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

JUN 30 2014

Memorandum For: Jolie Harrison
Acting Chief, Permits and Conservation Division

From: for Cathryn E. Tortorici
Chief, Endangered Species Act Interagency Cooperation Division

Subject: Biological Opinion on the proposal to issue permit No. 932-1905-01/MA-009526 to the Marine Mammal Health and Stranding Response Program (MMHSRP), which would carry out response, rescue, rehabilitation, and release operations and conduct health-related scientific research on marine mammals, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973 and Title IV of the Marine Mammal Protection Act of 1973

Enclosed is the NOAA's National Marine Fisheries Service (NMFS) biological opinion on the effects of the directed take of marine mammals for enhancement and scientific research purposes, prepared pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 USC 1531 *et seq.*).

In this biological opinion, NMFS concludes that the issuance of permit permit No. 932-1905-01/MA-009526 is likely to: adversely affect, but not likely to jeopardize, the continued existence of marine mammals; adversely affect, but not likely to destroy or adversely modify critical habitat of the Steller sea lion (Western DPS); and is not likely to adversely affect sea turtles and designated critical habitat of any other species.

This concludes formal consultation on this action. Consultation on this issue must be reinitiated if: (1) the amount or extent of allowable take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
Biological Opinion

Agency:	National Marine Fisheries Service, Office of Protected Resources, Permits and Conservation Division and Marine Mammal Health and Stranding Response Program
Action Considered:	Amendment and extension of the research and enhancement permit (No. 932-1905-01/MA-009526) and implementation of the Marine Mammal Health and Stranding Response Program
Consultation Conducted by:	National Marine Fisheries Service, Office of Protected Resources, Endangered Species Act Interagency Cooperation Division
Approved by:	Perry Gayaldo
Date:	JUN 30 2014

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536(a)(2)), requires Federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. When a Federal agency's action may affect listed species or critical habitat, consultation with the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) is required (50 CFR 402.14(a)).

The NMFS Permits and Conservation Division (i.e., the Permits Division) proposes to amend and extend a previously issued research and enhancement permit (No. 932-1905/MA-009526) to the NMFS Marine Mammal Health and Stranding Response Program (i.e., the MMHSRP or Program). The Program proposes to continue to carry out response, rescue, rehabilitation, and release operations and to conduct health-related, *bona fide* scientific research (herein after "research") on marine mammals under NMFS' jurisdiction, pursuant to Section 10 of the ESA and Sections 104, 109(h), 112(c), and Title IV of the Marine Mammal Protection Act (MMPA). Specifically, the Permits Division and Program propose to extend the current permit for one year and to include recently listed marine mammal species, i.e., the Cook Inlet beluga whale, Hawaiian Insular false killer whale, ringed seal, and bearded seal.

We, the ESA Interagency Cooperation Division of NMFS, consulted with the Permits Division and the MMHSRP on the issuance and implementation of the amended and extended permit (i.e., the Permit, No. 932-1905-01). This document transmits our biological opinion (Opinion) on the proposed action and its effects on ESA-listed species and designated critical habitat. We based our Opinion on information provided in the reinitiation request letter, the Programmatic Environmental Impact Statement (PEIS), consultation meetings, peer-reviewed publications, recovery plans, government reports, scientific and commercial data, and other sources of information. We prepared our Opinion in accordance with section 7(a)(2) of the statute (16 U.S.C. 1536(a)(2)), associated implementing regulations (50 CFR 402), and agency policy and guidance (USFWS and NMFS 1998).

1.0 Consultation History

The following dates are important to the history of this consultation:

- On February 26, 2009, we issued a biological opinion on the Permits Division's proposal to issue a permit (No. 932-1905/MA-009526), authorizing the MMHSRP to take ESA-listed marine mammals during responses to health emergencies and while conducting health-related research.

- On January 9, 2013, the Permits Division requested reinitiation of the consultation, as a result of the listing of the following species under the ESA: Cook Inlet beluga whale, Hawaiian Insular false killer whale, ringed seal, and bearded seal.

