate of the population currently is 2,269 animals with an annual PBR of 3.4 whales (Waring et al. 2009). However, data are insufficient to determine status and trends for this stock. Fishery interactions kill or seriously injury an average of 0.2 whales per year while vessel collisions take 1.2 whales per year. Schooling fish constitute a large proportion of the fin whale's diet in many areas of the North Atlantic, so trends in fish populations, whether driven by fishery operations, human-caused environmental deterioration, or natural processes, may strongly affect the size and distribution of fin whale populations.

California/Oregon/Washington stock: This stock is found along the U.S. west coast from California to Washington in waters out to 300 nmi. Because fin whale abundance appears lower in winter/spring in California (Dohl et al. 1983; Forney et al. 1995) and in Oregon (Green et al. 1992), it is likely that the distribution of this stock extends seasonally outside these coastal waters. The best available estimate of the stock's population size is 2,636 whales with a PBR of 14 whales (Carretta et al. 2008). Some data indicate that fin whales have increased in abundance in California coastal waters (Barlow 1994, 1997), but these trends are not significant. Ship strikes average 1.6 serious injuries or mortality each year. Fishery interactions may be approaching zero mortality and serious injury rate.

Northeast Pacific (Alaska) stock: Whales in this stock are found from Canadian waters north to the Bering Sea. Reliable estimates of current and historical abundance of fin whales in the entire northeast Pacific are currently not available. Based on surveys which covered only a small portion of the range of this stock, a rough minimum estimate of the size of the population west of the Kenai Peninsula is 5,700 with a PBR level of 11.4 whales (Angliss and Allen 2009). Data suggests that this stock may be increasing at an annual rate of 4.8 percent; however, this is based

on uncertain population size and incomplete surveys of its range (Angliss and Allen 2009). Fishery interactions may threaten this stock but fishery-related mortality levels can be determined to have met a zero mortality and serious injury rate.

Hawaii stock: The best available abundance estimate for this stock is 174 whales based on a 2002 survey of the entire Hawaiian Islands EEZ (Barlow 2003) with a PBR of 0.2 whales per year (Carretta et al. 2008). Data is not available to determine a population trend for this stock. Insufficient information is available to determine whether the total fishery mortality and serious injury for fin whales is insignificant and approaching zero mortality and serious injury rate.

Sei whale *(Balaenoptera borealis):* Sei whales are widely distributed in all oceans, although this species is not found as far into polar waters as other rorquals (Gambell 1985). Several stocks of sei whales have been identified, but updated estimates of the number of sei whales worldwide are not available. Commercial whaling reduced sei whale numbers in the North Pacific from 42,000 whales to approximately 7,000 to 12,000 animals by 1974 (Tillman 1977). For management purposes, sei whales within the U.S. EEZ are divided into four stocks: 1) Eastern North Pacific, 2) Hawaii, 3) Western North Atlantic, and 4) Nova Scotia.

Eastern North Pacific stock: The IWC recognizes only one stock of sei whales in the North Pacific, but some evidence exists for multiple populations (Masaki 1977; Mizroch et al. 1984; Horwood 1987). Lacking additional information on sei whale population structure, sei whales in the eastern North Pacific (east of longitude 180°) are considered a separate stock for management purposes under the MMPA. The best abundance estimate for whales off the coasts of California, Oregon and Washington is 46 animals with an annual PBR level of 0.05 (Caretta et al. 2008). No population trend is available for this stock. The offshore drift gillnet fishery may threaten this stock but no mortalities or serious injuries have been reported. Vessel collisions result in 0.2 whales killed each year.

Hawaii stock: Little information is known about animals in Hawaii waters. The best abundance estimate for whales off Hawaii is 37 animals with an annual PBR level of 0.1 (Caretta et al. 2008). No population trend is available for this stock. It is likely threatened by fishery interactions although none have been reported.

Western North Atlantic stock: The general lack of information regarding sei whales in the Atlantic precludes the stocks there from being adequately assessed, but only a few thousand sei whales are thought to occur in the North Atlantic. The southern portion of this stock's range is the Gulf of Maine and Georges Bank. Sei whales are not common in the U.S. Atlantic waters south of this location. The southernmost confirmed records are strandings along the northern Gulf of Mexico and in the Greater Antilles. Sei whales are generally found in deeper waters, characteristic of the continental shelf edge region (Hain et al. 1985). The sei whale population in the western North Atlantic is assumed to consist of two stocks, a Nova Scotian Shelf stock and a Labrador Sea stock. Within the action area, the sei whale is commonly distributed on Georges Bank and into the Gulf of Maine/Bay of Fundy region during spring and summer, primarily in deeper waters. Individuals may range as far south as North Carolina. There are occasional influxes of this species further into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with northern right whales in the southern

Gulf of Maine and in the Bay of Fundy. Insufficient data are available to determine trends of the sei whale population in the North Atlantic. Because there have been no abundance estimates within the last ten years, a minimum population estimate cannot be determined for NMFS' management purposes (Waring et al. 2009). For human impacts, only one case of a ship strike occurring in 1994 has been recorded.

Nova Scotia stock: The range of the Nova Scotia stock includes the continental shelf waters of the northeastern U.S., and extends northeastward to south of Newfoundland. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia, thence east to longitude 42°W. During the feeding season, a major portion of the stock is centered in northerly waters, perhaps on the Scotian Shelf (Mitchell and Chapman 1977). The southern portion of the species' range during spring and summer includes the northern portions of the U.S. Atlantic EEZ -the Gulf of Maine and Georges Bank. The period of greatest abundance there is spring, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (CETAP 1982). The sei whale is often found in the deeper waters characteristic of the continental shelf edge region (Hain et al. 1985). Mitchell (1975) reported that sei whales off Nova Scotia were often distributed closer to the 2,000 m depth contour than were fin whales. This general offshore pattern of sei whale distribution is disrupted during episodic incursions into more shallow and inshore waters. Although known to take piscine prey, sei whales (like right whales) are largely planktivorous, feeding primarily on euphausiids and copepods (Flinn et al. 2002). Based on 2006 data, the best estimate of abundance for sei whales is 207 whales with a PBR level of 0.3 whales annually (Waring et al. 2009). Fishery interactions threaten this stock resulting in an annual rate of serious injury and mortality of 0.2 sei whales. Likewise, ship strike results in 0.4 whales per year seriously injured or killed.

Sperm whale *(Physeter macrocephalus):* Sperm whales are the largest odontocete and the most sexually dimorphic cetaceans, with males considerably larger than females. Adult females may grow to lengths of 11 m and weigh 15 tons. Adult males, however, reach about 16 m and may weigh as much as 45 tons. The sperm whale is distinguished by its extremely large head, which takes up to 25 to 35 percent of its total body length. Sperm whales are mostly dark gray, but oftentimes the interior of the mouth is bright white, and some whales have white patches on the belly.

Because sperm whales spend most of their time in deep waters, their diet consists of many larger organisms that also occupy deep waters of the ocean. Their principle prey is large squid, but they will also eat large demersal and mesopelagic sharks, skates, and fishes. The average dive lasts about 35 minutes and is usually down to 400 m, however dives may last over an hour and reach depths over 1,000 m.

Female sperm whales reach sexual maturity around 9 years of age when they are roughly 9 m long. At this point, growth slows and they produce a calf approximately once every 5 years. After a 14 to 16 month gestation period, a single calf about 4 m long is born. Although calves will eat solid food before one year of age, they continue to suckle for several years. Females are physically mature around 30 years and 10.6 m long, at which time they stop growing. Males reach physical

maturity around 50 years and when they are 16 m long. Males often do not actively participate in breeding until their late 20s.

Most females will form lasting bonds with other females of their family, and on average 12 females and their young will form a family unit. While females generally stay with the same unit all their lives in and around tropical waters, young males between 4 and 21 years old form "bachelor schools", comprised of other males that are about the same age and size. As males get older and larger, they begin to migrate to higher latitudes and slowly bachelor schools become smaller, until the largest males end up alone. Older, larger males are generally found near the edge of pack ice in both hemispheres. On occasion, however, these males will return to the warm water breeding areas.

Sperm whales tend to inhabit areas with a water depth of 600 m or more, and are uncommon in waters less than 300 m deep. Female sperm whales are generally found in deep waters (at least 1,000 m) of low latitudes (less than 40°, except in the North Pacific where they are found as high as 50°). These conditions generally correspond to sea surface temperatures greater than 15°C, and while female sperm whales are sometimes seen near oceanic islands, they are typically far from land.

Sperm whales inhabit all oceans of the world. They can be seen close to the edge of pack ice in both hemispheres and are also common along the equator, especially in the Pacific. Their distribution is dependent on their food source and suitable conditions for breeding, and varies with the sex and age composition of the group. Their migrations are not as predictable or well understood as migrations of most baleen whales. In some mid-latitudes, there seems to be a general trend to migrate north and south depending on the seasons, moving poleward in summer. However, in tropical and temperate areas, there appears to be no obvious seasonal migration.

The greatest natural predators to sperm whales are killer whales, which have been documented killing at least one sperm whale in California. Typically, however, it is believed that most killer whale attacks are unsuccessful. Pilot whales have been observed harassing sperm whales, but it is unclear if they pose any real threat (Perry et al. 1999). Large sharks may also be a threat, especially for young sperm whales.

The greatest threat for sperm whales has been man, especially with the advent of whaling. By 1987, whalers took at least 345,000 sperm whales in the North Pacific and North Atlantic Oceans combined, with approximately 99 percent coming from North Pacific stocks (Perry et al. 1999). Hunting of sperm whales by commercial whalers declined in the 1970s and 1980s, and virtually ceased with the implementation of a moratorium against whaling by the IWC in 1988. Sperm whales are still being targeted in a few areas: there is a small catch by primitive methods in Lamalera, Indonesia, and Japan takes sperm whales for scientific purposes. There is also some evidence to suggest that sperm whales are being hunted illegally in some parts of the world (Angliss and Allen 2009).

In addition to whaling, sperm whales may be impacted by other shipping traffic, noise disturbance, and fishing operations. Sperm whales have the potential to be harmed by ship strikes and entanglements in fishing gear, although these are not as great of a threat to sperm whales as they

are to more coastal cetaceans. Disturbance by anthropogenic noise may prove to be an important habitat issue in some areas of this population's range, notably in areas of oil and gas activities or where shipping activity is high. Another potential human-caused source of mortality is from accumulation of stable pollutants (e.g. polycholorobiphenyls, chlorinated pesticides, polycyclic aromatic hydrocarbons, and heavy metals). Stable pollutants might affect the health or behavior of sperm whales. The potential impact of coastal pollution may be an issue for this species in portions of its habitat, though little is known on this to date. In efforts to recover this species, the NMFS' recovery plan for sperm whales noted that the potential effects of pollutants is poorly understood and should be determined (2006). At present, because of their general offshore distribution, sperm whales are less likely to be impacted by humans, and those impacts that do occur are less likely to be recorded.

Currently, no good estimate is available for the total number of sperm whales worldwide. For management purposes, sperm whales inhabiting U.S. waters have been divided into five stocks:

California-Oregon-Washington stock: Sperm whales are found year-round in California waters, but they reach peak abundance from April through mid-June and from the end of August through mid-November. They have been seen in every season except winter in Washington and Oregon. The most precise and recent estimate of sperm whale abundance for this stock is 2,853 animals from the ship surveys conducted in 2001 (Barlow and Forney 2007) and 2005 (Forney 2007). Survey data from the last few decades indicate that sperm whale abundance has been rather variable off California and does not show obvious trends. The offshore driftnet gillnet fishery is the main threat to this stock. The potential biological removal (PBR) level for this stock is set at 9.3 whales per year.

North Pacific (Alaska) stock: The shallow continental shelf apparently bars the movement of sperm whales into the northeastern Bering Sea and Arctic Ocean. Males are thought to move north in the summer to feed in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands. Current and historic estimates for the abundance of sperm whales in the North Pacific are considered unreliable. The number of sperm whales of the North Pacific occurring within Alaska waters is unknown. Consequently, the PBR for this stock is unknown. Potential entanglement in fishing gear is a growing concern for this stock as whales have been observed depredating in several commercial Alaskan fisheries.

Hawaiian stock: Summer/fall surveys in the eastern tropical Pacific show that although sperm whales are widely distributed in the tropics, their relative abundance tapers off markedly westward towards the middle of the tropical Pacific and tapers off northward towards the tip of Baja California. The best estimate for sperm whales occurring in U.S. waters of Hawaii is 7,082 (Barlow 2003); however, no population trend is available. The PBR for this stock is 11 animals per year. Commercial longline fisheries are a threat to this stock though no serious injuries or mortalities of sperm whales were reported from 1998 to 2002.

Northern Gulf of Mexico stock: Seasonal aerial surveys confirm that sperm whales are present in the northern Gulf of Mexico in all seasons, but sightings are more common during the summer. The best estimate of abundance for sperm whales in oceanic waters of the northern Gulf of Mexico is 1,665; however no population trend is available. The annual PBR for this stock is 2.8 whales.

Fisheries, seismic activities, and shipping traffic in the region have the potential to impact this stock but the degree to which such interactions occur is unknown and no serious injuries or mortalities due to these activities have been reported.

North Atlantic stock: In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to east of Delaware and Virginia, and is widespread throughout the central portion of the mid-Atlantic bight and the southern portion of Georges Bank. In summer, the distribution is similar but also includes the areas east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100 m isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf if at its highest levels, and there remains a continental shelf edge occurrence in the mid-Atlantic bight. The best available abundance estimate for this stock is 4,804 animals with an annual PBR of 7.1 animals. However, no population trend is available for this stock. Pollutants, drift gillnet fisheries and vessel collisions are threats to this stock. However, total U.S. fishery-related mortality and serious injury can be considered to be insignificant and approaching a zero mortality and serious injury rate

Permit Nos. 14585, 14122, and 14296 would target the following endangered species for research:

North Pacific right whale *(Eubalaena japonica):* Adults are generally between 45 and 55 feet (13.7-16.7 m) long and can weigh up to 70 tons (140,000 lbs; 63,502 kg). Females are larger than males, and give birth to their first calf at an average age of 9-10 years. Calves are 13-15 feet (3.9-4.6 m) long at birth. Gestation lasts approximately 1 year. Calves are usually weaned toward the end of their first year. It is believed that right whales live at least 50 years, but there are few data on the longevity of right whales.

North Pacific right whales inhabit the Pacific Ocean, particularly between 20° and 60° latitude. Before commercial whalers heavily exploited right whales in the North Pacific, concentrations were found in the Gulf of Alaska, eastern Aleutian Islands, south central Bering Sea, Sea of Okhotsk, and Sea of Japan. Recently, there have been few sightings of right whales in the central North Pacific and Bering Sea. Sightings have been reported as far south as central Baja California in the eastern North Pacific, as far south as Hawaii in the central North Pacific, and as far north as the sub-Arctic waters of the Bering Sea and sea of Okhotsk in the summer. Since 1996, right whales have been consistently observed in the southeastern Bering Sea in Bristol Bay during the summer months.

Migratory patterns of the North Pacific right whale are unknown, although it is thought the whales spend the summer on high-latitude feeding grounds and migrate to more temperate waters during the winter.

There are no reliable estimates of current abundance or trends for right whales in the North Pacific. However, the pre-exploitation size of this stock exceeded 11,000 animals. In general, there are no data on trends in abundance for either the eastern or western population. For the western North Pacific, sighting survey estimates for the summer feeding ground indicate an abundance of around 900 in the Sea of Okhotsk. It is clear that this population is significantly larger than that in the

eastern North Pacific. Over the past forty years, most sightings in the eastern North Pacific have been of single whales. However, during the last few years, small groups of right whales have been sighted. This is encouraging but there has been only one confirmed sighting of calves in the 20th century.

In the North Pacific, ship strikes and entanglements may pose a threat to right whales. However, because of their rare occurrence and scattered distribution, it is impossible to assess the threat of ship strikes or entanglement to North Pacific right whales at this time. Thus, the estimated annual rate of human-caused mortality and serious injury appears minimal. The reasons for the apparent lack of recovery for right whales in this region are unknown.

3.3.1.2 MMPA-Depleted Marine Mammal Species Directly Targeted for Research

Under the MMPA, a stock is designated as depleted when it falls below its optimum sustainable population. The MMPA defines optimum sustainable population as "the number of animals which would result in the maximum productivity of the population or the species, keeping in mind the optimum carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element" (16 U.S.C. 1362). NMFS regulations have further defined optimum sustainable population as "a population size, which falls within a range from [the carrying capacity of the] ecosystem to the population level that results in maximum net productivity." Once stocks have been designated as depleted, a conservation plan is developed to guide research and management actions to restore the population. All marine mammals stocks/species listed under the ESA are also considered depleted under the MMPA. However, some marine mammal stocks have only been designated by NMFS as depleted under the MMPA.

Depleted stocks targeted for research in the proposed action [File No. 14682; Au] include:

Spinner dolphin – Eastern stock *(Stenella longirostris orientalis)*: Spinner dolphins are distributed in tropical and subtropical waters worldwide (Perrin and Gilpatrick 1994) and are most abundant in warm, tropical waters (Wade and Gerrodette 1993). Spinners are an offshore, deep water species. The three subspecies of spinner dolphins in the Pacific Ocean are the white belly, the Central American, and the eastern, found in the Eastern Tropical Pacific (ETP) (Perrin 1990).

Spinner dolphins are relatively small, reaching lengths of 6 to 7 feet (2 m) and weighing approximately 130 to 170 pounds (59-77 kg) at adulthood. Spinner dolphins often occur in groups of several hundred to several thousand animals. They often school in large groups and with other dolphin species, such as spotted dolphins, bottlenose dolphins, or humpback whales in Hawaii.

Mating and calving occurs year-round, with gestation similar to that of most dolphins, around eleven months. Multiple males may mate with one female in short, consecutive intervals. Lactation often takes place for two years, but can also last for only one year. Calving intervals average three years. Maturity occurs at around 7 years of age and maximum longevity is 20 years.

In most places, spinner dolphins are found in the deep ocean where they likely track prey. The Hawaii population has a more coastal distribution. There, the animals rest in bays and protected areas during the day and then fuse into larger groups to feed in deeper water on fish and squid at night.

At the time of the MMPA depleted listing, the eastern spinner dolphin was estimated to be at 44 percent of its pre-exploitation population size. Currently, the eastern stock is estimated to have a population size of 613,000 (Gerrodette et al. 2005). The long-term trend is flat for this stock.

Due to the as yet unexplained association between large yellowfin tuna and some dolphin stocks in the ETP, the presence of the eastern stock of spinner dolphins has been used by the tuna purse-seine fishery to find tuna. Dolphins can become trapped in the nets and drown. Stress from becoming encircled in purse seines has also been documented as a very serious threat to dolphins. Currently, fishing methods for tuna imported into the U.S. under the Dolphin-Safe program do not allow fishing practices, such as setting on dolphins. Interactions with tourists are a growing threat to the Hawaiian stock; because the species is active at night, daytime interactions with tourists inhibit necessary rest and sleep time.

Bottlenose dolphin - Western North Atlantic Coastal stock (*Tursiops truncatus*): In the western North Atlantic Ocean, there are two stocks of bottlenose dolphins: offshore and coastal. Offshore dolphins inhabit the waters along the continental shelf break from Georges Bank to Cape Hatteras. Coastal dolphins inhabit coastal waters less than 25 m deep, south from Long Island, New York. During the winter months, the groups overlap in the waters south of Cape Hatteras, North Carolina.

Scientists have documented the presence of coastal dolphin resident communities in Charleston, South Carolina (Zolman 1996), Central Florida (Odell and Asper 1990), and Pamlico Sound, North Carolina (Waring et al. 2006). The coastal migratory stock was designated as depleted under the MMPA. From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the WNA, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units. The prospective stocks replace these management units. This prospective stock structure continues to be evaluated using available data and will be finalized when these analyses are complete.

The 2008 Stock Assessment Report identifies seven prospective stocks of coastal morphotype bottlenose dolphins inhabiting nearshore coastal waters along the Atlantic coast: the Northern Migratory, Southern Migratory, Southern North Carolina, South Carolina, Georgia, Northern Florida, and Central Florida. The total best estimate for the population of these prospective stocks is approximately 40,000 (Waring et al. 2009).

The impacts of entanglements with crab pots in Georgia and South Carolina and the total mortality associated with pound nets in Virginia are unknown. Likewise, the total mortality in the mid-Atlantic gillnet fishery is currently unknown pending collection of additional data and analysis. The total U.S. fishery-related mortality and serious injury for the Northern Migratory and Southern Migratory stocks likely is not less than 10% of the calculated PBR, and thus cannot be considered to be insignificant and approaching zero mortality and serious injury rate. Since one or more of the stocks may be depleted, all stocks retain the depleted designation.

3.3.1.3 Other Species Directly Targeted for Research

Takes for several marine mammal species that are not listed under the ESA or depleted under the MMPA have been requested under the proposed action. (See Appendices B-J for more information on specific takes requested.)

NMFS publishes annual Stock Assessment Reports (SARS) which describe the distribution, abundance, productivity, and annual human-caused mortality for the marine mammals under its jurisdiction. The SARS are available in PDF format at www.nmfs.noaa.gov. Species directly targeted for research in each permit, and the associated SARS with the most recently updated information on that species or stock, are summarized in Table 7.

Table 7. Other species targeted for study in the proposed action, by permit, location, and level of harassment, and their associated SARS.

Species	**Permit No.**	**HI**	**AK**	**Other Pacific**	**Atlantic**	**Level B harassment**	**Level A harassment**	**SARS**
Dolphin, Atlantic spotted	Mobley No. 14451				X	X		Atlantic 2009[1]
Dolphin, Atlantic white-sided	Mobley No. 14451				X	X		Atlantic 2009
Dolphin, bottlenose	Au No. 14682	X				X	X	Pacific 2006[2]
	Mobley No. 14451	X	X	X	X	X		Pacific 2006, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2006
Dolphin, clymene	Mobley No. 14451				X	X		Atlantic 2009
Dolphin, common, short-beaked	Au No. 14682	X				X	X	Pacific 2008[3]
	Mobley No. 14451	X	X	X	X	X		Pacific 2008, Atlantic 2009
Dolphin, common, long-beaked	Mobley No. 14451		X	X		X		Pacific 2008
Dolphin, Fraser's	Mobley No. 14451	X		X	X	X		Pacific 2004[4], Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Dolphin, northern right whale	Mobley No. 14451		X	X		X		Pacific 2008

[1] Atlantic 2009 SAR: Waring et al. 2009
[2] Pacific 2006 SAR: Carretta et al. 2007
[3] Pacific 2008 SAR: Carretta et al. 2008
[4] Pacific 2004 SAR: Carretta et al. 2005

Species	Permit No.	HI	AK	Other Pacific	Atlantic	Level B harassment	Level A harassment	SARS
Dolphin, Pacific white-sided	Au No. 14682	X				X	X	Pacific 2008
	Cartwright No. 10018-01		X			X		Pacific 2009[5]
	Mobley No. 14451		X	X		X		Pacific 2008, 2009
Dolphin, pantropical spotted	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X		X	X	X		Pacific 2004, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Dolphin, Risso's	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, 2008, Atlantic 2009
Dolphin, rough-toothed	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Dolphin, spinner	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X		X	X	X		Pacific 2004, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Dolphin, striped	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, 2008, Atlantic 2008[6], 2009
	Pack No. 14585	X				X		Pacific 2004
Whale, Baird's beaked	Mobley No. 14451	X	X	X		X		Pacific 2005[7], 2008
Whale, Blainville's beaked	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Whale, Bryde's	Mobley No. 14451	X	X	X	X	X		Pacific 2004, Atlantic 2009

[5] Pacific 2009 SAR: Carretta et al. 2009
[6] Atlantic 2008 SAR: Waring et al. 2008
[7] Pacific 2005 SAR: Carretta et al. 2006

Species	Permit No.	HI	AK	Other Pacific	Atlantic	Level B harassment	Level A harassment	SARS
	Pack No. 14585	X				X		Pacific 2004
Whale, Cuvier's beaked	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, 2005, 2008, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Whale, dwarf sperm	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, 2008, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Whale, Eden's	Mobley No. 14451			X		X		N/A
Whale, false killer	Au No. 14682	X				X	X	Pacific 2009
	Mobley No. 14451	X	X	X	X	X		Pacific 2009, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2009
Whale, Gervais' beaked	Mobley No. 14451				X	X		Atlantic 2009
Whale, ginkgo-toothed beaked	Mobley No. 14451		X	X		X		Pacific 2008
Whale, Gray	Mobley No. 14451			X				Pacific 2008
	Darling No. 13846			X		X		Pacific 2008
Whale, Hubbs' beaked	Mobley No. 14451		X	X		X		Pacific 2008
Whale, killer	Au No. 14682	X				X	X	Pacific 2004
	Cartwright No. 10018-01		X			X		Alaska 2006[8], 2007[9]
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, Alaska 2006, 2007, Atlantic 2009

[8] Alaska 2006 SAR: Angliss and Outlaw 2007
[9] Alaska 2007 SAR: Angliss and Outlaw 2008

Species	Permit No.	HI	AK	Other Pacific	Atlantic	Level B harassment	Level A harassment	SARS
	Witteveen No. 14296		X			X	X	Alaska 2006, 2007
	Pack No. 14585	X				X		Pacific 2004
	Straley No. 14599		X			X	X	Alaska 2006, 2007
	Sharpe No. 14122		X			X		Alaska 2006, 2007
Whale, Longman's beaked	Mobley No. 14451	X	X	X		X		Pacific 2004
Whale, melon-headed	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, Atlantic 2007[10], 2009
	Pack No. 14585	X				X		Pacific 2004
Whale, minke	Witteveen No. 14296		X					Alaska 2006
	Mobley No. 14451	X	X	X	X	X		Atlantic 2009
	Pack No. 14585	X				X		Pacific 2004
Whale, northern bottlenose	Mobley No. 14451				X	X		Atlantic 2008
Whale, pilot, short-finned	Au No. 14682	X				X	X	Pacific 2006
	Mobley No. 14451	X	X	X	X	X		Pacific 2006, 2008, Atlantic 2009
	Pack No. 14585	X				X		Pacific 2006
Whale, pilot, long-finned	Mobley No. 14451				X	X		Atlantic 2009
Whale, pygmy killer	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X	X	X		Pacific 2004, Atlantic 2007, 2009
	Pack No. 14585	X				X		Pacific 2004
Whale, pygmy sperm	Au No. 14682	X				X	X	Pacific 2004
	Mobley No. 14451	X	X	X		X		Pacific 2004, 2008

[10] Atlantic 2007 SAR: Waring et al. 2007

Species	Permit No.	HI	AK	Other Pacific	Atlantic	Level B harassment	Level A harassment	SARS
	Pack No. 14585	X				X		Pacific 2004
Whale, Sowerby's beaked	Mobley No. 14451				X	X		Atlantic 2009
Whale, Stejneger's beaked	Mobley No. 14451		X	X		X		Alaska 2005[11]
Whale, True's beaked	Mobley No. 14451				X	X		Atlantic 2009
Porpoise, harbor	Cartwright No. 10018-01		X			X		Alaska 2009[12]
Porpoise, Dall's	Cartwright No. 10018-01		X			X		Alaska 2009
	Mobley No. 14451		X	X		X		Pacific 2008, Alaska 2009

3.3.2 Non-Target Species

In addition to the target species, a wide variety of non-target species could be found within the action area, including marine mammals, invertebrates, fish, and sea birds. Merely being present within the action area does not necessarily mean a marine organism will be affected by the proposed action. Research is not directed at these species and any impacts would be considered incidental to the proposed action. (See Appendices B-J for more information on incidental takes of marine mammals for each proposed permit.)

Because not all applicants propose to target all species, some ESA-listed species identified as target species could also be incidentally harassed. Mitigation measures would be employed by researchers to avoid harassing non-target species (e.g., not approaching non-target species and suspending activities that might disturb ESA-listed non-target species).

ESA-listed non-target species within the action area that might be incidentally harassed during authorized activities include:

In Alaska and the Pacific Northwest:

- Steller sea lions (*Eumetopias jubatus*)
- Northern fur seals *(Callorhinus ursinus)*
- Killer whales – Eastern North Pacific Southern Resident stock *(Orcinus orca)*
- Bowhead whale (*Balaena mysticetus)*

[11] Alaska 2005 SAR: Angliss and Outlaw 2005
[12] Alaska 2009 SAR: Allen and Angliss 2010

In Hawaii:

- Hawaiian Monk Seals (*Monachus schauinslandi*)
- Green Sea Turtles* (*Chelonia mydas*)
- Hawksbill Sea Turtles *(Eretmochelys imbricata*)
- Leatherback Sea Turtles (*Dermochelyts coriacea*)
- Loggerhead Sea Turtles (*Caretta caretta)*
- Olive Ridley Sea Turtles* (*Lepidochelys olivacea*)

**Green turtles and Olive ridley turtles in U.S. waters are listed as threatened except for the Florida breeding population and Mexico's Pacific coast breeding population, which are listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green and Olive ridley turtles are considered endangered wherever they occur in U.S. waters.*

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

This chapter represents the scientific and analytic basis for comparison of the direct, indirect, and cumulative effects of the alternatives. Regulations for implementing the provisions of NEPA require consideration of both the context and intensity of a proposed action (40 CFR Parts 1500-1508).

4.1 EFFECTS OF ALTERNATIVE 1: No Action

The majority of the activities requested in the permit applications are currently authorized under current or recently expired permits, as described in Chapter 1.2, and as such are considered as part of the baseline. The take numbers currently authorized are similar to those requested in the action.

Under Alternative 1, the requested permits would not be issued. Activities currently authorized by scientific research permits would cease as each permit expires by November 2010. Activities authorized by Permit No. 10018 would continue as currently authorized, but the permit amendment would not be issued. This alternative would eliminate any potential risk to the environment from the proposed research activities. However, the research would not be conducted and the opportunity would be lost to collect information that would contribute to better understanding marine mammal populations. This information is necessary for NMFS to conduct mandated stock assessments and status reviews and implement management activities.

More specifically, the No Action alternative would prohibit the researchers from collecting valuable information on cetaceans in the action area. The work described in the proposed action directly addresses research needs identified in NMFS recovery plans for several of the target species, and would provide important information that would help conserve, manage, and recover species as required by the ESA, MMPA, and implementing regulations. The information would also contribute substantially to conservation efforts by providing critical information about marine mammal ecology. Without relevant, up-to-date information on species biology, ecology, and behavior, management decisions may be too conservative or not sufficiently conservative to ensure a stock or species to recover.

Even if the requested permits and permit amendment are not issued, marine mammals living within the action area would still be exposed to vessel traffic and anthropogenic effects, including existing permitted scientific research and future requests for permits. This includes a total of 23 permits that currently authorize takes on the target species in the proposed action area (Appendix K); seven of those 23 permits would be replaced or amended by the proposed action. Takes in these permits occur by a variety of research and enhancement activities involving harassment, as defined under the MMPA, and take as defined under the ESA.

4.2 EFFECTS OF ALTERNATIVE 2: Issue permit with standard conditions

The proposed activities would allow research conducted under various prior scientific research permits (see Chapter 1.2) to continue for five additional years under eight new permits and would expand the action area in the proposed amendment to Permit No. 10018. Six of the eight requested new permits would replace existing permits; the other two would replace permits that recently expired. The number of animals proposed to be taken annually would be slightly higher than is currently authorized for some species, but would not be substantially different from the level of

effort authorized under current permits. The overall effects of issuing the permits and amendment would be similar to the effects of issuing previous permits, which have been analyzed under a variety of NEPA documents (see Section 1.2), all resulting in a FONSI. Research activities may result in short-term behavioral responses by individuals, but would not be expected to result in stock- or species-level effects.

Although some of the tags used in this research would be shed into the ocean and are unlikely to be recovered, given the very small amount of debris they would represent and the fact that they do not contain any highly dangerous or radioactive materials, NMFS does not expect them to have any significant effect on the environment.

The issue most relevant to this analysis is the potential for negative impacts on the target species. It is important to recognize that an adverse effect on a single individual or a small group of animals does not translate into an adverse effect on the population or species unless it results in reduced reproduction or survival of the individual(s) that causes an appreciable reduction in the likelihood of survival or recovery for the species. In order for the proposed action to have an adverse effect on a species, the exposure of individual animals to the research activities would first have to result in:

- direct mortality,
- serious injury that would lead to mortality, or
- disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the individual's likelihood of successful reproduction or survival was substantially reduced.

That mortality or reduction in the individual's likelihood of successful reproduction or survival would then have to result in a net reduction in the number of individuals of the species. In other words, the loss of the individual or its future offspring would not be offset by the addition, through birth or emigration, of other individuals into the population. That net loss to the species would have to be reasonably expected, directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of the listed species in the wild.

Effects of Directed Research on Cetaceans

Level B harassment, as defined by the MMPA, would occur during aerial surveys, large and small vessel surveys, behavioral observations, photo-identification activities, underwater photography and videography. These activities were analyzed in past EAs for large whale research conducted by the applicants, and it was determined that they could lead to short-term disturbance of marine mammals, but that there would be no significant impact from issuance of the permits and amendments (NMFS 2004, 2005b, 2008). The differences in close approach activities requested in the proposed action from what was previously authorized are limited to small increases in the number of animals that would be taken, and would not be expected to have any additional effects that were not previously analyzed.

Laser-based videogrammetry proposed for use by Pack would not be expected to have impacts in addition to the effects of close approach. Zorn, Churnside and Oliver (2000) reported on laser safety for various species of cetaceans and pinnipeds for which visual acuity data were available. The authors analyzed the acuity data to show that the sensitivity ratio of these marine mammals was less than that of humans. Therefore, if the safety standards for humans are applied to these

marine mammals, the probability of harm should be zero. The study was based on airborne Lidar (light detection and ranging systems) in the blue-green region of the visible spectrum. The use of Lidar underwater should be even less intrusive than in-air use as a portion of the energy of the laser beams would be attenuated in the water column.

Level B harassment would also occur during acoustic playbacks. The effects of playbacks were analyzed in past EAs for large whale research conducted by the applicants, and it was determined that they could lead to short-term disturbance of marine mammals, but that there would be no significant impact from issuance of the permits and amendments (NMFS 2004, 2005b). Not all sounds that would be played under the proposed action and methodologies that would be used were analyzed in those EA.

Playbacks to endangered species

In addition to the potential for behavioral responses to close approach (described above), individuals targeted for acoustic playbacks would be expected to display behavioral responses, as the goals of playbacks (which vary by permit) include studying responses to sounds of conspecifics and eliciting behavioral responses to study methods of alerting cetaceans. The sounds produced under the proposed permits would be of a source level and distance from target animals that would result in exposure levels below those expected to cause injury or death. Previous playback experiments with humpback whales have not resulted in reported behavioral reactions by the whales other than minor disturbance; responses of target animals would not be expected to exceed short-term stress and discomfort and no long-term effects would be anticipated.

Field playbacks to marine mammals have been used since 1968 to answer questions on wildlife management, impacts of anthropogenic noise, interactions between predators and prey, individual and kin recognition, and the function of communicative sounds, but a 2006 review identified relatively few (46) publications (Deecke 2006). Of these, only 25 publications focused on cetaceans.

The hearing thresholds of humpback whales, or any baleen whale, have not been explicitly tested. However, models based on humpback whale sound production, such as songs and feeding calls, and ear anatomy have suggested a potential hearing range of 10Hz to 300kHz (Helweg et al. 2000, Mercado et al. 2008). Indirect evidence suggests that baleen whales are most sensitive to frequencies below 1 kHz, but some can hear sounds up to much higher frequencies. There is evidence that humpback whales have reacted to sonar signals at 3.1-3.6 kHz (Richardson et al. 1995). Baleen whales were observed to react to sounds at frequencies up to 28 kHz, but did not respond to pingers and sonars at 36 kHz and above (Richardson et al. 1995).

In the proposed permits, playbacks would include both natural and synthetic sounds, with the majority consisting of humpback whale songs and social sounds played to humpbacks. Target whales would not be exposed to sound levels greater than 170 dB rms. Average rms source levels produced by singing humpback whales are above 170 dB rms (Au et al. 2006). At a source level of 187 dB, for a conspecific approximately 90 ft (27 meters or approximately two whale lengths) away, the received level at the whale would be 158 dB due to attenuation of the sound. Singers are often that distance away from cows with calves, with no apparent behavioral disturbance to non-singers. The proposed playbacks would be initiated at lower source levels than those of singing

humpbacks. NMFS would not anticipate that marine mammals would experience physiological effects that might result in sensory impairment as a result of exposure to playbacks of natural sounds within the acoustic range of those produced by cetaceans.