- On June 5, 2013, the MMHSRP requested a one-year extension on the permit (No. 932-1905/MA-009526).

- On December 12, 2013, the Permits Division sent the draft permit (No. 932-1905-01/MA-009526).

2.0 Description of the Proposed Action

The Permits Division proposes to issue the Permit (No. 932-1905-01/MA-009526) to the MMHSRP to extend their current permit by one year and to amend the permit to include radiography and additional ESA-listed species under NMFS jurisdiction. The MMHSRP proposes to continue to implement their program, which has the following objectives:

(1) Carry out response, rescue, rehabilitation and release of threatened and endangered marine mammals under NMFS jurisdiction [Cetacea and Pinnipedia (excluding walrus)] pursuant to sections 109(h), 112(c), and Title IV of the MMPA; and carry out such activities as enhancement pursuant to section 10 the ESA;

(2) Conduct health-related research studies on marine mammals and marine mammal parts under NMFS jurisdiction pursuant to section 104 of the MMPA and section 10 of the ESA;

(3) Conduct Level B harassment on marine mammals under NMFS (species under the USFWS's jurisdiction are not considered here) incidental to all MMHSRP activities in the United States;

(4) Collect, salvage, receive, possess, transfer, import, export, analyze, and curate marine mammal specimens under NMFS jurisdiction for purposes delineated in numbers (1) and (2) above.

The purpose of the proposed action is to:

- Allow the MMHSRP to fulfill its statutory mandates under Title IV of the MMPA to collect and disseminate reference data on the health and health trends of marine mammals in the wild;
- Correlate the health of marine mammals with available data on physical, chemical, and biological environmental parameters;
- Coordinate effective responses to unusual mortality events;
- Respond to health emergencies involving marine mammals including, but not limited to, animals that are stranded, trapped out of habitat, or otherwise in peril;
- Respond to unusual mortality events (UMEs)
- Rehabilitate and release endangered and threatened marine mammals;
- Temporarily hold endangered or threatened individuals that cannot be released into the wild until those individuals can be placed in permanent holding facilities;
- Disentangle all endangered or threatened marine mammal species;
- Under section 109(h) of the MMPA, the MMHSRP may also "take" marine mammals to protect public health and welfare and may conduct non-lethal removals of nuisance animals.

To fulfill their mandate, the MMHSRP also conducts research projects on marine mammal species under the jurisdiction of NMFS, including endangered and threatened marine mammals, as follows:

- Receive, possess, analyze, transfer, import and export samples or parts from all marine mammal species under the jurisdiction of NMFS or USFWS;
- Collect samples from marine mammals under NMFS' jurisdiction;
- Develop baseline health parameters for marine mammals;
- Undertake health surveillance programs;
- Collect morbidity and mortality information

The proposed permit amendment and extension would authorize the MMHSRP to continue to implement the following activities for one year (2014 – 2015), as described in Tables 1-2, copied from the draft permit No. 932-1905-01/MA-009526. The proposed permit amendment and extension would authorize the MMHSRP to perform the activities as described below on all threatened and endangered marine mammals species under NMFS jurisdiction, including species listed since the original permit, including: the Cook Inlet beluga whale, Hawaiian Insular false killer whale, ringed seal, and bearded seal. The proposed permit amendment and extension includes the use of radiography, described below; all other activities, described in the biological opinion on the original permit are also described below.

Table 1. Take authorized by Permit No. 932-19050-1/MA-009526 for enhancement activities, incidental harassment, and import/export of marine mammals and marine mammal parts under the jurisdiction of the National Marine Fisheries Service (NMFS). Enhancement activities are conducted pursuant to Section 10(a)(1(A) of the ESA, in conjunction with Sections 109(h), 112(c), and Title IV authorities of the MMPA. Activities may occur at any time of year through June 30, 2015.