In a poster presented at the 17th Biennial Conference on the Biology of Marine Mammals, Darling et al. (2007) reported that during humpback playback trials in Hawaii, singing whales: 1) were immediately aware of a new song added to their surroundings; 2) could pinpoint a 25 cm speaker from 800 m; and 3) may respond to similar song by stopping and joining its source, which did not occur with playbacks of a different song. During the 19 trials:

- Nine playbacks of similar songs all resulted in neutral to positive (attraction) responses, with the singer joining the playback speaker in five of these trials.
- Seven playbacks of different songs all led to neutral to negative (repulsion) responses, as did playback of two non-whale sounds.
- One compound trial playback beginning with different song led to the singer moving away while continuing to sing; however when the playback was changed to similar song, the whale stopped singing and joined the playback speaker.
- Singing stopped during 70% of playbacks, ranging from immediately (27 sec) to after a full song (17 min). Stop time in similar song playbacks tended to be shorter (median: 2.5 min) than different song (median: 11.5 min).

The 2008 annual report for Permit No. 735-1599 (Darling) indicated that, during playback trials of humpback songs, no behavior occurred that had not been observed during natural whale-whale interactions. Behaviors observed during those playbacks included no changes, moving towards or away from the sound source, and either continuing or halting singing. In the 2007 report, Darling noted 7 instances (out of 10 trials) in which the target singer moved either away from or toward the sound source and 5 cases in which singers stopped singing. In the presence of escorts with females and calves, Darling noted that target animals were observed to move 79% of the time (23 of 29 trials) during playback trials. In the 2006 annual report, Darling noted 4 instances of measurable reactions by singers to playbacks, in which he observed that the target animal stopped singing and moved either away from or toward the sound source. In the presence of escorts with females and calves, Darling noted reactions in 9 (of 16) playbacks during which he observed animals moving up to 3 km in distance. No other reactions were noted. No overt strong behavioral reactions (e.g., breaching, head slaps) were exhibited by target animals during any of Darling's trials.

Previous playbacks of various sources to humpback whales in waters off Hawaii indicate only transient effects to whales ranging from rapid approach to the playback vessel, to slight avoidance, to no reaction (Mobley et al. 1988; Frankel et al. 1995; Frankel and Clark 1998, 2000, and 2002). The work in Hawaii indicated that some whales (not cows with calves) were attracted to playback of social sounds, but no whales approached, and the majority of whales moved away from song playbacks (Tyack 1983). Baker and Herman (1984) found that song and synthetic sounds were played to humpbacks with no notable response to either. A 1988 study indicated that whales were attracted to playbacks of feeding sounds from Alaska and, like the Tyack (1983) study, social sounds from competitive groups. In a small percentage of trials (3 of 89), whales approached during a song playback but this was a smaller percentage than responded to synthetic sounds (Mobley et al. 1988). In this study, 22% of target animals responded by rapidly approaching the playback vessel (Mobley et al. 1988).

The acoustic deterrent devices proposed for use in Permit No. 14296 [Witteveen] are currently used by commercial fisherman to deter cetaceans from entanglement in fishing gear. Alerting whales to the presence of fishing gear with noisemaking devices has been found to reduce humpback whale bycatch in eastern Canada trap fisheries (Lien et al.1990) and harbor porpoise bycatch in Canadian (Kraus et al. 1997, Trippel et al. 1999) and US gillnet fisheries (Barlow & Cameron 2003).

There is concern that widespread use of acoustic deterrent devices will contribute additional anthropogenic noise to an increasingly noisy marine environment (Richardson et al. 1995, Jasny et al. 2005, Tyack 2008). Playbacks of acoustic deterrent devices in the proposed study would be temporary in nature, not constant, with an ultimate goal of acoustic deterrents that are triggered only when necessary (i.e. in response to a potential interaction), reducing the potential for "ensonification" of the ocean. This would also reduce the potential for habituation by whales to the deterrents used.

Although researchers have documented local movements by whales in response to sounds, humpbacks continue to return to known feeding and calving grounds year after year suggesting that playbacks occurring there have not resulted in a permanent shift in habitat use. NMFS expects that the proposed playback sessions would likewise result in no more than local, temporary reactions (via behavior and movements) by targeted whales. No prolonged or permanent shift in habitat use would be expected.

Based on the proposed source levels and received levels, source levels of vocalizations produced by live humpback whales, the design of the experiments, reports from Permit Holders, and published literature, NMFS does not expect that whales (individuals, populations or species) would be significantly impacted by the proposed playback sessions. No mortality or serious injury would be expected as a result of playback sessions. NMFS does not expect that whale hearing would be harmed or injured. Any behavioral impacts to target animals would likely be short-term and negligible. Consequently, the proposed research activities are not expected to adversely affect the survival, longevity, or lifetime reproductive success of large whales.

Playbacks to non-endangered species

Non-ESA-listed cetaceans in Hawaii would also be subject to playbacks [Permit No. 14682; Au]. Because of the timing (not during humpback whale season) and mitigation measures described by the applicant (see Chapter 2), NMFS would not expect ESA-listed marine mammals or sea turtles to be affected by this portion of playbacks. Sounds would be played using a highly directional transducer, further decreasing the possibility that non-target animals would be exposed.

In addition to the potential for behavioral responses to close approach (described above), individuals targeted for acoustic playbacks would be expected to display behavioral responses, as the goals of playbacks are to determine the effects of these sounds on behavior. The sounds produced under the proposed permit would be of a source level and distance from target animals that would result in exposure levels below those expected to cause injury or death. Target animals would not be exposed to received sound pressure levels in excess of 160. Target animals would be between 50 and 100 m from the vessel, and the source level would be moderated at the transducer

based on distance to target animals, as described in Chapter 2. Responses of target animals would not be expected to exceed short-term stress and discomfort and no long-term effects would be anticipated.

In addition to the behavioral responses to sounds produced by conspecifics described above, marine mammals have shown reactions to sounds made by predators. Cummings and Thompson (1971) played recordings of killer whales to grey whales, eliciting increased levels of spy hopping and a movement away from the playback source. Harbor seals are able to discriminate between the calls of fish-eating and mammal-eating killer whale populations, showing that they possess the ability to discriminate between threatening and non-threatening sounds (Deeke et al. 2002). The ability to discriminate information has implications for other issues, including the issue of habituation to warning signals (such as those played to marine mammals for management purposes).

There is very little information about what noises cause avoidance responses in marine mammals, and responses by cetaceans to anthropogenic noise can be highly variable by species. For example, experiments of playbacks to harbor porpoises elicited avoidance responses (Olesuik et al. 2002, Koschinski et al. 2003), but another to fin and blue whales did not elicit any obvious responses to sound (Croll et al. 2001). Hatsuonki (i.e., Oikami pipes), hollow steel pipes that have been historically used in Japanese drive fisheries, have been effective in moving killer whales and dolphins. They were recently used in an attempt to herd a humpback cow-calf pair in the Sacramento river delta in California (up to 72 nmi inland) back to sea but the response of the humpbacks was not consistent (Guland et al. 2008).

Based on the proposed source levels and received levels, the design of the experiments, and published literature, NMFS does not expect that target animals (individuals, populations or species) would be significantly impacted by the proposed playback sessions. No mortality or serious injury would be expected as a result of playback sessions. NMFS does not expect that whale hearing would be harmed or injured. Any behavioral impacts to target animals would likely be short-term and negligible. Consequently, the proposed research activities are not expected to adversely affect the survival, longevity, or lifetime reproductive success of target animals.

Summary of Effects of Playbacks

There is no evidence that responses of target animals would exceed short-term stress and discomfort and no long-term effects would be anticipated. The short-term behavioral responses that might result from research activities would not likely lead to mortality, serious injury, or disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the individual's likelihood of successful reproduction or survival would be substantially reduced. Therefore, NMFS does not believe disturbances from these activities are likely to reduce the reproduction, numbers, or distribution of these species. In addition, conditions and mitigation measures would be placed in the permit to further limit the potential for negative effects from playbacks.

Summary of Effects of Level B Harassment

Behavioral responses would be expected to vary from no response to diving, tail slapping, or changing direction. With experienced vessel drivers, any potential effect of vessel approach should be short-lived and minimal. These short-term behavioral responses would not likely lead to

mortality, serious injury, or disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the individual's likelihood of successful reproduction or survival would be substantially reduced. Annual reports submitted by the applicants under current and past permits indicate that conduct of activities resulting in level B harassment have not lead to mortality, serious injury, or disruption of essential behaviors such as feeding, mating, or nursing.

In addition to the mitigation measures identified by the applicants and described in Chapter 2.2, the permits, if issued, would contain conditions requiring the applicants to retreat from animals if behaviors indicate the approach may be interfering with reproduction, pair bonding, feeding, or other vital functions.

Level A harassment, as defined by the MMPA, would occur during genetic sampling and tagging activities, when physical contact is made that has the potential to injure animals. Actual injury would be minimized by measures identified by the applicants and described in Chapter 2.2 and conditions of the permits limiting how activities may occur, such as avoiding sensitive areas of the body during sampling and tag attachment and limiting the sound production and amount of time playbacks would be conducted.

Level B harassment, as described above, would occur concurrently with Level A harassment activities.

Biopsy sample collection
Biopsy sampling has been used extensively worldwide and is a common and widely accepted method for obtaining tissue samples, especially because the unequivocal value of molecular genetic tools and analyses has been recognized. The potential for serious injury and/or long-term effects on individuals from remote biopsy sampling is considered minimal. The biopsy darts would not contain any hazardous materials, and the penetration depth of the dart relative to the blubber depth, and the mitigation measures employed to prevent deeper penetration, make it highly unlikely that serious injury would occur to target individuals.

As with any instance where the dermis is penetrated, there is the possibility of infection associated with biopsy sampling. However, no evidence of infection has been seen at the point of penetration or elsewhere among the many whales re-sighted in days following the taking of a biopsy sample. There have been no documented cases of infection or injury to large whales resulting from biopsies, including well-monitored populations with repeatedly observed identified individuals.

Wounds heal quickly in cetaceans (Weller et al. 1997, Krützen et al. 2002, Parsons et al. 2003). In addition to naturally occurring coloration patterns, the marks used to identify individuals include healed wounds from predation attempts (see Heithaus 2001*a* for a review of predator interactions), inter- and intra-species interactions, barnacles, remora, entanglement, and vessel interactions. In Shark Bay, Australia, approximately 74% of non-calf bottlenose dolphins had shark bite scars (Heithaus 2001*b*). A recent permit application for capture of bottlenose dolphins in the Indian River Lagoon, Florida, indicated that wounds from the collection of a full-thickness skin and blubber wedge biopsy approximately 5 cm length x 3 cm width typically heal in 14-30 days. No known morbidity or mortality has been associated with these procedures as described (G. Bossart, File No. 14352). Biopsy samples collected in the proposed action would be approximately 5-9 mm

in diameter and 40-60 mm in depth from large whales and 10 mm in depth from small cetaceans; these relatively small wounds would be expected to heal in a similar time frame.

Reeb and Best (2006) collected deeper biopsy samples from Southern right whales (*E. australis*) of all age classes using a hand-held pole system. The longest (deepest) samples collected for that study were from two early season calves (11.7 and 12.4 cm), a late season calf (13.2 cm), an early season adult (18.6 cm), and a late season adult (21.2 cm). Behavioral reactions to this system of biopsy collection were no greater than those observed during use of the more superficial Paxarms biopsy system (Best et al. 2005). The greatest component of the behavioral reaction to pole sampling was to the close approach of the vessel (Reeb and Best 2006). The biopsy site was hardly visible following biopsy, with one exception. In that instance, a thin spray of blood was seen from the biopsy site of a neonate, who reacted by lifting its head and fluke, slapping the water surface with its fluke, and swimming away. The bleeding ceased within minutes and the neonate's behavior appeared normal (Reeb and Best 2006).

The only permit that would authorize biopsy sampling of large whale calves less than 6 months old is Permit No. 14585 (Pack); the applicant has requested authorization to biopsy sample humpback whale calves older than neonates. Jan Straley (Permit No. 14599) has requested to biopsy sample calves 4 to 12 months in age. No small cetaceans less than one year old would be biopsy sampled under any permit.

In the years that the applicants have been collecting biopsy samples, no known instance of an injury to a marine mammal has occurred. Bearzi et al. (2000) reported the death of a common dolphin following penetration of a biopsy dart and subsequent handling. The authors concluded that the biopsy dart did not produce a lethal wound, but that the biopsy darting and subsequent handling, perhaps in combination with potential pre-existing health conditions of the animal, produced physical and/or physiological consequences that were fatal to the animal. There is no evidence that the biopsy procedure or associated boat approaches, if conducted responsibly and by experienced individuals, has any significant impact on cetacean populations. Studies to date indicate no long-term consequences on survival, return rates, or fecundity.

Effects of biopsy sample collection on large whales

The effects of biopsy sampling and skin swabbing on the large whale species requested in the proposed action were analyzed in previous EAs prepared as described in Chapter 1.2 (NMFS 2004, 2005b, 2008). All of these analyses found that there would be no significant impact from issuance of the permits and amendments.

In addition to the effects of the close approach of a vessel to whales associated with collecting biopsy samples (described above), the analyses determined:

- No evidence of infection has been seen at the point of penetration of a biopsy dart or elsewhere among whales re-sighted following biopsy sampling.
- The responses of whales are generally minimal to non-existent when approaches are slow and careful, and even when subjected to invasive biopsy and tagging procedures, a careful approach generally elicits at most a minimal and short-lived response from the whales.

- Biopsy sampling would not be expected to have long-term, adverse effects on the target species; therefore disturbances from the activities were considered not likely to have a significant cumulative effect on any research animals.

Biopsy sampling has been conducted successfully with little or no behavioral reactions (e.g., Weinrich et al. 1991, 1992; Clapham and Mattila 1993; Brown et al. 1994; Gauthier and Sears 1999; Cerchio 2003); NMFS' Northeast Fisheries Science Center (NEFSC) has reported that most right whales darted during past research (80.6 percent; Brown et al. 1991) have shown no reaction. Those individuals that did react either responded by "flinching" or through a tail flick or dive. Whales that have been inadvertently biopsied more than once have been documented displaying either no response or short-term behavioral responses (Gauthier and Sears 1999), although Southern right whale cows in cow-calf pairs may react more strongly to inadvertent repeat sampling (Best et al. 2005).

Au's 2006 Annual Report for Permit No. 1000-1617 indicated that of 10 humpback whales biopsy sampled, none exhibited more than a mild behavioral response. A few strong reactions have been documented in humpback whales following biopsy procedures (Weinrich et al. 1991, 1992), but all involved unusual instances, such as a biopsy dart retrieval line being snagged on a fluke. Observations of whales in the days and years following darting indicated no long-term effects of the procedure. When reactions to biopsy sampling are observed, most individuals resume their normal behavior within a few minutes (Gauthier and Sears 1999).

There is no evidence that responses of individual whales to biopsy sampling would exceed short-term stress and discomfort and no long-term effects would be anticipated. The activities would not be expected to have any additional effects that were not analyzed in the previous EAs. The short-term behavioral responses that might result from research activities would not likely lead to mortality, serious injury, or disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the individual's likelihood of successful reproduction or survival would be substantially reduced. In addition, conditions and mitigation measures would be placed in the permit to further limit the potential for negative effects from these activities.

Effects of Biopsy Sampling Large Whale Calves and Mother/Calf Pairs
The effects of biopsy sampling young humpback whale calves, i.e., those animals less than six months of age, or females attending such calves, was previously analyzed for a permit issued to NMFS National Marine Mammal Laboratory (NMFS 2005a). The analysis found that there would be no significant impact from issuance of the amendment.

Studies indicate that mothers/calf pairs are no more sensitive to biopsy procedures than other groups, although mothers may be more evasive of approaching boats (Weinrich et al. 1991, 1992). Mother/calf pairs show qualitatively similar reactions to sampling as other animals, and in some cases mothers react significantly less than other age classes to the actual biopsy hit (Clapham and Mattila 1993), although Southern right whale cows in cow-calf pairs may react more strongly to inadvertent repeat sampling (Best et al. 2005). The potential for disturbance of mother/calf pairs lies not in the sampling, but rather in the associated vessel approach (Clapham and Mattila 1993). Similar to other age classes, changes in behavior associated with sampling have been observed to be momentary; the biopsied individual will almost always continue the

original behavior, or resume the behavior within a few minutes.

The main consideration for potential impacts from biopsy sampling calves and mother/calf pairs is the potential for the close presence of the vessel to disrupt the important mother/calf pair bond or otherwise interfere with mother or calf fitness or survival. There have been a number of studies that have collected biopsy samples from large whales, including calves, with the following results:

- Clapham and Mattila (1993) conducted a detailed, directed study of the effects of biopsy sampling on humpback whales, including individual calves less than 6 months old, and concluded "biopsies can be obtained from mothers and their calves with little effect on the animals." They analyzed behaviors before and after biopsy sampling, and the immediate reactions of 565 biopsied humpback whales (in addition to 427 misses). They found that most whales did not react (or did so minimally), and those behaviors, before and after, most often did not change. Additionally, mothers were the *least* likely to react to a biopsy hit, and calves reacted the same as non-calf whales that were not anticipating contact (*e.g.*, noncompetitive and not mothers). Minimal reaction has been observed in studies of biopsy-sampled calves (Clapham and Mattila 1993, Cerchio 2003). Calves reacted more to biopsy hits than mothers, principal escorts, challengers and secondary escorts, but not significantly different than all the other classes of whales (Clapham and Mattila 1993). In no instance was a calf ever observed to separate from a mother, and many hundreds of mothers and calves have been observed and biopsied. The reactions were always short-term and the mothers and calves resumed normal behavior after the sampling ended (Clapham and Mattila 1993).

- Gauthier and Sears (1999) studied reactions of three baleen whales species, including humpback, fin and blue whales, revealing differences between the species. The majority of fin and blue whales exhibited no behavioral response to biopsy sampling, including two fin whale calves biopsied. No strong reactions were observed for these species (Gauthier and Sears 1999). The majority of humpback responses were moderate, consisting of hard tail flicks. Of the humpback whale calves biopsied, 4 out of 7 had a moderate to low reaction while the rest had no reaction (Gauthier and Sears 1999). They also noted that reactions of whales typically lasted at the most only a few minutes.

- Minimal reactions of biopsied adult females, including mothers, have been observed in many studies (Weinrich et al. 1992; Clapham and Mattila 1993; Brown et al. 1994). Mothers reacted significantly less to the biopsy strike than all other classes combined (Clapham and Mattila 1993). Reactions were always short in duration.

- A study of the long-term effects of biopsy sampling Southern right whales found that the majority of cows that accompanied calves elicited a non-forceful fluke movement or lesser reaction (Best et al. 2005). Calves of cow/calf pairs on average showed a lesser response akin to a startle when biopsied (Best et al. 2005). Their data also suggested that cows may become more sensitive to repeated biopsy sampling within short time frames (less than 1 year) while this could not be detected in calves due to low sample sizes (Best et al. 2005). The authors also were unable to detect any difference in reproductive success or the

proportion of normal calving intervals based on whether an animal was biopsy sampled in the prior 2 years, but they caution this could be due to low sample sizes and statistical power. Despite this, no major effects to the population were detected and the authors cautiously approve of the biopsy sampling of southern right whale cow/calf pairs when done with care.

- The NEFSC has evaluated long-term impacts of biopsy sampling for humpback whale mothers and calves, and a similar analysis is underway for right whales. The humpback whale data indicates that survival of biopsied (n = 106) and unbiopsied (n = 112) calves is not significantly different. Similarly, the fecundity and return rates of biopsied adult females (n = 52) and unbiopsied mature females (n = 144) were not significantly different. The NEFSC has seen little effect from biopsy activities conducted on right and humpback whales both in the short and long term based on records maintained for biopsy operations. The available data suggest that in all cases, the activity has had little effect on right and humpback whales (Clapham et al. in prep).

- The NMFS National Marine Mammal Lab (NMML) is authorized to biopsy sample humpback, blue, fin, sei, bowhead, Southern right, and sperm whale calves less than six months of age and females accompanying them in Permit No. 782-1719-09. Annual reports indicate that no more than short-term behavioral responses (e.g., tail flick, dive) have been observed during sampling. The mother-calf bond has not been broken during sampling events.

Based on this information, NMFS expects that the effects of biopsy sampling large whale calves and females with calves would be similar to sampling adult large whales. These procedures would be expected to result only in short-term stress and discomfort and no long-term effects would be anticipated. Any behavioral impacts to this age class and pairing would likely be short-term and considered minimal. In addition, conditions and mitigation measures would be placed in the permit to further limit the potential for negative effects from these activities.

Effects of biopsy sample collection on dolphins [File No. 14682 only]
As with large whales, the effects expected from biopsy sampling dolphins would include behavioral reactions to close vessel approach (as described above) and responses to biopsy darts. During similar research conducted by NMFS Southwest Fisheries Science Center (SWFSC), reactions by individuals of various species to biopsy sampling generally have been low-level and short-lived, ranging from no visible response to a “startled” reaction sometimes followed by an animal swimming away or diving; individual animals were more likely to respond to the approach of the small boat than to the biopsy itself. Bowriding dolphins sampled from the main research vessel often continue to ride the bow after the biopsy sample has been collected. No known injuries or other significant effects have been observed during the two decades the SWFSC has conducted this type of sampling.

There is no evidence that responses of individual animals would exceed short-term stress and discomfort and no long-term effects would be anticipated. The activities would not be expected to have any additional effects that were not previously analyzed. The short-term behavioral responses that might result from research activities would not likely lead to mortality, serious

injury, or disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the individual's likelihood of successful reproduction or survival would be substantially reduced. In addition, conditions and mitigation measures would be placed in the permit to further limit the potential for negative effects from these activities.

Summary of effects of biopsy sample collection
The proposed activities would not be expected to result in more than short-lived, minimal harassment of individual animals of any age class or sex. No serious injury or mortality would be expected from these activities. Vessel collision during research is not likely to occur given the nature of the proposed activities, the researchers' experience in maneuvering boats around cetaceans, and the mitigating measures in the permit. Mitigating measures would also reduce the level of harassment to sensitive groups such as females with calves and repeated harassment of animals during all activities.

The proposed activities would not be expected to reduce the reproductive fitness or success of any cetacean. Re-sightings of sampled animals suggest that animals would not significantly alter their range or habitat use and that any wounds at the biopsy site would heal over time, resulting in no long-term adverse effects to individual health. The proposed biopsy activities would not likely lead to serious injury, mortality, or disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the individual's likelihood of successful reproduction or survival would be substantially reduced; therefore no stock- or species-level effects would be expected.

Effects of Tagging
In addition to the potential for behavioral responses to close approach (described above), potential effects to individuals targeted for tagging include behavioral responses to attachment of the tag, increased hydrodynamic drag, and the possibility for infection at the attachment site of tags that break the skin. In terms of size and weight, the tags proposed for use are approximately equal to or less than the tag units currently authorized for use, and would therefore be expected to create less hydrodynamic drag.

The proposed tagging activities would continue the use of the suction cup attached tags and implantable tags currently authorized by many of the permits and analyzed previously (NMFS 2004, 2005). As described in that analysis, the total in-water weight of tags would be limited to 0.1% of total body weight; tags described in the proposed action would not exceed this. The use of suction cup attached and implantable tags was analyzed in the original SPLASH EA (NMFS 2004), and NMFS determined that, in addition to any level B harassment resulting from the close approach to attach tags:

- Suction-cup attachments would be short-term (generally less than one day), and could be dislodged by the animal by maneuvering rapidly, breaching, or rubbing against a solid surface.
- The suction cup assembly could migrate along the skin of the whale, but because the tag would be attached caudal to the blowhole, movement would be toward the fluke of the animal and therefore would create no danger that the tag would cover the blowhole.
- The proportion of the tag assembly to the animal's size and weight would be such that any additional energetic demand created by hydrodynamic drag would likely be insignificant.

- Implantable tags would work their way out of the blubber in days to weeks after tagging, and the chance of infection would be expected to be extremely low.
- None of the attachment types would be likely to injure individuals or elicit more than a minimal, short-lived response from whales.

Fully implantable satellite tags would not be authorized in any of the permits. The partially implantable tags proposed for use by Straley would penetrate no deeper than 10 cm into the blubber layer. Whaling data determined the mean ± SD blubber thickness for 2,086 sperm whales longer than 15 m taken by the Soviet whaling ship Yuri Dolgorukiiy was 12.97 + 1.6 cm (Phil Clapham, pers. com. to Straley 2007). The mean ± SD blubber thickness for whales in the 12 – 13 m length class was 10.38 ± 1.14 cm, so even on smaller sperm whales the 10 cm penetration depth would not be likely to reach the muscle layer. Mate et al. (2007) concluded that there is no adverse risk associated with implanting a satellite tag as deep as the muscle layer.

The "dart" tags are medium-duration satellite tags (after Andrews et al. 2008) that attach using small, penetrating darts for an average of four weeks before backing out of the entrance holes. Applications of the "dart" tag unit on marine mammals indicate that it may remain attached for 14 weeks (Jay 2006). The tag would be expected to back out of the entry site leaving only small wounds that will heal rapidly. Signs of chronic inflammation have been observed at the dart site in two pilot whales, but after tag loss the penetration sites and surrounding tissue appeared to be granulation tissue (Hanson et al. 2008). The NMFS' SWFSC reported that three "dart" tags were applied to the dorsal fins of fin whales in 2008, and transmitted for 26, 34, and 86 days. Although follow-up photographs had not yet been obtained at the time of reporting, Hanson et al. (2008) have shown this tag type to have minimal long-term impact and generally only slight scarring evident around the tag implant site.

Exact dimensions and weights vary with tag generation and specific components (Table 2), but the ongoing trend is toward smaller, lighter tags. For example, the Crittercam 5.7 model weighs 0.7 kg, approximately 59% lighter than the earliest model employed by Pack. The tags described in the original EA (NMFS 2004) weighed up to approximately 500 g, and annual reports from the use of older tag models indicate that no known mortality or serious injury has arisen from their use under past permits. Duration of tag attachment would also vary based on tag types (Table 2), and might remain attached longer than tags described in the original EA (NMFS 2004). Tags attached with suction cups would be expected to remain attached for less than 72 hours and tags that use a mechanism to attach to blubber would be expected to remain attached for up to five months.

Tag configurations might include the use of VHF transmitters to aid researchers in locating tags, but the frequency range for these transmitters would be greater than 148 MHz. This is well above the known hearing range for marine mammals and turtles, and NMFS considers anything over 200 KHz to have no effects (A. Scholik-Schlomer, pers. comm. to K. Beard, Oct 2009), therefore VHF transmissions are not considered further.

There is no evidence that responses of individual whales would exceed short-term stress and discomfort and no long-term effects would be anticipated. The activities would not be expected to have any additional effects that were not previously analyzed. The short-term behavioral responses that might result from research activities would not likely lead to mortality, serious injury, or disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the

individual's likelihood of successful reproduction or survival would be substantially reduced. In addition, conditions and mitigation measures would be placed in the permit to further limit the potential for negative effects from these activities.

Effects of Suction Cup Tagging Large Whale Calves and Mother/Calf Pairs

Attaching suction cup tags to large whale calves less than six months of age and mother/calf pairs was not analyzed in previous EAs related to this action, but close approach to this age class was analyzed (NMFS 2004, 2005b, 2008). As described above, in addition to the potential for behavioral responses to close approach, potential effects to individuals targeted for suction cup tagging include behavioral responses to attachment of the tag and increased hydrodynamic drag. Potential effects to calves and mother/calf pairs would not be expected to differ from these effects. The proposed tags are small and lightweight (Burgess et al. 1998, Johnson and Tyack 2003), would not break the skin, and would be attached for less than 24 hours. Humpback whale calves are about 16 feet long and weigh about 2 tons at birth, roughly the size of adult beluga whales and some beaked whales.

Tagging of non-neonate humpback whale calves on the breeding grounds, as requested by Au and Zoidis, should not pose a significantly greater risk than standard approaches for level B harassment activities. Zoidis provided information in her permit application from years of data showing that calves are often separated from their resting mothers by up to 10-20 meters, and for up to 2-5 minutes at a time. Typical mother/calf behavior includes mothers resting subsurface, up to 10 meters or more deeper than the calf, while the calf surfaces to breathe (as it cannot hold its breath as long as its mother or the escort). Cartwright and Sullivan (2009) confirmed that during calf circling activities humpback mothers were at rest below the calf; that older (class 2) calves spent more time at rest or circling alone at the surface than younger calves, who spent more time in persistent travel; and that mothers were within one calf body length of their calf during 98% of all surfacings. Mothers and escorts stay submerged longer and typically escorts stay deeper. During this time, according to information provided by Zoidis, the mother is typically unaware of the calf's behavior while at the surface, and does not rouse in the majority of encounters during close approach with underwater divers or the boat. Additionally, calves often approach research divers and exhibit "curious" behaviors. On occasion, during times of "play" behavior, calves have approached and made contact with divers. This has not induced a reaction in the calves for longer than 1 minute, and the reaction is generally simply diving to join or to rest again with the mother (Zoidis, File No. 14353).

Eight humpback whales were tagged with implantable tags attached with a stainless steel anchoring system equipped with foldable barbs and a triangular sharp tip in the Cook Islands during 2006 and 2007; five of the tagged whales were females accompanied by calves. No noticeable immediate post-tagging reaction was observed for four of the whales, an increase in swimming speed was recorded for three, and a slight tail slap was seen for another whale (Hauser et al. 2010).

Baumgartner and Mate (2003) attached suction cup tags to two North Atlantic right whale calves while on the whales' feeding grounds and did not report strong reactions from the calves to tagging events or to the close approach of the research vessel, nor was a significant change in dive behavior seen as a result of the tagging event.

There is no evidence that responses of calves or mother-calf pairs would exceed short-term stress and discomfort and no long-term effects would be anticipated. The short-term behavioral

responses that might result from research activities would not likely lead to mortality, serious injury, or disruption of essential behaviors such as feeding, mating, or nursing, to a degree that the individual's likelihood of successful reproduction or survival would be substantially reduced. In addition, conditions and mitigation measures would be placed in the permit to further limit the potential for negative effects from these activities. The use of suction cup tags for remote behavioral observation would allow researchers to remain farther from animals while collecting data. As such, it is possible that the use of suction cup tags may result in a lower level of disturbance to calves and mother-calf pairs than would result from continuous close approach and behavioral tracking of mother-calf pairs by a research vessel.

Effects of Fishing Modifications

Modifications to fishing operations were analyzed in a 2009 SEA for an amendment to Straley's permit (473-1700-02; NMFS 2009), and the SEA determined that sperm whales would not be negatively affected from modification of fishing operations. Similar research is proposed in Straley's new permit application (File No. 14122).

During normal fishing operations, sperm whales are attracted to the fishing vessel to depredate (i.e., remove fish from commercial fishing gear) on prey. During research sets, sounds produced by the manipulation of mechanics of the vessel (e.g., cavitation noise generated from the propeller rotation speed) may attract additional sperm whales. No other added sound would be emitted into the environment; sounds produced by fishing operations would simply be produced individually rather than simultaneously.

The fishing modifications are part of the Southeast Alaska Sperm Whale Avoidance Project (SEASWAP), which is investigating sperm whale depredation on the sablefish longline fishery in Alaska. The study began in 2003 with a group of fishermen, managers and scientists (including the applicant) aiming to reduce sperm whale depredation as it results in an economic hardship for fishermen, as well as to reduce the risk of entanglement to sperm whales. When SEASWAP began, nothing was known about sperm whale foraging behavior in the higher latitudes of the North Pacific other than from commercial whaling data.

Over the past five years, SEASWAP has conducted research of increasing complexity resulting in insights about sperm whale depredation. Research on fishing modifications has been conducted by the applicant and reactions of whales have been published (Thode et al. 2007, Tiemann et al. 2006). It is apparent that cavitation noise generated from the propeller rotation speed produces a significant broadband acoustic signature which can be detected by marine mammals kilometers away. Based on the past studies, it is predicted that sperm whales would halt normal diving behavior when this sound is heard and mirror the path of the fishing vessel, closely approaching the vessel. Because whales approach vessels purposely during normal fishing operations, it is expected that whales would not experience additive negative effects specifically as a result of the proposed research.

The deployment of the underwater audio visual recording equipment on the longline would not add an increased risk to a whale interacting with the fishing vessel. The recovery and subsequent deployment of a longline attached with instruments (e.g., a camera) is exactly the same method as a fisherman uses (no additional lines or other gear besides the equipment attached to the line).

During fishing operations, including deployments of scientific instrumentation, it is possible that a whale could become entangled; however, this could occur regardless of research and it has been determined that there is no added increased risk of entanglement due to shortening length of gear set during research hauls.

During the 2009 field season no whales were observed arriving or departing the vessel due to fishing operation modifications. However, the acoustic record is still being analyzed and will provide more information to determine if whale behavior changed during fishing modifications.

4.3 SUMMARY OF COMPLIANCE WITH APPLICABLE LAWS, NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

As summarized below, NMFS has determined that the proposed research is consistent with the purposes, policies, and applicable requirements of the MMPA, ESA, and NMFS regulations. NMFS issuance of the permits and amendment would be consistent with the MMPA and ESA.

4.3.1 Endangered Species Act

This section summarizes conclusions resulting from consultation as required under section 7 of the ESA. The consultation process was concluded after close of the comment period on the applications to ensure that no relevant issues or information were overlooked during the initial scoping process summarized in Chapter 1. For the purpose of the consultation, the draft EA represented NMFS' assessment of the potential biological impacts. The consultation determined that the proposed action would not jeopardize any endangered species or destroy or modify any critical habitat (NMFS 2010).

4.3.2 Marine Mammal Protection Act

The applicants each submitted an application which included responses to all applicable questions in the application instructions. The requested research is consistent with applicable issuance criteria in the MMPA and NMFS implementing regulations. The views and opinions of scientists or other persons or organizations knowledgeable of the marine mammals that are the subject of the application or of other matters germane to the application were considered, and support NMFS's initial determinations regarding the applications.

The permits and amendment would contain standard terms and conditions stipulated in the MMPA and NMFS's regulations. As required by the MMPA, each permit would specify: (1) the effective date of the permit; (2) the number and kinds (species and stock) of marine mammals that may be taken; (3) the location and manner in which they may be taken; and (4) other terms and conditions deemed appropriate. Other terms and conditions deemed appropriate relate to minimizing potential adverse impacts of specific activities, coordination among permit holders to reduce unnecessary duplication and harassment, monitoring of impacts of research, and reporting to ensure permit compliance.

4.3.3 Magnuson-Stevens Fishery Conservation and Management Act

NMFS considered whether the proposed action might have the potential to adversely affect Essential Fish Habitat (EFH), and determined that the action will not affect EFH. Although impacts on habitat could result from playbacks, playbacks would be short in duration and not constant. The impacts of playbacks associated with the proposed action would be negligible and would not adversely affect EFH. Review of acoustic playback activities was requested from EFH Coordinators in the Alaska and Pacific Islands Regions. The Alaska Region indicated that they do not expect any adverse effects to EFH from activities conducted under File Nos. 13846 [Darling], 14599 [Sharpe], 14122 [Straley], or 14296 [Witteveen]; no further EFH consultation was required. The Pacific Islands Region did not indicate that adverse effects to EFH would result from activities conducted under File Nos 14296 [Au] or 13846 [Darling].

4.3.4 National Marine Sanctuaries Act

Permits have been or will be obtained to conduct research in the Sanctuaries associated with each applicant.

4.3.5 Convention on International Trade in Endangered Species of Wild Fauna

Permits have been or will be obtained from the US Fish and Wildlife Service to authorize under CITES the import/export activities included in this action.

4.4 COMPARISON OF ALTERNATIVES

Many of the activities described in the proposed action are currently authorized under existing permits, and as such are included in the baseline of the No Action alternative. The Proposed Action would increase take numbers for some species (see Appendices), and if all requested takes were to be used, may result in a small amount of additional disturbance. The Proposed Action does not represent a substantial increase in the harassment of marine mammals in the action area, but would extend the duration of harassment for five years beyond what is currently authorized. The potential for adverse impacts on the human environment is not greater under the Proposed Action than under the No Action alternative.

4.5 MITIGATION MEASURES

In addition to the measures identified by researchers in their application and otherwise considered "good practice or protocol", all NMFS marine mammal and sea turtle research permits contain conditions intended to minimize the potential adverse effects of the research activities on the animals. These conditions are based on the type of research authorized, the species involved, information in the literature and from the researchers about the effects of particular research techniques and the responses of animals to these activities.