Species	**Life Stage**	**Sex**	**Number of Individuals "Taken"**	**Number of Takes per Individual**	**Authorized Actions**
All ESA-listed cetaceans, all ESA-listed pinnipeds under NMFS jurisdiction	All (no restriction on age class)	Male or Female	As warranted to respond to emergencies	As warranted to respond to emergencies[1]	Close approach; ground, aerial and vessel surveys; disentanglement; capture, restraint, anesthesia, sedation, handling, marking (excluding hot branding), tagging, ultrasound and X-ray, sample collection (including biopsy); sample analysis; treatment; import/export of live animals; transport, relocation, rehabilitation, release; hazing away from harmful situations; acoustic sampling, recording, and playbacks Live animals may be transported to rehabilitation facilities and release sites; live animals may be relocated; captive maintenance of non-releasable animals
All ESA-listed cetaceans, all ESA-listed pinnipeds under NMFS jurisdiction	All	Male or Female	As warranted to respond to emergencies	As warranted to respond to emergencies	Incidental mortality, euthanasia, necropsy, carcass disposal Carcasses may be transported to disposal sites or laboratories
All cetaceans, all pinnipeds under NMFS jurisdiction	All	Male or Female	As warranted to respond to emergencies	As warranted to respond to emergencies	Incidental harassment
All cetaceans, all pinnipeds under NMFS jurisdiction	All	Male or Female	As warranted to respond to emergencies	As warranted to respond to emergencies	Import/export of live non-ESA listed marine mammals Collection, receipt, possession, transport, import, export, analysis, and curation of hard and soft parts Analytical and diagnostic samples may be transported, imported or exported as needed to laboratories

[1] The term "emergencies" generally refers to health emergencies involving marine mammals and include, but are not limited to stranding events, entanglements, disease outbreaks, UMEs, and exposure to biotoxins. Due to their nature, the number of individuals that might be "taken" during responses cannot be determined in advance. The reason the number of takes is listed "as warranted" is so that the MMHSRP does not limit a response/rescue activity in a way that prevents the saving of the life of an animal (e.g., if we permit 25 animals, and 26 need to be rescued, we would have to do a major amendment to increase the numbers).

Table 2. Take authorized by Permit No. 932-1905-01/MA-009526 for research activities on marine mammals under NMFS jurisdiction pursuant to Section 104(c) of the MMPA and Section 10(a)(1)(A) of the ESA (as applicable). Activities may occur at any time of year. Prior approval in accordance with Condition B.2 is required before any research project may occur. Activities may occur at any time of year through June 30, 2015.

Species	**Life Stage**	**Sex**	**Expected Number of Individuals "Taken"**	**Number of Times an Individual Might be "Taken"**	**Proposed Action**
Small cetaceans	All	Male or female	As warranted[2]	5	Harassment from close approach, aerial and vessel surveys
Small cetaceans	All except young-of-the-year (YOY)	Male or female	Up to 200 annually (total)	5	Capture (net or hand), restraint, handling, tagging, marking (including freeze branding), sample collection, release; ultrasound and X-ray; and acoustic sampling, recording, and playbacks
Small cetaceans	All except YOY	Male or female	3 annually (total)	1	Incidental mortality during capture activities
Small cetaceans	All except YOY	Male or female	Up to 400 annually (total)	5	Collection of samples during other legal takes/permitted activities (subsistence harvest, by-catch, live capture/release)
Large whales	All except calves ≤ 6 months in age and cows with calves	Male or female	Up to 4,900 annually (total)	5	Harassment from close approach, aerial and vessel surveys
Large whales	All except calves ≤ 6 months in age and cows with calves (for tagging and health sampling)	Male or female	Up to 100 annually (total)	5	Close approach, aerial and vessel surveys, tagging and sample collection (including biopsy and respiratory gases), acoustic sampling (including recording and playback experiments), collection of feces, photo-identification (for visual health assessment and identification)

[2] As warranted to satisfy the requirements of study design. Research studies are inherently linked to emergency responses in that the research objectives are to study the health of marine mammal populations, often after a significant event such as an unusual mortality event (UME), which cannot be predicted. Direct take numbers are provided as estimates of sample sizes for research studies. Incidental take numbers are difficult to determine in advance of knowing what population is being studied. Prior approval of research projects is required.