A full list of permit conditions is available in the permits; conditions would include:

- Limitations on activities authorized for specific age classes and species.
- Requirements for Researchers to suspend permitted activities in the event serious injury or mortality of protected species occurs or authorized take is exceeded.
- Requirements for Researchers to exercise caution when approaching animals and retreating if behaviors indicate the approach may be interfering with reproduction, feeding, or other vital functions.
- During authorized activities on females with calves:
    - Termination of efforts if there is any evidence that the activity may be interfering with pair-bonding or other vital functions.
    - Not positioning the research vessel between the mother and calf.
    - Approaching mothers and calves gradually to minimize or avoid startle response.
    - Not approaching mothers or calves while the calf is actively nursing.
    - Sampling the calf first to minimize the mother's reaction.
- Requirements for Researchers to take reasonable measures to avoid unintentional repeated tagging or biopsy sampling of any individual (e.g., compare photo-identifications).
- Limitations on the number of attempts that would be made to tag or biopsy sample an individual.

- Requirements that Researchers not attempt to biopsy or tag a cetacean anywhere forward of the pectoral fin.
- Requirements to discontinue attempts to attach tags or collect biopsy samples if an animal exhibits repetitive strong adverse reactions to the activity or the vessel.

All permit holders would also be required to notify the appropriate Assistant Regional Administrator(s) for Protected Resources in the NMFS Region(s) where they would be conducting field work, and to coordinate planned activities with those of other permitted researchers conducting similar activities in the area.

4.6 UNAVOIDABLE ADVERSE EFFECTS

The mitigation measures imposed by permit conditions are intended to reduce, to the maximum extent practical, the potential for adverse effects of the research on the targeted species as well as any other species that may be incidentally harassed.

4.7 CUMULATIVE EFFECTS

Cumulative effects are defined as those that result from incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency (federal or nonfederal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions that take place over a period of time.

4.7.1 Vessel Interactions: Ship Strikes

Collisions with commercial ships are an increasing threat to many large whale species, particularly as shipping lanes cross important large whale breeding and feeding habitats or migratory routes. Many types and sizes of vessels have been involved in ship strikes, including container/cargo ships/freighters, tankers, steamships, U.S. Coast Guard (USCG) vessels, U.S. Navy vessels, cruise ships, ferries, recreational vessels, fishing vessels, and whale watching vessels (Jensen and Silber 2003).

Vessel speed (if recorded) at the time of a large whale collision has ranged from 2 to 51 knots (Jensen and Silber 2003). A summary paper on ship collisions and whales by Laist et al. (2001) reported that, of 28 recorded collisions causing lethal or severe injuries to whales, 89 percent involved vessels traveling at 14 knots or faster, and the remaining 11 percent involved vessels traveling at 10 to 14 knots; none occurred at speeds below 10 knots, although there is a predicted 45 percent chance of death or serious injury to the whale at 10 knots (Pace and Silber 2005). New regulations (discussed in Section 4.7.3) requiring vessels to slow down in certain circumstances may reduce the likelihood of future vessel collisions with large whales.

Collisions occur off almost every U.S. coastal state, but strikes are most common along the east coast, followed by the west coast and Alaska/Hawaii (Jensen and Silber 2003). The 2008 and 2009 U.S. Pacific Marine Mammal Stock Assessments (Caretta et al. 2008, 2009) report:

- Ship strikes were implicated in the deaths of at least two humpback whales in 1993, one in 1995, and one in 2000. One humpback was reported injured as the result of a ship strike in 2005 and another in 2007, but the fate of both animals is unknown and details are lacking to determine if they were serious injuries.

- Ship strikes were implicated in the deaths of blue whales in 1980, 1986, 1987, 1993, 2002 and 2004; four deaths were attributed to ship strikes in 2007. In addition, there was one blue whale injured as the result of a ship strike in 2003 (blood observed in the water).
- Ship strikes were implicated in the deaths of seven fin whales and the injury of another in CA/OR/WA from 2002 to 2006 (NMFS, unpublished stranding data),
- A ship strike mortality was reported for a sei whale in Washington in 2003 (NMFS Northwest Regional Office, unpublished data).
- Twelve injuries and one mortality of unidentified large whales were reported from 2002-2006.

Based on a recent estimate of the mortality rate and records of ship strikes to large whales, scientists estimate that less than one-quarter (17 percent) of ship strikes are actually detected (Kraus et al. 2005). Incidences of ship strikes on large whales in the proposed action area are difficult to quantify because not all whales that are hit will strand, and if they do, there is not always a clear indicator of the cause of death or injury.

4.7.2 Vessel Interactions: Marine Mammal Watching

Commercial and private vessels engaged in marine mammal watching or other recreational activities have the potential to impact cetaceans in the proposed action area. A study of whale watch activities worldwide found that the business of viewing whales and dolphins in their natural habitat has grown rapidly over the past decade into a billion dollar (U.S. dollars) industry involving over 80 countries and territories and over 9 million participants (Hoyt 2001). In 1988, a workshop sponsored by the Center for Marine Conservation (CMC) and NMFS was held to review and evaluate whale watching programs and management needs (CMC and NMFS 1988). Several recommendations were made to address concerns about the harassment of marine mammals during wildlife viewing activities including the development of regulations to restrict operating thrill craft near cetaceans, swimming and diving with the animals, and feeding cetaceans in the wild.

Although marine mammal watching is considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational, and scientific benefits, it is not without potential negative impacts. One concern is that animals may become more vulnerable to vessel strikes once they habituate to vessel traffic (Swingle et al. 1993; Wiley et al. 1995). Another concern is that preferred habitats may be abandoned if disturbance levels are too high. In the Notice of Availability of Revised Whale Watch Guidelines for Vessel Operations in the Northeastern United States (64 FR 29270; June 1, 1999), NMFS noted that whale watch vessel operators seek out areas where whales concentrate, which has led to numbers of vessels congregating around groups of whales, increasing the potential for harassment, injury, or even the death of these animals.

Several recent research efforts have monitored and evaluated the impacts of people closely approaching, swimming, touching, and feeding marine mammals and have suggested that marine mammals are at risk of being disturbed ("harassed"), displaced, or injured by such close interactions. It is a concern that mammals may avoid preferred habitat altogether if the disturbance in that area is too high. Researchers are reporting boat strikes, disturbance of vital behaviors and social groups, separation of mothers and young, abandonment of resting areas, and habituation to humans (Kovacs and Innes 1990; Kruse 1991; Wells and Scott 1997; Samuels and Bejder 1998;

Bejder et al. 1999; Colborn 1999; Cope et al. 1999; Mann et al. 2000; Samuels et al. 2000; Boren et al. 2001; Constantine 2001; Nowacek et al. 2001). More recently, a study conducted by Weinrich and Corbelli (2009) suggests that whale watching does not result in long-term impacts to humpback whales. The authors found that whale watching in New England waters did not negatively affect long-term calving rates of females, calf survival during the first two years of life, or a female's reproductive success in a given year.

4.7.3 Conservation Efforts

Some human activities result in beneficial impacts to the target cetacean species, including guidelines that encourage responsible, safe viewing of protected animals by the public, regulations that reduce the potential for harmful interactions with aircraft and vessels, and conservation efforts to reduce interactions with commercial fisheries. NMFS has launched an education and outreach campaign to provide commercial boat operators and the general public with responsible marine mammal viewing guidelines. Each NMFS region provides guidelines for the public's viewing of marine wildlife. Viewing distances vary slightly by region, but NMFS generally recommends the public remain at least 50 to 100 yards away from protected marine mammals.

In addition to the viewing guidelines, federal regulations (50 CFR 224.103) prohibit vessels from approaching humpback whales within 100 yards in Alaska and Hawaii or from approaching right whales within 500 yards. There are a few exceptions to these regulations, such as permitted researchers, but whale-watching vessels must maintain the regulatory distance. These regulations on vessel approaches have reduced the potential for temporary, perhaps relatively minor, effects on these whales. However, recent collisions between whale-watching boats and a humpback (2001) and a minke whale (1998) illustrate that death or serious injury is still possible.

In November 2006, NMFS established a set of recommended vessel routes in four locations to reduce the likelihood of collisions in key right whale habitats. In October 2008, NMFS issued new regulations to reduce the likelihood of vessel collisions with North Atlantic right whales. The regulations implement speed restrictions of 10 knots or less for vessels 65 feet and greater in certain areas and at certain times of the year along the U.S. Atlantic seaboard that correspond to right whale occurrence. Exempted from the rule are state enforcement vessels and U.S. Government vessels, which must follow guidance provided under ESA section 7 consultations. The rule also contains a provision exempting vessels from speed restrictions in poor sea and weather conditions, thereby ensuring safe vessel maneuverability under those special conditions. The rule also provides for establishment of temporary, voluntary dynamic management areas (DMAs) in times and/or areas where the seasonal management measures are not in effect and where whales occur. In these locations, mariners would have the option to cross through the DMA at a speed no greater than 10 knots, or to route around the area.

Following four blue whale deaths attributed to ship strikes in 2007, NOAA implemented a plan designed to reduce these deaths using NOAA weather radio and U.S. Coast Guard advisory broadcasts to mariners entering the Santa Barbara Channel to be observant for whales and recommended that they transit the channel at 10 knots or less. The Channel Islands National Marine Sanctuary also developed a blue whale/ship strike response plan, which involved weekly overflights to record whale locations. Additional plan information can be found at http://channelislands.noaa.gov/focus/alert.html.

NMFS also strives to reduce the injuries and deaths of large whales as a result of incidental entanglement in commercial fisheries. The Atlantic Large Whale Take Reduction Team (ALWTRT) is one of several TRTs established by NMFS to help develop plans to mitigate the risk to marine mammals posed by fishing gear. TRTs were established as advisory teams under the MMPA. The ALWTRT's plan consists of a combination of regulatory and non-regulatory programs, including broad gear modifications, time-area closures, expanded disentanglement efforts, extensive outreach efforts in key areas, gear research, and an expanded right whale surveillance program to supplement the Mandatory Ship Reporting System.

4.7.4 Commercial Whaling and Subsistence Hunting

The target large whale populations were the subject of commercial whaling to varying degrees for hundreds of years. The development of steam-powered boats in the late 19th century, coupled with the use of the forward-mounted gun-fired harpoon, made it possible to more efficiently kill and tow ashore the larger baleen whale species such as blue, fin, and minke whales. Earliest efforts to end commercial whaling included a ban by the League of Nations in the mid-1930s and the formation of the International Convention for the Regulation of Whaling in 1946. Prior to current prohibitions on whaling, such as the IWC's moratorium, most large whale species had been depleted to the extent that it was necessary to list them as endangered under the ESA.

The industry caused significant declines in several of the target species' populations. Over 28,000 humpback whales were taken by commercial whalers during the 20th century (Rice 1978). Before its protection by the IWC in 1966, whalers took approximately 9,500 blue whales throughout the North Pacific over a span of 55 years, beginning in 1910 (Ohsumi and Wada 1972). Commercial whaling severely depleted the Eastern gray whale population between the mid-1800s and early 1900s. Sei whales were estimated to have been reduced to 20% of their pre-whaling abundance in the North Pacific (Tillman 1977). Over 3,000 blue whales were taken by whalers in the Eastern North Pacific during the early 1900s (Carretta et al. 2007). At least 20,000 Bryde's and 436,000 sperm whales were harvested in the North Pacific (Best 1976; Ohsumi 1980; Brownell 1998; Kasuya 1998; Carretta et al. 2008).

Native tribes have an IWC subsistence quota for Eastern gray whales. The annual subsistence take averaged 122 whales by foreign and national tribes from 1999 to 2003, which does not exceed the PBR for this stock (Angliss and Allen 2009).

4.7.5 Entrapment and Fishing Gear Entanglement

Because the occurrence of some large whales can overlap with frequented fishing areas, gear entanglements are common and can cause death by drowning or serious injuries such as lacerations, which in turn can lead to severe infections. Injuries and entanglements that are not initially lethal may result in a gradual weakening of entangled individuals, making them more vulnerable to some other direct cause of mortality (Kenney and Kraus 1993). For example, entanglement may reduce a whale's ability to maneuver, making it more susceptible to ship strikes. Entanglement-related stress may decrease an individual's reproductive success or reduce its life span, which may in turn depress population growth.

Annual fishery related mortality and serious injury is described in the 2008 Pacific Marine Mammal Stock Assessment Reports. The estimated minimum annual mortality rate of gray whales incidental to U.S. commercial fisheries (6.7 whales) does not exceed 10 percent of the PBR for the stock and, therefore, is considered to be insignificant and approaching a zero mortality and serious injury rate (Angliss and Allen 2009). In the North Pacific, on average ≥2.6 humpback (Carretta et al. 2008) 0.2 bowhead, 0.23 fin, 0.32 minke, and 2 sperm (Angliss and Allen 2009) whale deaths result from fishery interactions each year.

The number of deaths attributed to fishing gear interactions may be grossly underestimated. In many cases, veterinarians and researchers are unable to determine a cause of death from a whale carcass. Another possibility is that some whales become entangled, drown, and fail to resurface, so their carcasses are never recovered and examined.

4.7.6 Habitat Degradation

Some researchers have correlated contaminant exposure to possible adverse health effects in marine mammals. Organochlorines are chemicals that tend to bioaccumulate through the food chain, thereby increasing the potential of exposure to a marine mammal via its food source. During pregnancy and nursing, some of these contaminants can be passed from the mother to developing offspring. Contaminants like organochlorines do not tend to accumulate in significant amounts in invertebrates, but do accumulate in fish and fish-eating animals. Thus, contaminant levels in planktivorous mysticetes have been reported to be one to two orders of magnitude lower compared to piscivorous odontocetes (Borell 1993; O'Shea and Brownell 1994; O'Hara and Rice 1996; O'Hara et al. 1999). Chronic exposure to the neurotoxins associated with paralytic shellfish poisoning (PSP) via contaminated zooplankton prey has been shown to have detrimental effects on marine mammals. Estimated ingestion rates are sufficiently high enough to suggest that the PSP toxins are affecting marine mammals, possibly resulting in lower respiratory function, changes in feeding behaviour, and a lower reproductive fitness (Durbin et al. 2002).

Anthropogenic activities, such as emitting discharge from wastewater facilities, dredging, ocean dumping and disposal, aquaculture, and coastal development are also known to have deleterious impacts on marine mammals and their prey's habitat, ultimately affecting the animals themselves. Point source pollutants from coastal runoff, at sea disposal of dredged material and sewage effluents, oil spills, as well as substantial commercial and recreational vessel traffic and impacts of fishing operations continue to negatively affect marine mammals in the proposed action areas.

4.7.7 Noise

The impacts of noise pollution and the increasing level of anthropogenic noise are growing concerns that may affect cetacean communication (Carretta et al. 2001). Animals inhabiting the marine environment are continually exposed to many sources of sound. Naturally occurring sounds such as lightning, rain, sub-sea earthquakes, and animal vocalizations (*e.g.*, whale songs) occur regularly.

There is evidence that anthropogenic noise has substantially increased the ambient level of sound in the ocean over the last 50 years. Much of this increase is due to increased shipping as ships become larger and more numerous. Commercial fishing vessels, cruise ships, transport boats, airplanes, helicopters and recreational boats all emit sound into the ocean. The military uses

acoustics to test the construction of new vessels as well as for naval operations, and has recently requested MMPA 101(a)(5)(A) authorization for activities in the Hawaii Range Complex, as well as having been issued Incidental Harassment Authorizations (IHAs) for prior training activities in this vicinity.

In some areas where oil and gas production takes place, noise originates from the drilling and production platforms, tankers, vessel and aircraft support, seismic surveys, and the explosive removal of platforms. Many researchers have described behavioral responses of marine mammals to sounds produced by helicopters and fixed-wing aircraft, boats and ships, as well as dredging, construction, and geological explorations (Richardson 1995). Most observations have been limited to short-term behavioral responses, which included cessation of feeding, resting, or social interactions. Several studies have demonstrated short-term effects of disturbance on humpback whale behavior (Hall 1982; Baker et al. 1983; Krieger and Wing 1984; Bauer and Herman 1986), but the long-term effects, if any, are unclear or not detectable.

The marine mammals and their prey that occur in the proposed action area are regularly exposed to these types of natural and anthropogenic sounds. Marine mammals can be found in areas of intense human activity, suggesting that some individuals or populations may tolerate, or have become habituated to, certain levels of exposure to noise (Richardson 1995). Impacts may be chronic, resulting in behavioral changes that can stress the animal and ultimately lead to increased vulnerability to parasites and disease. The net effect of disturbance is dependent on the size and percentage of the population affected the ecological importance of the disturbed area to the animals, and the parameters that influence an animal's sensitivity to disturbance or the accommodation time in response to prolonged disturbance (Geraci and St. Aubin 1980).

4.7.8 Climate and Ecosystem Change

The extent to which climate and/or ecosystem changes impact the target cetacean species is largely unknown. However, NMFS recognizes that such impacts may occur based on the biology, diet, and foraging behavior of dolphins and whales. Interannual, decadal, and longer time-scale variability in climate can alter the distribution and biomass of prey available to large whales. The effects of climate-induced shifts in productivity, biomass, and species composition of zooplankton on the foraging success of planktivorous whales have received little attention. Such shifts in community structure and productivity may alter the distribution and occurrence of foraging whales in coastal habitats and affect their reproductive potential as well. Similar shifts in prey resources could likewise impact large whales if climate change alters the density, distribution, or range of prey.

4.7.9 Incidental Harassment Authorizations

In addition to scientific research permits, NMFS issues Letters of Authorization (LOAs) and Incidental Harassment Authorizations (IHAs) under the MMPA for the incidental take of marine mammals. As of June 1, 2010, there are five active LOAs (File Nos. 14469, 14536, 14566, 15231, and 15438) and seven active IHAs (File Nos. 13333, 14426, 14518, 14530, 14568, 14927, and 15345) in the Pacific, and nine active LOAs (File Nos. 14559, 14588, 14600, 14649, 15132, 15282, 15293, 15344, and 15377) and three active IHAs (File Nos. 14299, 14491, and 14615) in the Atlantic.

4.7.10 Other Scientific Research Permits and Authorizations

Marine mammals have been the subject of field studies for decades. The primary purposes of most studies are monitoring populations and gathering data for behavioral and ecological studies. Over time NMFS has issued dozens of permits for the take of marine mammals by harassment from a variety of activities, including aerial and vessel surveys, photo-identification, remote biopsy sampling, attachment of scientific instruments, and acoustic playbacks in the Atlantic, Pacific, and Southern Oceans. One permit (NMFS Marine Mammal Health and Stranding Response Program, File No. 932-1905) authorizes the take of stranded or distressed marine mammals, including disentangling whales.

The number of permits and associated takes by harassment indicate a high level of research effort of some endangered marine mammal species in the proposed action area. This is due, in part, to intense interest in developing appropriate management and conservation measures to recover these species. Given the number of permits, associated takes and research vessels and personnel present in the environment, repeated disturbance of individual large whales is likely to occur in some instances, particularly in coastal areas (due to the proximity to shore). It is difficult to assess the effects of such disturbance. However, NMFS has taken steps to limit repeated harassment and avoid unnecessary duplication of effort through permit conditions requiring coordination among permit holders. NMFS would continue to monitor the effectiveness of these conditions in avoiding unnecessary repeated disturbances.

Many of the active permits (Appendix K) will expire before the proposed permits and amendment can be issued or shortly thereafter (within approximately 6 months). As permits expire, the level of impact on each species would gradually decrease, assuming that none of the active permits are amended to increase take activities. NMFS expects that some researchers, such as NMFS Science Centers, which are mandated to assess the status of U.S. marine mammal stocks, will request new permits, or renewals, to continue their work once the current permit expires. NMFS cannot predict with certainty the level of take of each species that may be requested in the future but, conservatively, expects the amount of future research to be similar to or slightly greater than current levels as interest in marine conservation, biology, and management of these species grows.

A total of 35 permits authorize the harassment of one or more of the target cetacean species in the action area (Appendix K). Seven of these permits would be replaced by permits in the Proposed Action. Permits in Appendix K are identified by ocean basin, but each permit authorizes a smaller study area or region within an ocean basin, reducing the chance of repeated harassment of individual whales by researchers. Most of this research does not overlap in area or timing. Some spatial overlap exists for research on species with known feeding or breeding grounds, such as humpback whales. The majority of the takes authorized by these permits are for Level B harassment that will result in no more than disturbance to the target species.

In addition to these permits, 28 Letters of Confirmation (LOC) under the General Authorizations have been issued for at least one of the target species in the action area; these LOCs confirm that the research will result in no more than Level B harassment of non-ESA marine mammals. Unlike research permits, LOCs do not authorize activities or associated take numbers for the target species but rather only confirm that the activities will not result in Level A harassment.

Six of the permits are currently operating under a one-year extension (Appendix K); an extension does not authorize additional takes of the target species but allows researchers to use authorized takes remaining from the last year of the permit for an additional 12 months or until the remaining takes have been exhausted, whichever occurs first.

In addition to the active permits, NMFS Office of Protected Resources is processing seven permit requests to conduct research on one or more of the target species/stocks in the action area. At least three of these requests are from current permit holders whose permit is set to expire by the end of 2010 or permit holders that have recently had a permit expire. ESA section 7 consultations and NEPA analyses will be completed for these requests as required.

None of the active research permits authorize activities likely to result in the serious injury or mortality of any animal. Further, no such incidences have been reported by permitted cetacean researchers. Therefore, the number of takes proposed by the applicants is not expected to result in a significant adverse impact on the target species, especially considering many of the takes are authorized by current permits. In addition, all permits issued by NMFS for research on protected species, including the proposed permits and amendment, contain conditions requiring the Permit Holders to coordinate their activities with the NMFS regional offices and other Permit Holders conducting research on the same species in the same areas, and, to the extent possible, share data to avoid unnecessary duplication of research and disturbance of animals.

NMFS acknowledges that repeated disturbance of some individual large whales could occur. However, NMFS expects that the temporary harassment of individuals would dissipate within minutes, and therefore animals would recover before being targeted for research by another Permit Holder. Further, NMFS has taken steps to limit repeated harassment and avoid unnecessary duplication of effort through permit conditions requiring coordination among Permit Holders. Coordination between humpback researchers in Hawaii is facilitated by the requirement to fly a clearly visible triangular pennant from the research vessels and to obtain a research permit from the state of Hawaii. NMFS would continue to monitor the effectiveness of these conditions in avoiding unnecessary repeated disturbances.

It is also important to note that many of the target whales are migratory and may transit in and out of U.S. waters and the high seas. NMFS does not have jurisdiction over the activities of individuals conducting field studies in other nations' waters, and cumulative effects from all scientific research on these species across the Proposed Action area cannot be fully assessed. However, where possible, NMFS attempts to collaborate with foreign governments to address management and conservation of these transboundary ESA-listed species.

4.7.11 Summary of cumulative effects

The activities noted above are likely to have some level of impact on marine mammal populations in the Proposed Action area, particularly where ESA-listed (endangered and threatened) and MMPA-depleted species are involved. Although the target species are impacted by a number of human activities, it is important to note that these activities are not occurring simultaneously on the same individuals of a population/stock on a daily basis and most human impacts are not known to cause serious injury or mortality of dolphins and whales. Further, the target species are not

exposed to all human activities at all times, particularly given the migratory nature of some species.

The short-term stresses (separately and cumulatively with other environmental stresses) resulting from the proposed research activities would be expected to be minimal to targeted animals. Behavioral reactions suggest that harassment is brief, lasting minutes, before animals resume normal behaviors. NMFS expects any effects of harassment to dissipate before animals could be harassed by other human activities. Significant cumulative impacts are not expected since no serious injury or mortality is expected (resulting in no direct loss of animals from the population) nor is an appreciable reduction in the fecundity of target individuals. Therefore, the proposed research would contribute a negligible increment of harassment over and above the effects of the baseline activities currently occurring in the marine environment of the proposed action area over the life of the permits.

Although the effects of repeated or chronic disturbance from scientific research activities should not be dismissed, the potential long-term benefits and value of information gained on these species also must be considered. The proposed research would provide valuable information on these species' biology and ecology that in turn may be used to improve their management and reduce the effects of human activities on these populations.

CHAPTER 5 LIST OF PREPARERS AND AGENCIES CONSULTED

This document was prepared by Kristy Beard with the Permits, Conservation and Education Division of NMFS' Office of Protected Resources in Silver Spring, Maryland.

The National Marine Sanctuary Program was consulted for activities that would be conducted in the Hawaiian Islands Humpback Whale National Marine Sanctuary and the Olympic Coast National Marine Sanctuary.

NMFS Office of Habitat Conservation in the Alaska and Pacific Islands Regions were consulted for activities involving active acoustics in Essential Fish Habitat.

LITERATURE CITED

Andrews, R.D., Mazzuca, L., Matkin, C.O. 2005. Satellite tracking of killer whales. In: synopsis of Research on Steller Sea Lions: 2001 – 2005. Edited by T.R. Loughlin, D.G. Calkins, and S. Atkinson.

Andrews RD, Pitman RL, Ballance LT. 2008. Satellite tracking reveals distinct movement patterns for Type B and Type C killer whales in the southern Ross Sea, Antarctica. Polar Biology 31(12):1461-1468.

Angliss, R.P. and B.M. Allen. 2009. Alaska marine mammal stock assessments, 2008. U.S. Dep. Commer., NOAA Tech. Memo. NMFS AFSC-193, 258 pp.

Angliss, R.P. and R.B. Outlaw. 2008. Alaska marine mammal stock assessments, 2007. U.S. Dep. Commer., NOAA Tech. Memo. NMFS AFSC-180, 263 pp.

Angliss, R.P. and R.B. Outlaw. 2007. Alaska marine mammal stock assessments, 2006. U.S. Dep. Commer., NOAA Tech. Memo. NMFS AFSC-168, 255 pp.

Angliss, R. P., and R. B. Outlaw. 2005. Alaska marine mammal stock assessments, 2005. U.S. Dep. Commer., NOAA Tech. Memo. NMFSAFSC-161, 250 p.

Au, W. W. L., et al. 2006. Acoustic properties of humpback whale songs. Journal of the Acoustical Society of America 120(2): 1103-1110.

Baird RW, Lingon AD, Hooker SK (2000) Sub-surface and night-time behavior of humpback whales off Maui, Hawaii: A preliminary report. Report No. Report prepared under Contract #40ABNC050729 from the Hawaiian Islands Humpback Whale National Marine Sanctuary, Kihei, HI to the Hawaii Wildlife Fun, Paia, HI, Hawaiian Islands Humpback Whale National Marine Sanctuary, Paia, Hawaii.

Baker, C. S. 1985. The population structure and social organization of humpback whales (Megaptera novaeangliae) in the central and eastern North Pacific. PhD, Unpublished doctoral dissertation, University of Hawaii, Honolulu.

Baker, C.S. and L.M. Herman. 1987. Alternative population estimates of humpback whales (Megaptera novaeangliae) in Hawaiian waters. Canadian Journal of Zoology 65(11): 2818-2821.

Baker, C.S., L.M. Herman, B.G. Bays and G.B. Bauer. 1983. The impact of vessel traffic on the behavior of humpback whales in southeast Alaska: 1982 season. Report submitted to the National Marine Mammal Laboratory, Seattle, WA, 78 pp.

Baker, C.S., S.R. Palumbi, R.H. Lambertsen, M.T. Weinrich, J. Calambokidis, and S.J. O'Brien. 1990. Influence of seasonal migration on geographic distribution of mitochondrial DNA haplotypes in humpback whales. Nature 344:238-240.

Balcomb, K., and G. Nichols. 1978. Western North Atlantic humpback whales. Rep. Int. Whal. Comm. 28:159-164.

Barlow, J. 1994. Abundance of large whales in California coastal waters: a comparison of ship surveys in 1979/80 and in 1991. Report to the International Whaling Commission. 44: 399-406.

Barlow, J. 1997. Preliminary estimates of cetacean abundance off California, Oregon, and Washington based on a 1996 ship survey and comparisons of passing and closing modes. Admin. Rept. LJ-97-11 available from Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA. 25 pp.

Barlow, J. 2003. Cetacean abundance in Hawaiian waters during summer/fall 2002. Admin. Rep. LJ-03-13. Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037.

Barlow J and Cameron GA. 2003. Field experiments show that acoustic pingers reduce marine mammal bycatch in the California drift gill net fishery. Mar Mamm Sci 19:265-283.

Barlow, J. and P.J. Clapham 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecology 78: 535-546.

Barlow, J. and K.A. Forney. 2007. Abundance and population density of cetaceans in the California Current ecosystem. Fishery Bulletin 105:509-526.

Bauer, G.B. and L.M. Herman. 1986. Effects of vessel traffic on the behavior of humpback whales in Hawaii. Report Submitted to NMFS Southwest Region, Western Pacific Program Office, Honolulu, HI. 151 pp.

Baumgartner, M.F. and B.R. Mate. 2003. Summertime foraging ecology of North Atlantic right whales. Marine Ecology Progress Series 264:123-135.

Bearzi G. 2000. First report of a common dolphin (Delphinus delphis) death following penetration of a biopsy dart. Journal of Cetacean Resource Management 2(3):217-221.

Bejder, L., S.M. Dawson, and J.A. Harraway. 1999. Responses by Hector's dolphins to boats and swimmers in Porpoise bay, New Zealand. Mar. Mamm. Sci., 15(32):738-750.

Berzin, A. A., and A. A. Rovnin. 1966. The distribution and migrations of whales in the northeastern part of the Pacific, Chukchi and Bering Seas. Izvestiya Tikhookeanskogo Nauchno-Issledovatel'skogo Institut Rybnogo Khozyaistva I Okeanografii 58:179-207. (Translated by Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, Seattle, 1968, pp. 103-136. In K. I. Panin (ed.), Soviet Research on Marine Mammals of the Far East.)

Best, P. B. 1976. A review of world sperm whale stocks. Paper ACMRR/MM/SC/8 Rev. 1, FAO Scientific Consultation of Marine Mammals, Bergen, Norway.

Best PB, Reeb D, Rew MB, Palsboll P, J., Schaeff C, Brandao A. 2005. Biopsying Southern right whales: Their reactions and effects on reproduction. Journal of Wildlife Managment 69(3):1171-1189.

Borell, A. 1993. PCB and DDTs in blubber of cetaceans from the northeastern north Atlantic. Marine Pollution Bulletin 26:146-151.

Boren, L.J., N.J. Gemmell, and K. Barton. 2001. Controlled approaches as an indicator of tourist disturbance on New Zealand Fur Seals (Arctocephalus forsteri). Page 23 in Abstracts of the Southern Hemisphere Marine Mammal Conference 2001, Victoria, Australia, May 29-June 1, 2001.

Brown, M.W., S.D. Kraus, and D.E. Gaskin. 1991. Reaction of right whales (Eubalaena glacialis) to skin biopsy sampling for genetics and pollutant analysis. Repts. Intl. Whaling Commn., Special Issue 13:81-89.

Brown, M.W., Corkeron, P.J., Hale, P.T., Schultz, K.W. and Bryden, M.M. 1994. Behavioral responses of east Australian humpback whales Megaptera novaeangliae to biopsy sampling. Mar. Mamm. Sci. 10(4):391-400.

Brownell, R.L., Jr., A.V. Yablokov and V.A. Zemmsky. 1998. USSR pelagic catches of North Pacific sperm whales, 1949-1979: Conservation implications. Paper SC/50/CAWS27 presented to the International Whaling Commission, June 1998 (unpublished).

Burgess, W.C., P.L. Tyack, B.J. Le Boeuf, and D.P. Costa. 1998. A programmable acoustic recording tag and first results from free-ranging northern elephant seals. Deep-Sea Res. Part II 45, 1327–1351.

Calambokidis J. 2003. Underwater behavior of blue whales examined with suction-cup attached tags. ONR Report: Grant Number N00014-02-1-0849.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, C. Ewald, S. Kruse, R. Wells, and R. Sears. 1990. Sightings and movements of blue whales off central California 1986-88 from photo-identification of individuals. Report to the International Whaling Commission, Special Issue 12:343-348.

Calambokidis, J. 1995. Blue whales off California. Whalewatcher 29(1):3-7.

Calambokidis, J., G.H. Steiger, and J.R. Evenson. 1993. Photo-id and abundance estimates of humpback and blue whales off California in 1991-92. Final Contract Report 50ABNF100137 to Southwest Fisheries Science Center, P.O. Box 271, LaJolla, CA. 92038. 67pp.

Calambokidis, J., G.H. Steiger, J.M. Straley, T. Quinn, L.M. Herman, S. Cerchio, D.R. Salden, M. Yamaguchi, F. Sato, J.R. Urban, J. Jacobson, O. Von Zeigesar, K.C. Balcomb, C.M. Gabriele, M.E. Dahlheim, N. Higashi, S. Uchida, J.K.B. Ford, Y. Miyamura, P. Ladron de Guevara, S.A. Mizroch, L. Schlender, and K. Rasmussen. 1997. Abundance and population structure of humpback whales in the North Pacific basin. Final Contract Report 50ABNF500113 to Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038. 72pp.

Calambokidis, J., E.A. Falcone, T.J. Quinn, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán R., D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific. Final report for Contract AB133F-03-RP-00078. 57pp.

Carretta, J.V., J. Barlow, K.A. Forney, M.M. Muto, and J. Baker. 2001. U.S. Pacific Marine mammal stock assessments: 2001. U.S. Dept. of Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-317, 280p.

Carretta, J.V., K.A. Forney, M.M. Muto, J. Barlow, J. Baker, B. Hanson, and M.S. Lowry. 2005. U.S. Pacific Marine Mammal Stock Assessments: 2004. U.S. Dept. of Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-375, 322 pp.

Carretta, J.V., K.A. Forney, M.M. Muto, J. Barlow, J. Baker, B. Hanson, and M.S. Lowry. 2006. U.S. Pacific Marine Mammal Stock Assessments: 2005. U.S. Dept. of Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-388, 325 pp.

Carretta, J.V., K.A. Forney, M.M. Muto, J. Barlow, J. Baker, B. Hanson, and M.S. Lowry. 2007. U.S. Pacific Marine Mammal Stock Assessments: 2006. U.S. Dept. of Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-398, 313 pp.

Carretta, J.V. K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, D. Johnston, B. Hanson, M.M. Muto, D. Lynch, and L. Carswell. 2008. U.S. Pacific Marine Mammal Stock Assessments: 2008. NOAA-TM-NMFS-SWFSC-434.

Carretta, J.V. K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, D. Johnston, B. Hanson, R.L. Brownell Jr., J. Robbins, D.K. Mattila, K. Ralls, M.M. Muto, D. Lynch, and L. Carswell. 2009. U.S. Pacific Marine Mammal Stock Assessments: 2009. NOAA-TM-NMFS-SWFSC-453. 341pp.

Cartwright, R. and Sullivan, M. 2009. Behavioral ontogeny in humpback whale (Megaptera novaeangliae) calves during their residence in Hawaiian waters. Marine Mammal Science 25(3): 659-680.

Center for Marine Conservation and National Marine Fisheries Service. 1988. Proceedings of the Workshop to Review and Evaluate Whale Watching Programs and Management Needs. Sponsored by the Center for Marine Conservation and National Marine Fisheries Service. November 14-16, 1988, Monterey, California. 53 pp.

Cerchio, S. 2003. Paternity, Polygyny and Alternative Mating Tactics in Humpback Whales (Megaptera novaeangliae). Doctoral dissertation in: Ecology and Evolutionary Biology. 165 pp. Ann Arbor: University of Michigan.

CETAP 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf, final report. Washington, DC, Bureau of Land Management. #AA551-CT8-48 538 pp.

Chittleborough, R.G. 1965. Dynamics of two populations of humpback whale, Megaptera novaeangliae (Borowski). Aust. J. Mar. Freshwater Res. 16:33-128.

Christensen, I., T. Haug and N. Øien 1992. Seasonal distribution, exploitation and present abundance of stocks of large baleen whales (Mysticeti) and sperm whales (Physeter macrocephalus) in Norwegian and adjacent waters. ICES J. Mar. Sci. 49: 341-355.

Clapham, P.J. and D.K. Mattila. 1993. Reaction of humpback whales to skin biopsy sampling on a West Indies breeding ground. Mar. Mamm. Sci. 9(4):382-391.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Mattila, C.A. Mayo, M.A. Murphy and S. Pittman 1993. Seasonal occurrence and annual return of humpback whales, Megaptera novaeangliae, in the southern Gulf of Maine. Can. J. Zool. 71: 440-443.

Clapham, P.J. and C.A. Mayo 1987. Reproduction and recruitment of individually identified humpback whales, Megaptera novaeangliae, observed in Massachusetts Bay, 1979-1985. Can. J. Zool. 65: 2853-2863.

Clark, C.W. 1994. Blue deep voices: insights from the Navy's Whales '93 program. Whalewatcher 28(1):6-11.

Clark, C.W. 1995. Application of US Navy underwater hydrophone arrays for scientific research on whales. Rep. int. Whal. Commn 45:210B212.

Colborn, K. 1999. Interactions between humans and bottlenose dolphins, Tursiops truncates, near Panama City, Florida. Master's Thesis, Duke University, Durham, NC. 45pp.