Species	**Life Stage**	**Sex**	**Expected Number of Individuals "Taken"**	**Number of Times an Individual Might be "Taken"**	**Proposed Action**
Large whales	All except for live calves ≤ 6 months in age and cows with calves	Male or female	Up to 400 annually (total)	5	Collection of samples from dead animals in conjunction with the activities of other investigators who are operating under other permits or legal authority, subsistence harvest, or by-catch; collection of respiratory gasses and blood samples from live animals in conjunction with the activities of other investigators who are operating under other permits or legal authority, or during emergency response activities covered under the proposed permit
Pinnipeds (except Guadalupe fur seal, Hawaiian monk seal, Steller sea lion)	All	Male or female	As warranted	5	Harassment from close approach, aerial and vessel surveys
Pinnipeds (except Guadalupe fur seal, Hawaiian monk seal, Steller sea lion)	All	Male or female	Up to 300 annually (total for all species)	5	Capture (net or hand), restraint, handling, tagging, marking (excluding hot branding), sample collection (including biopsy), release; and acoustic sampling, recording, and playbacks
Pinnipeds (except Guadalupe fur seal, Hawaiian monk seal, Steller sea lion)	All	Male or female	3 annually (total for all species)	1	Incidental mortality during capture activities
Pinnipeds (except Guadalupe fur seal, Hawaiian monk seal, Steller sea lion)	All	Male or female	Up to 400 annually (total for all species)	5	Collection of samples during other legal takes/permitted activities (subsistence harvest, by-catch, live capture/release)

Species	Life Stage	Sex	Expected Number of Individuals "Taken"	Number of Times an Individual Might be "Taken"	Proposed Action
Hawaiian monk seals, Guadalupe fur seals, and Steller sea lions (eastern and western population) that are held in captivity and those undergoing rehabilitation	All	Male or female	As warranted	As warranted	Capture (net or hand), restraint, handling, tagging, marking (tagging and marking excludes hot branding and would only occur in an animal that is not already marked or is not otherwise identifiable), sample collection (including biopsy samples,) release, and acoustic sampling, recording, and playbacks
All cetaceans, all pinnipeds	All	Male or female	As warranted	As warranted	Collection, receipt, possession, transport, import, export, analysis, and curation of hard and soft parts Analytical and diagnostic samples may be transported, imported, or exported to laboratories as needed
All cetaceans, all pinnipeds	All	Male or female	As warranted	As warranted	Collection, receipt, possession, transport, import, export, analysis, and curation of hard and soft parts Analytical and diagnostic samples may be transported, imported, or exported to laboratories as needed

Aerial Surveys

The MMHSRP proposes to use aerial surveys to (1) locate imperiled marine mammals; (2) monitor behavior or disease in a given population or individual; and (3) survey the extent of disease outbreaks or die-offs. The type of aircraft used to respond to health emergencies depends upon the aircraft available at the time of the response and the logistics of the response. The frequency of surveys depends on the circumstances of stranded or entangled animals, the disease, or the occurrence of an unusual mortality event.

Aerial surveys are flown along predetermined transect lines at a set altitude and air speed while observers scan the water for signs of marine mammals. When participants in aerial surveys sight a marine animal or group of marine mammals, the survey aircraft descends and circles over the animal or animals while photographs are taken. The time and altitude of the aircraft depends on the aircraft and the response or research situation.

Vessel Surveys

The MMHSRP proposes to conduct vessel surveys to: collect data on animal abundance, assess animals; locate animals for research activities; and collect research samples. They propose to use vessel surveys to monitor animals subsequent to their release, assess health, for photo-identification, and tracking. They also propose to use vessels as a platform for conducting animal sampling.

For small cetaceans, inshore monitoring surveys are conducted using small (5-7 m) outboard motor powered boats. Animals are located by visually searching waters as the boat proceeds along a specified route at slow speeds (8-16 km/hr). Animals outfitted with very high frequency (VHF) radio tags are located by listening for the appropriate frequency and, after detecting a signal, maneuvering the boat towards the animal using a combination of signal strength and directional bearings. Frequencies and remote sensors may also be monitored. Once a group of animals is located, the boat approaches the group to assess their physical and medical condition. Photographs of the dorsal fins of individual animals are taken for later identification and matching to existing dorsal fin catalogs. When an animal is located that has been recently caught for a health evaluation, an attempt is made to photograph the dorsal fin and body to confirm identification, health, position, and behavior. A photograph of the dorsal fin would also be used to assess healing after tag attachment. The area behind and below the posterior aspect of the dorsal fin may also be photographed to assess healing at the site of the biopsy sample. A telephoto lens would be used for photographs, so vessels would not need to be too close to animals.

Multiple approaches may be required to obtain appropriate quality photographs, particularly if there are multiple individuals within a group. A close approach will be terminated and the boat will move away from a group of marine mammals if members of the group begin to display behavior that suggests they are experiencing undue stress (e.g., significant avoidance behavior such as "chuffing" or forced exhalation, tail slapping, or erratic surfacing).

Capture, Handling, and Restraint

The MMHSRP proposes to capture marine mammals to collect samples, perform an examination, or attach tags or scientific instruments.

For health assessment studies of small cetaceans (which include beluga, killer whales, and false killer whales), small schools of animals are approached for identification. If the school contains animals desired for capture, the school is followed until it is in waters that facilitate safe capture (waters outside of boating channels, equal to or less than 1.5 m deep, where currents are minimal). Typically no more than three animals are captured at one time. The animals are encircled with a 600 m long by 4 m deep seine net, deployed at high speed from an 8 m long commercial fishing motor boat. Small (5-7 m) outboard-powered vessels are used to help contain the animals until the net circle is complete. These boats make small, high-speed circles, creating acoustic barriers.

Once the net is completed, about 15-25 handlers are deployed around the outside of the corral to correct net overlays and aid any animals that may become entangled in the net. The remaining 10-20 or more team members prepare for sampling and data collection and begin the process of isolating the first individual. Isolation is accomplished by pinching the net corral into several smaller corrals.

Handlers are usually able to put their arms around the selected animal as it bobs in place or swims slowly around the restricted enclosure; however, animals may strike the net and become entangled. After any immediate danger is removed, the animals are restrained by handlers, and an initial evaluation is performed by a trained veterinarian. Once cleared by the veterinarian, the animal is transported to the processing boat via a navy mat and/or a sling. A sling is also used to place an animal back in the water for release.

In some cases, animals may need to be captured in deep waters. A break-away hoop-net is used to capture individuals as they ride at the bow of the boat. When they surface to breathe, the hoop is placed over their head and they move through the hoop, releasing the net. The additional drag of the net slows the animals substantially, but the design allows the animal to still use its flukes to reach the surface to breathe. The net is attached to a tether and large float, and the animal is retrieved, maneuvered into a sling and brought onboard the capture boat. All other procedures are the same for animals capture using either technique.

With both capture techniques, following restraint, animals are generally placed on foam pads on the deck of a boat, either solid hulled or inflatable, or another safe platform. The animal is shaded by a canvas top. The animal's respirations and behavior are monitored and recorded by one researcher. Another team member is responsible for ensuring that the animal's eyes are shaded from direct sunlight. Two to four personnel are positioned around the animal for restraint, as necessary, and to keep the animal wet and cool using buckets of water and sponges.