Constantine, R. 2001. Increased avoidance of swimmers by wild bottlenose dolphins (Tursiops truncates) due to long-term exposure to swim-with-dolphin tourism. Mar. Mamm. Sci., 17(4):689-702.

Cope, M., D. St. Aubain, and J. Thomas. 1999. The effect of boat activity on the behavior of bottlenose dolphins (Tursiops truncates) in the nearshore waters of Hilton Head, South Carolina. Page 37 in Abstracts of the 13th Biennial Conference on the Biology of Marine Mammals, Wailea, Hawaii, November 38-December 3, 1999.

Croll, D.A., Clark, C.W., Calambokedis, J., Ellison, W.T., and Tershy, B.R. 2001. Effect of anthropogenic noise on the foraging ecology of Balaenoptera whales. Animal Conservatin 4: 13-27.

Cummings, W.C., and Thompson, P.O. 1971. Gray whales, Eschrichtius robustus, avoid the underwater sounds of killer whales, Orcinus orca. Fishery Bulletin 69: 525-530.

Darling, J.D. 1991. Humpback whales in Japanese waters. Ogasawara and Okinawa. Fluke identification catalog 1987-1990. Final Contract Report, World Wide Fund for Nature, Japan. 22pp.

Darling, J. D., J. E. Meagan, et al. 2007.. Responses of humpback whale singers to playback of similar and different song. 17th Biennial Conference on the Biology of Marine Mammals, Cape Town, South Africa, 29 November-3 December, 2007.

Davis, J.D., 1984. Western Cape Cod Bay: Hydrographic, Geological, Ecological, and Meteorlogical Backgrounds for Environmental Studies. In: J.D. Davis and D. Merriman (Editors), Observations on the ecology and biology of western Cape Cod Bay, Massachusetts. Lecture notes on costal and estuarine studies. Springer-Verlag, New York, NY, pp. 1-18.

Deeke, V.B., Slater, P.J.B., and Ford, J.K.B. 2002. Selective habituation shapes acoustic predator recognition in harbor seals. Nature 42: 171-173.

Deecke, V. B., Ford, J. K. B., and Slater, P. J. B. 2005. The vocal behaviour of mammal-eating killer whales: communicating with costly calls. Animal Behaviour 69, 395-405.

Deeke, V.B. 2006. Studying marine mammal cognition in the wild: A review of four decades of playback experiments. Aquatic Mammals 32: 461-482.

DoN, August 2002. Marine Resource Assessment for the Charleston/Jacksonville Operating Area. Final Report, Naval Facilities Engineering Command, Atlantic Division, Norfolk, VA.

Dohl, T. P., R. C. Guess, M. L. Duman, and R. C. Helm. 1983. Cetaceans of central and northern California, 1980-83: Status, abundance, and distribution. Final Report to the Minerals Management Service, Contract No. 14-12-0001-29090. 284p.

Donovan, G.P. 1991. A review of IWC stock boundaries. Rept. Int. Whal. Commn., Special Issue 13:39-68.

Durbin, E., G. Teegarden, R. Campbell, A. Cambellay, M. Baumgartner, and B. Mate. 2002. North Atlantic right whales exposed to Paralytic Shellfish Poisoning (PSP) toxins via a zooplankton vector, Calanus finmarchicus. North Atlantic Right Whale Consortium Annual Meeting. Oct. 29-30, 2002.

Fidell, S., Pearsons, K.S., and Bennett, R. 1973. Prediction of aural detectability of noise signals. Human Factors 16: 373-383.

Flinn, R.D., A.W. Trites and E.J. Gregr 2002. Diets of fin, sei, and sperm whales in British Columbia: An analysis of commercial whaling records, 1963-1967. Mar. Mamm. Sci. 18(3): 663-679.

Forney, K.A. 2007. Preliminary estimates of cetacean abundance along the U.S. west coast and within four National Marine Sanctuaries during 2005. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-406. 27p.

Forney, K. A., J. Barlow, and J. V. Carretta. 1995. The abundance of cetaceans in California waters. Part II: Aerial surveys in winter and spring of 1991 and 1992. Fish. Bull. 93:15-26.

Forney, K.A., and R.L. Brownell, Jr. 1997. Preliminary report of the 1994 Aleutian Island marine mammal survey. Paper SC/48/011 presented to the International Whaling Commission Scientific Committee, June 1996 (unpublished).

Frankel, A.S., J.R. Mobley, and L.M. Herman. 1995. Estimation of auditory response thresholds in humpback whales using biologically meaningful sounds. In: Sensory Systems of Aquatic Mammals (eds. R.A. Kastelein, J.A. Thomas and P.E. Nachtigall). De Spil Pulbishers. Netherlands.

Frankel, A.S. and C.W. Clark. 1998. Results of low-frequency playback of M-sequence noise to humpback whales, Megaptera novaeangliae, In Hawai'i. Can. J. Zool. 76: 521-535.

Frankel, A.S. and C.W. Clark. 2000. Behavioral responses of humpback whales (Megaptera Novaeangliae) to full-scale ATOC signals. J. Acoust. Soc. Am. 108(4): 1-8.

Frankel, A.S. and C.W. Clark. 2002. ATOC and Other Factors Affecting the Distribution and Abundance of Humpback Whales (Megaptera Novaeangliae) Off the North Shore of Kauai. Mar. Mamm. Sci. 19(3): 644-662. 8.

Franks, P.J.S. and Anderson, D.M., 1992. Alongshore transport of a toxic phytoplankton bloom in a buoyance current: Alexandrium tamarense in the Gulf of Maine. Marine Biology, 112: 153-164.

Gambell, R. 1985. Sei whale Balaenoptera borealis Lesson, 1828. Pp. 155-170 in S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Vol. 5. Academic Press, London.

Gauthier, J. and R. Sears. 1999. Behavioral response of four species of balaenopterid whales to biopsy sampling. Mar. Mamm. Sci. 15(1):85-101.

Geraci, J.R. and D.J. St. Aubin. 1980. Offshore petroleum resource development and marine mammals: A review and research recommendations. Mar. Fish. Rev. 42:11: 1-12.

Gerrodette, T., Watters. G., and Forcada, J. 2005. Preliminary estimates of 2003 dolphin abundance in the eastern tropical Pacific. SWFSC Admin. Rep. LJ-05-05. 26 pp.

Geyer, W.R. et al., 1992. Physical Oceanographic Investigation of Massachusetts and Cape Cod Bays; Report to the Massachusetts Bays Program. Pub. #17268-504-200-1/93-11.44C.R.

Green, G.A., J.J. Brueggeman, R.A. Grotefendt, C.E. Bowlby, M.L. Bonnell, K.C. Balcomb, III. 1992. Cetacean distribution and abundance off Oregon and Washington, 1989-1990. Ch.1 In:J.J. Brueggeman(ed.). Oregon and Washington marine Mammal and Seabird Surveys. Minerals Management Service Contract Report 14-12-0001-30426.

Gulland, F.M.D., Nutter, F.B., Dixon, K., Calambokidis, J., Schorr, G., Barlow, J., Rowles, T., Wilkin, S., Spradlin, T., Gage, L., Mulsow, J., Reichmuth, C., Moore, M., Smith, J., Folkens, P., Hanser, S.F., Jang, S., and Baker, C.S. 2008. Health assessment, antibiotic treatment, and behavioral responses to herding efforts of a cow-calf pair of humpback whales (Megapterta novaeangliae) in the Sacramento River Delta, California. Aquatic Mammals 34: 182-192.

Gunnlaugsson, T., and J. Sigurjónsson. 1990. NASS-87: Estimation of whale abundance based on observations made on board Icelandic and Faroese survey vessels. Report to the International Whaling Commission. 40:571-580.

Hall, J.D. 1979. A survey of cetaceans of Prince William Sound and adjacent vicinity—their numbers and seasonal movements. Pp. 631-726. in Environmental Assessment of the Alaska Continental Shelf; final Reports of the Principal Investigators. Biological Studies, Vol. 6. Boulder, NOAA-OCCSEAP.

Hall, J.D. 1982. Prince William Sound, Alaska: Humpback whale population and vessel traffic study. Final Report, Contract No. 81-ABG-00265. NMFS, Juneau Management Office, Juneau, Alaska. 14 pp.

Hain, J. H. W., M. A. M. Hyman, R. D. Kenney, and H. E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. Mar. Fish. Rev. 47(1): 13-17.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, Balaenoptera physalus, in waters of the northeastern United States continental shelf. Rep. Int. Whal. Comm. 42: 653-669.

Hanson, M.B., R.D. Andrews, G.S. Schorr, R.W. Baird, D.L. Webster, and D.J. McSweeney. 2008. Re-sightings, healing, and attachment performance of remotely-deployed dorsal fin-mounted tags on Hawaiian odontocetes. PSRG-2008-10 submitted to the Pacific Scientific Review Group.

Hauser, N., A.N. Zerbini, Y. Geyer, M. Heide-Jørgensen and P. Clapham. 2010. Movements of satellite-monitored humpback whales, Megaptera novaeangliae, from the Cook Islands. Marine Mammal Science. DOI: 10.1111/j.1748-7692.2009.00363.x

Heithaus, M.R. 2001a. Predator-prey and competitive interactions between sharks (order Selachii) and dolphins (suborder Odontoceti): a review. J. Zool., Lond. 253, 53-68.

Heithaus, M.R. 2001b. Shark attacks on bottlenose dolphins (Tursiops aduncus) in Shark Bay, Western Australia: Attack rate, bite scar frequencies, and attack seasonality. Marine Mammal Science. 17(3):526-539.

Helweg, D. A., D. S. Houser, and P. W. B. Moore. 2000. An integrated approach to the creation of a humpback whale hearing model. SSC San Diego, CA 92152-5001.

Herman, L.M. Forestell, P.H., and R.C. Antinoja. 1980. The 1976/1977 migration of humpback whales into Hawaiian waters: composite description. Marine Mammal Commission Report No. MMC 77-19. Washington, D.C.

Horwood, J. 1987. The Sei Whale: Population Biology, Ecology and Management. Croom Helm, London, U.K. 375pp.

Hoyt, E. 2001. Whale watching 2001: Worldwide Tourism Numbers, Expenditures, and Expanding Socioeconomic Benefits. International Fund for Animal Welfare, Yarmouth Port, MA, USA. 158 pp.

Jay CV, Heide-Jorgensen MP, Fischbach AS, Jensen MV, Tessler DF, Jensen AV. 2006. Comparison of remotely deployed satellite radio transmitters on walruses. Marine Mammal Science 22(1):226-236.

Jasny M, Reynolds J, Horowitz C, Wetzler A. 2005. Sounding the Depths II: The Rising Toll of Sonor, Shipping and Industrial Ocean Noise on Marine Life. , Vol. Natural Resources Defense Council New York, New York.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. (2008). Marine Mammals of the World, A Comprehensive Guide to their Identification. Amsterdam, Elsevier. Pp. 47-50.

Jensen, A.S. and G.K. Silber. 2003. Large Whale Ship Strike Database. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-OPR-25, 37 pp.

Johnson, M. P. and P. L. Tyack. 2003. "A Digital Acoutic Recording Tag for Measuring the Response of Wild Marine Mammals to Sound." IEEE Journal of Oceanic Engineering 28(1): 3-12.

Johnson, J. H., and A. A. Wolman. 1984. The humpback whale, Megaptera novaeangliae. Mar. Fish. Rev. 46(4):30-37.

Katona, S.K. and J.A. Beard 1990. Population size, migrations, and feeding aggregations of the humpback whale (Megaptera novaeangliae) in the western North Atlantic ocean. Rep. Int. Whal. Comm. (Special Issue) 12: (295-306).

Kastelein, R. A. and de Haan, D. and Vaughan, N. and Staal, C. and Schooneman, N. M. 2001. The influence of three acoustic alarms on the behaviour of harbour porpoises (Phocoena phocoena) in a floating pen. Marine Environmental Research 52(4):351-371.

Kastelein, R. A. and Jennings, N. and Verboom, W. C. and de Haan, D. and Schooneman, N. M. 2006a. Differences in the response of a striped dolphin (Stenella coeruleoalba) and a harbour porpoise (Phocoena phocoena) to an acoustic alarm. Marine Environmental Research 61(3):363-378.

Kastelein, R. A. and van der Heul, S. and Terhune, J. M. and Verboom, W. C. and Triesscheijn, R. J. V. 2006b. Deterring effects of 8-45 kHz tone pulses on harbour seals (Phoca vitulina) in a large pool. Marine Environmental Research 62(5):356-373.

Kasuya, T. 1998. Evidence of statistical manipulations in Japanese coastal sperm whale fishery. Paper SC/50/CAWS10 presented to the International Whaling Commission, June 1998 (unpublished).

Kenney, R. D. and S. D. Kraus. 1993. Right whale mortality — a correction and an update. Mar. Mamm. Sci. 9: 445-446.

Koschinski, S., Culik, B.M., Henriksen, O.D., Tregenza, N., Ellis, G.M., and Jansen, C. 2003. Behavioral reactions of free-ranging porpoises and seals to the noise of a simulated 2 MW windpower generator. Marine Ecology Progress Series. 265: 263-273.

Kovacs, K.M. and S. Innes. 1990. The impact of tourism on harp seals (Phoca groenlandica) in the gulf of St. Lawrence, Canada. Applied Animal Behaviour Science, 26:15-26.

Kraus S, Read A, Anderson E, Baldwin K, Solow A, Spradlin T, Williamson J (1997) Acoustic alarms reduce porpoise mortality. Nature 388:525.

Kraus SD, Brown MW, Caswell H, Clark CW, Fujiwara M, Hamilton PK, Kenney RD, Knowlton AR, Landry S, Mayo CA, McLellan WA, Moore MJ, Nowacek DP, Pabst DA, Read AJ, Rolland RM. 2005 July 22. North Atlantic right whales in crisis. Science:561-562.

Krieger, K. and B.L. Wing. 1984. Hydroacoustic surveys and identifications of humpback whale forage in Glacier Bay, Stephens Passage, and Frederick Sound, southeastern Alaska, Summer 1983. NOAA Tech. Memo. NMFS/NWC-66. 60 pp.

Kruse, S. K., D.K. Caldwell, and M.C. Caldwell. 1999. Risso's dolphin Grampus griseus. Pages 183-212 In: S. H. Ridgway and R. Harrison (eds.), Handbook of Marine Mammals, Volume 6. Academic Press, San Diego.

Krützen, M., L.M. Barré, L.M. Möller, M.R. Heithaus, C. Simms, and W.B. Sherwin. 2002. Biopsy system for small cetaceans: darting success and wound healing in Tursiops spp. Mar. Mamm. Sci. 18:863-878.

Laist DW, Knowlton AR, Mead JG, Collet AS, Podesta M. 2001. Collisions between ships and whales. Marine Mammal Science 17(1):35-75.

Lammers, M.O., Au, W.W.L and Herzing, D.L. 2003. The broadband social acoustic signaling behavior of spinner and spotted dolphins. J. Acoust. Soc. Am. 114(3):1629-1639.

Lerczak JA, Shelden KEW, Hobbs RC. 2000. Application of Suction-cup-attached VHF Transmitters to the Study of Beluga, Delphinapterus leucas, Surfacing Behavior in Cook Inlet, Alaska. Mar Fish Rev 62:99-111.

Lien J, Todd S, Guigne J. 1990. Inferences about perception in large cetaceans, especially humpback whales, from incidental catches in fixed fishing gear, enhancment of nets by "alarm devices," and the acoustics of fishing gear. . In: Thomas J, Kastelein R (eds) Sensory Abilities of Cetaceans. Plenum Press, New York, p 347-362.

Madsen, P., M. Johnson, and P. Miller. 2006. Quantitative measures of air-gun pulses recorded on sperm whales (Physeter macrocephalus) using acoustic tags during controlled exposure experiments J. Acoust. Soc. Am. Volume 120, Issue 4, pp. 2366-2379.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in wild bottlenose dolphins (Tursiops sp.): Life history, habitat, provisioning, and group size effects. Behavioral Ecology, 11:210-219.

Marshall, G.J. 1998. Crittercam: An animal-borne imaging and data logging system. Mar. Technol. Soc. J. 32:11-17.

Masaki, Y. 1977. The separation of the stock units of sei whales in the North Pacific. Rept. Int. Whal. Commn., Special Issue 1:71-77.

Mate, B.R., R. Mesecar, & B.A. Lagerquist. 2007. The evolution of satellite-monitored radio tags for large whales: One laboratory’s experience. Deep Sea Research, II, 224-227.

Mathias, D., A. Thode, J. Straley, and K. Folkert. 2009. Relationship between sperm whale (Physeter macrocephalus) click structure and size derived from videocamera images of a depredating whale (sperm whale prey acquisition). J. Acoust. Soc. Am. 125(5):3444-53.

Mayo, CA and Marx, MK. 1990. Surface foraging behaviour of the North Atlantic right whale, Eubalaena glacialis, and associated zooplankton characteristics. Canadian Journal of Zoology 68:2214-2220.

Mercado III, E., S. R. Green, and J. N. Schneider. 2008. Understanding auditory distance estimation by humpback whales: A computational approach. Behavioural Processes 77:231-242.

Miller, P.O. 2006. Diversity in sound pressure levels and estimated active space of resident killer whale vocalizations. Journal of Comparitive Physiology A 192: 449-459.

Milliman, J.D. and Imamura, E., 1992. The Physical Oceanography of the U.S. Atlantic and Eastern Gulf of Mexico. Final Report, supported by U.S. Deptartment of Interior and Minerals Management Service.

Mitchell, E. 1975. Preliminary report on Nova Scotia fishery for sei whales (Balaenoptera borealis). Rep. Int. Whal. Comm. 25: 218-225.

Mitchell, E. and D.G. Chapman 1977. Preliminary assessment of stocks of northwest Atlantic sei whales (Balaenoptera borealis). Rep. Int. Whal. Comm. (Special Issue) 1: 117-120.

Mizroch, S. A., D. W. Rice, and J. M. Breiwick. 1984. The blue whale, Balaenoptera musculus. Mar. Fish. Rev. 46:15-19.

Mobley, J.R., L.M. Herman, and A.S. Frankel. 1988. Responses of wintering humpback whales (Megaptera novaeangliae) to playback of recordings of winter and summer vocalizations and of synthetic sound. Behav. Ecol. Sociobiol., 23:211-223.

NMFS. 2004. Environmental Assessment on the Effects of the Issuance of Eleven National Marine Fisheries Service Permitted Scientific Research Activities on Marine Mammal and Sea Turtle Species in the U.S. Territorial Waters and High Seas of the North Pacific Ocean (including the Gulf of Alaska and Bering Sea), Arctic Ocean (including the Chukchi Sea and Beaufort Sea), Southern Ocean (including waters off Antarctica), and Foreign Territorial Waters of Mexico (Gulf of California only), Canada, Russia, Japan and the Philippines.

NMFS. 2005a. Supplemental Environmental Assessment on the Effects of the Issuance of One National Marine Fisheries Service Permit Amendment for Scientific Research Activities on Humpback Whales on the Winter Breeding and Nursing Grounds of Hawaii.

NMFS. 2005b. Supplemental Environmental Assessment on the Effects of the Issuance of Nine National Marine Fisheries Service Permit Actions for Scientific Research Activities on Marine Mammal Species in the U.S. Territorial Waters and High Seas of the Eastern, Central and Western North Pacific Ocean, with a Primary Focus on the Waters Off Hawaii and From California Northward to Southeast Alaska (Including Gulf of Alaska and Aleutian Islands), and Including Foreign Territorial Waters of Japan.

NMFS. 2006. Draft recovery plan for the fin whale (Balaenoptera physalus). National Marine Fisheries Service, Silver Spring, MD.

NMFS. 2008. Environmental Assessment on the Issuance of Two Scientific Research Permits for the Harrasment of Cetaceans in Hawaiian Waters.

NMFS. 2009. Supplemental Environmental Assessment On The Effects Of The Issuance Of One Of Eleven National Marine Fisheries Service Permitted Scientific Research Activities (Gulf Of Alaska) Janice Straley [File No. 473-1700-02].

NMFS. 2010. Biological Opinion on the Permits, Conservation and Education Division's proposal to issue eight Permits (14682, 13846, 14451, 14585, 14599, 14122, 14296, 14353) and one Permit Amendment (10018-01) to scientific researchers, for research on multiple large whale species pursuant to section 10(a)(1)(A) of the Endangered Species Act of 1973 and section 104 of the Marine Mammal Protection Act.

Nishiwaki, M. 1966. Distribution and migration of the larger cetaceans in the North Pacific as shown by Japanese whaling results. Pp. 172-191 In K. S. Norris (ed.), Whales, Dolphins and Porpoises, University of California Press, Berkeley, CA.

Norris, T.F., Smultea, M. A., Zoidis, A. M., Rankin, S., Loftus, C., Oedekoven, O., Hayes, J. L., and Silva, E. 2005. A Preliminary Acoustic-Visual Survey of Cetaceans in Deep Waters around Ni'ihau, Kaua'i, and portions of O'ahu, Hawai'i from aboard the R/V Dariabar, February 2005. Prepared by: Cetos Research Organization, Bar Harbor, ME., under contract #2057SA05-F to Geo-Marine, Inc. for NAVFAC Pacific.

Nowacek, S.M., R.S. Wells, and A.R. Solow. 2001. Short-term effects of boat traffic on bottlenose dolphins, Tursiops truncatus, in Sarasota Bay, FL. Mar. Mamm. Sci., 17(4):673-688.

Nowacek, D. P., et al. 2004. North Atlantic right whales (Eubalaena glacialis) ignore ships but respond to alerting stimuli. Proceedings of the Royal Society of London Series B-Biological Sciences 271(1536): 227-231.

O'Hara, T.M. and C. Rice. 1996. Polychlorinated biphenyls. In Noninfectious diseases of wildlife, 2nd edition, A. Fairbrother, L.Locke, and G. Hoff (eds.). Iowa State University Press, Ames, Iowa, pp. 71-86.

O'Hara, T.M., M.M. Krahn, D. Boyd, P.R. Becker, and L.M. Philo. 1999. Organochlorine contaminant levels in Eskimo harvested bowhead whales of arctic Alaska. J. Wildlife Diseases 35(4): 741-52.

O'Shea, T.J. and R.L.J. Brownell. 1994. Organochlorine and metal contaminants in baleen whales: A review and evaluation of conservation implications. Science of the Total Environment 154 (2-3): 179-200.

Odell, D.K. and Asper, E.D., 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: S. Leatherwood and R.R. Reeves (Editors), The bottlenose dolphin. Academic Press, San Diego, CA, pp. 515-540.

Ohsumi, S. 1980. Catches of sperm whales by modern whaling in the North Pacific. Rep. Int. Whal. Commn. Special Issue 2: 11-18.

Ohsumi, S. and S. Wada. 1972. Stock assessment of blue whales in the North Pacific. Working Paper for the 24th Meeting of the International Whaling Commission. 20 pp.

Olesiuk, P.F., Nichol, L.M., Sowden, M.J., and Ford, J.K.B. 2002. Effect of the sound generated by an acoustic harassment device on the relative abundance and distribution of harbor porpoises (Phocoena phocoena) in Retreat Passage, British Colombia. Marine Mammal Science 18: 843-862.

Pace, R.M, and G.K. Silber. 2005 Abstract. Simple analyses of ship and large whale collisions: Does speed kill? Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, December 2005.

Palsbøll, P.J., J. Allen, M. Berube, P. Clapham, T. Feddersen, P. Hammond, R. Hudson, H. Jorgensen, S. Katona, A.H. Larsen, F. Larsen, J. Lien, D. Mattila, J. Sigurjonsson, R. Sears, T. Smith, R. Sponer, P. Stevick and N. Oien 1997. Genetic tagging of humpback whales. Nature 388: 767-769.

Parsons, K.M., J.W. Durban, and D.E. Claridge. 2003. Comparing two alternative methods for genetic sampling of small cetaceans. Mar. Mamm. Sci. 19:224-231.

Perrin, W. F. 1990. Subspecies of Stenella longirostris (Mammalia: Cetacea: Delphinidae). Proc. Biol. Soc. Wash. 103:453-463.

Perrin, W. F. and J. W. Gilpatrick, Jr. 1994. Spinner dolphin Stenella longirostris (Gray, 1828). In: S. H. Ridgway and R. Harrison (eds.), Handbook of Marine Mammals, Vol.5: The First Book of Dolphins, pp. 99-128. Academic Press, 416 pp.

Perry, A., C.S. Baker, and L.M. Herman. 1990. Population characteristics of individually identified humpback whales in the central and eastern North Pacific: a summary and critique. Rep. Int. Whal. Comm. (Special Issue 12):307-317.

Perry, S.L., D.P. DeMaster and G.K. Silber. 1999. The Great Whales: History and Status of Six Species Listed as Endangered Under the Endangered Species Act of 1973. Marine Fisheries Review (special issue), 6(1) 74 pp.

Rasmussen, M.H., Lammers, M., Beedholm, K, and Miller, L.A. 2006. Source Levels and harmonic content of whistles in white-beaked dolphins (Lagenorhynchus albirostris). Journal of the Acoustical Society of America 120:510-517.

Reeb, D., and Best, P.B. 2006. A biopsy system for deep-core sampling of the blubber of Southern right whales, Eubalaena australis. Marine Mammal Science, 22(1): 206-213.

Rice, D.W. 1974. Whales and whale research in the eastern North Pacific. Pages 170-195 in: W.E. Schevill, D.G. Ray, K.S. Norris (eds.). The Whale Problem. Harvard University Press, Cambridge, Massachusetts.

Rice, D.W. 1978. The humpback whale in the North Pacific: distribution, exploitation and numbers. Appendix 4. Pp. 29-44 In K.S. Norris and R.R. Reeves (eds.), Report on a workshop on problems related to humpback whales (Megaptera novaeangliae) in Hawaii. U.S. Dep. Commer., Nat. Tech. Info. Serv. PB-280 794. Springfield, VA.

Richardson, W.J. 1995. Documented disturbance reactions. In: Marine Mammals and Noise. W.J. Richardson, C.R. Greene, Jr., C.I. Malme, and D.H. Thomson, editors. Academic Press, San Diego, California.

Samuels, A. and L. Bejder. 1998. Habitual interactions between humans and wild bottlenose dolphins (Tursiops truncatus) near Panama City Beach, Florida. Report to the Marine Mammal Commission, Silver Spring, MD. 13 pp.

Samuels, A., L. Bejder, and S. Heinrich. 2000. A Review of the Literature Pertaining to Swimming with Wild Dolphins. Report to the Marine Mammal Commission. 57 pp.

Sears, R., J.M. Williamson, F.W. Wenzel, M. Bérubé, D. Gendron, and P. Jones. 1990. Photographic identification of the blue whale (Balaenoptera musculus) in the Gulf of St. Lawrence, Canada. Report to the International Whaling Commission, Special Issue 12:335-342.

Sherman, K. et al., 1987. Zooplankton Production and the Fisheries of the Northeastern Shelf. In: R.H. Backus and D.W. Bourne (Editors), Georges Bank. The MIT Press, Cambridge, MA, pp. 268-282.

Sigurjónsson, J., and T. Gunnlaugsson. 1990. Recent trends in abundance of blue (Balaenoptera musculus) and humpback whales (Megaptera novaeangliae) off west and southwest Iceland, with a note on occurrence of other cetacean species. Report to the International Whaling Commission. 40:537-551.

Southall, B. L., Bowles, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Greene Jr., C. R., Kastak, D., Ketten, D. R., Miller, J. H., Nachtigall, P. E., Richardson, W. J., Thomas, J. A., and Tyack, P. L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations, Aquatic Mammals, 33 (4), pp. 411-509.

Stafford, K.M. 2003. Two types of blue whale calls recorded in the Gulf of Alaska. Marine Mammal Science. 19: 682-693.

Stafford, K.M., S.L. Nieukirk, and G.G. Fox. 2001. Geographic and seasonal variation of blue whale calls in the North Pacific. Journal of Cetacean Research and Management 3(1): 65-76.

Steiger, G.H., J. Calambokidis, R. Sears, K.C. Balcomb, and J.C. Cubbage. 1991. Movement of humpback whales between California and Costa Rica. Mar. Mammal Sci. 7:306-310.

Stewart, B.S., S.A. Karl, P.K. Yochem, S. Leatherwood, and J.L. Laake. 1987. Aerial surveys for cetaceans in the former Akutan, Alaska, whaling grounds. Arctic 40:33-42.

Stevick, P., N. Øien and D.K. Mattila 1998. Migration of a humpback whale between Norway and the West Indies. Mar. Mamm. Sci. 14: 162-166.

Stevick, P.T., J. Allen, P.J. Clapham, N. Friday, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsbøll, J. Sigurjónsson, T.D. Smith, N. Øien and P.S. Hammond 2003. North Atlantic humpback whale abundance and rate of increase four decades after protection from whaling. Mar. Ecol. Prog. Ser. 258: 263-273.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan, and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9:309-315.

Tashmukhambetov, Arslan M., George E. Coup, and Juliette W. Ioup, Natalia A. Sidorovskaia, Joal J. Newcomb. 2008. Three-dimensional seismic array characterization study: Experiment and modeling J. Acoust. Soc. Am. Volume 123, Issue 6, pp. 4094-4108.

Thode, A., J. Straley, C.O. Tiemann, K. Folkert, and V.O'Connell. 2007. Observations of potential acoustic cures that attract sperm whale to longline fishing in the Gulf of Alaska. J. Acoust. Soc. Am. 122(2) 1265-1277.

Thomson, F., Franck, D., and Ford, J.K.B. 2000. Characteristics of whistles from the acoustic repertoire of resident killer whales (Orninus orca) off Vancouver Island, British Colombia. Journal of the Acoustical Society of America 109: 1240-1246.

Tiemann, C.G., A.M. Thode, V.O'Connell, and K. Folkert. 2006. Three-dimensional localization of sperm whales using a single hydrophone. J. Acoust. Soc. Am. 120(4): 2355-2365.

Tillman, M.F. 1977. Estimates of population size for the North Pacific sei whale. Rep. Int. Whal. Comm. Spec. Iss. 1:98-106.

Tomilin, A.G. 1967. Mammals of the USSR and adjacent countries. Vol. 9, Cetacea. Israel Program Sci. Transl. No. 124, Natl. Tech. Inf. Serv. TT 65-50086. Springfield, VA 717pp. (Translation of Russian text published in 1957).

Trippel EA, Strong MB, Terhune JM, Conway JD. 1999. Migigation of harbour porpoise (Phocoena phocoena) by-catch in the gillnet fishery in the lower Bay of Fundy. Can J Fish Aquat Sci 56:113-123

Tyack, P. 1983. Differential response of humpback whales, Megaptera novaeangliae to play back of song or social sounds. Behav. Ecol. Sociobiol. 13: 49-55.

Tyack, P. L., M. Johnson, et al. 2006. Extreme diving of beaked whales. Journal of Experimental Biology. 209: 4238-4253.

Tyack PL. 2008. Implications for marine mammals of large-scale changes in the marine acoustic environment. J Mammal. 89:549-558.

Von Ziegesar, O. 1984. A survey of the humpback whales in southeastern Prince William Sound, Alaska: 1980, 1981, and 1983. Report to the state of Alaska, Alaska Council on Science and Technology, 34 pp.

Von Ziegesar, O., and C.O. Matkin. 1986. Humpback whales in Prince William Sound in 1985: a contract report. Contract No. 41 USC 252, NMFS, National Marine Mammal Laboratory, Seattle, WA.

Wada, S. 1980. Japanese whaling and whale sighting in the North Pacific 1978 season. Rep. Intl. Whal Comm. 30:415-424.

Wade, P.R. and T. Gerrodette. 1993. Estimates of cetacean abundance and distribution in the eastern tropical Pacific. Rept. Int. Whal. Commn. 43:477-493.

Waring, G.T., Josephson, E., Fairfield, C.P. and Maze-Foley, K., 2006. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments, 2005.

Waring GT, Josephson E, Fairfield-Walsh CP, Maze-Foley K, editors. 2007. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2007. NOAA Tech Memo NMFS NE 205; 415 p.

Waring GT, Josephson E, Fairfield-Walsh CP, Maze-Foley K, editors. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2008. NOAA Tech Memo NMFS NE 210; 440 p.

Waring GT, Josephson E, Maze-Foley K, and Rosel PE, editors. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2009. NOAA Tech Memo NMFS NE 213; 528 p.

Watkins, W.A., J.E. George, M.A. Daher, K. Mullin, D.L. Martin, S.H. Haga, and N.A. DiMarzio. 2000. Whale call data for the North Pacific November 1995 through July 1999: Occurrence of calling whales and source locations from SOSUS and other acoustic systems. Technical Report WHOI_00_02 available from Woods Hole Oceanographic Institution. 160pp.

Weller, D.W., Cockcroft, V.G., Würsig, B., Lynn, S.K. and Fertl, D. 1997. Behavioral responses of bottlenose dolphins to remote biopsy sampling and observations of surgical biopsy wound healing. Aquat. Mammal. 23:49-58.

Wells, R.S. and M.D. Scott. 1997. Seasonal incidence of boat strikes on bottlenose dolphins near Sarasota, Florida. Mar. Mamm. Sci. 13(3):475-480.

Weinrich, M. and C. Corbelli. 2009. Does whale watching in Southern New England impact humpback whale (Megaptera novaeangliae) calf production or calf survival? Biological Conservation. 142:2931-2940.

Weinrich, M.T., R.H. Lambertsen, C.S. Baker, M.R. Schilling, and C.R. Belt. 1991. Behavioural responses of humpback whales (Megaptera novaeangliae) in the southern Gulf of Maine to biopsy sampling. Rep. Int. Whal. Commn. Special Issue 13:91-97.

Weinrich, M.T., R.H. Lambertsen, C.R. Belt, M.R. Schilling, H.J. Iken and S.E. Syrjala. 1992. Behavioural reactions of humpback whales Megaptera novaeangliae to biopsy procedures. Fishery Bulletin 90(3): 588-598.

Whitehead, H. 1982. Populations of humpback whales in the northwest Atlantic. Rep. Int. Whale Comm. 32:345-353.

Whitehead, H. 1987. Updated status of the humpback whale, Megaptera novaeangliae, in Canada. Canadian Field-Naturalist 101(2):284-294.

Wiley, D.N., R.A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortality of humpback whales, Megaptera novaeangliae, in the mid-Atlantic and southeast United States, 1985-1992. Fish. Bull. U.S. 93:196-205.

Witteveen BH, Foy RJ, Wynne KM, Tremblay Y. 2008. Investigation of foraging habits and prey preference of humpback whales (Megapatera novaeangliae) near Kodiak Island, Alaska using acoustic tags. Mar Mamm Sci 24:516.

Yochem, P.K., and S. Leatherwood. 1985. Blue whale, Balaenoptera musculus (Linnaeus 1758). Pages 193-240 In: Ridgway, S.J., and R. Harrison (Eds.), Handbook of marine mammals, Vol. 3: the sirenians and baleen whales. Academic Press, London. 362 pp.

Zolman, E.S., 1996. Residency patterns, relative abundance and population ecology of bottlenose dolphins (Tursiops truncatus) in the Stono River Estuary, Charleston County, South Carolina. Master of Science Thesis, University of Charleston, Charleston, SC, 128 pp.

Zorn, H. M., Churnside, J. H., & Oliver, C. W. 2000. Laser safety thresholds for cetaceans and pinnipeds. Marine Mammal Science, 16, 186-200.

APPENDICES

APPENDIX A:	Comments Received on Applications
APPENDIX B:	File No. 14682 [Au] Authorized Annual Takes in the Pacific Ocean Around Hawaii.
APPENDIX C:	File No. 10018-01 [Cartwright]: Authorized Annual Takes in Hawaiian and Alaskan waters.
APPENDIX D:	File No. 13846 [Darling]: Authorized Annual Takes in the Pacific Ocean.
APPENDIX E:	File No. 14451 [Mobley]: Authorized Annual Takes in the Pacific and Atlantic Oceans
APPENDIX F:	File No. 14585 [Pack]: Authorized Annual Takes in the Pacific Ocean.
APPENDIX G:	File No. 14599 [Sharpe]: Authorized Annual Takes in the Pacific Ocean; Southeast Alaska including Frederick Sound, Chatham Strait, Icy Strait, Sumner Strait, Clarence Strait and coastal waters.
APPENDIX H:	File No. 14122 [Straley]: Authorized Annual Takes in the Pacific Ocean in all waters of Alaska.
APPENDIX I:	File No. 14296 [Witteveen]: Authorized Annual Takes in the Pacific Ocean in the Coastal Waters of the Gulf of Alaska.
APPENDIX J:	File No. 14353 [Zoidis]: Authorized Annual Takes in Hawaiian waters.
APPENDIX K**:**	Active Scientific Research Permits Authorizing Research on Target Species in the Action Area.