Some animals do not acclimate well to being on the platform; for these individuals the assessment is conducted in the water. Animals that appear to be pregnant (but not in the late 2nd or 3rd trimester) and young animals may also be worked up in the water when this is considered to be in the dolphin's best interest. In addition, for animals that have been caught in previous years a reduced sampling protocol may be employed, reducing the need for the animal to be removed from the water.

To disentangle large whales, whales may be either physically or chemically restrained. Physical restraint of the animal is accomplished by attaching control lines, floats, and buoys to the entangling gear with a grappling hook or by attaching new gear to the animal to hold it. Responders use control lines to pull themselves up to the whale. Floats and buoys are used to slow the animal down by increasing drag.

For pinnipeds, capture methods include, but are not limited to, nets, traps, conditioning, anesthesia, and immobilization agents administered remotely by a dart. Investigators typically capture pinnipeds that are resting onshore by stalking them and capturing them in circle, hoop, dip, stretcher, and throw nets. Net guns and pole nooses may also be used for capture. The MMHSRP may use herding boards to maneuver animals into cages. Young pups may be caught, picked up, and handled by researchers during their investigations.

For water captures of pinnipeds, dip nets, large nets, modified gill nets, floating or water nets, and platform traps may be used. Purse seine nets may be used offshore of haul-out sites to capture pinnipeds when they stampede into the water (Jeffries *et al.* 1993). Animals become entangled in these nets when the nets are pulled ashore. Once removed from the net, adult or juvenile pinnipeds are usually placed head first into individual hoop nets. Older animals may be restrained using gas anesthesia (administered through an endotracheal tube), a fabric restraining wrap, a restraining net, or through sedation. Pups may be restrained by hand, in a hoop net, or with the inhalation of a gas anesthesia (administered through a mask over their nose).

Transport

The MMHSRP proposes to use vehicles, boats, or aircraft to transport marine mammals to rehabilitation facilities or release sites. Commercial vehicle transport procedures for marine mammals under U.S. jurisdiction should comply with the Animal and Plant Health Inspection Service's "Specifications for the Humane Handling, Care, Treatment, and Transportation of Marine Mammals" (9 CFR Ch 1, Subpart E). The MMHSRP will follow the "Live Animal Regulations" published by the International Air Transport Association, and accepted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora, for the air transport of animals under foreign jurisdiction (IATA 2006). Both sets of standards have specifications for containers, food and water requirements, methods of handling, and care during transit.

Cetaceans may be transported on stretchers, foam pads, or air mattresses. For short-term transport, closed-cell foam pads are preferred because they are rigid and do not absorb water. Open cell foam is typically used for long-term transport of cetaceans because it can contour to the animal's form. Boxes may be constructed to transport the animal upright in a stretcher. Cetaceans will be protected from exhaust fumes, sun, heat, cold, and wind, as transport often occurs on the flatbed of a truck. Animals will be kept moist and cool, to avoid overheating (Geraci and Lounsbury 2005).

Small pinnipeds are typically transported in plastic kennel cages. Cages are large enough for animals to turn around, stretch out, and raise their heads. Cages should prevent animal contact with waste and allow proper air circulation. As with cetaceans, pinnipeds traveling by vehicle will be protected from the sun, heat, cold, wind, and exhaust fumes. Pinnipeds may overheat during transit and wetting the animal helps to prevent hyperthermia (Geraci and Lounsbury 2005). Large pinnipeds may need to be sedated during transport.

Close Approach

The MMHSRP proposes to closely approach marine mammals by aircraft, surface vessel, and on foot for disentanglement, photo-identification, behavioral observation, hazing (during emergency response), capture, tagging, marking, biopsy sampling, skin scrapes, swabs, collection of sloughed skin and feces, breath sampling, blood sampling, administration of drugs, video recording, and incidental harassment. These close approaches may involve more than one vessel.

Tagging and Attachment of Scientific Instruments

The MMHSRP proposes to tag marine mammals to monitor an animal's movements after it has been released from a stranding site, after rehabilitation, or after samples have been taken during research activities. The MMHSRP uses a variety tags and other scientific instruments, including, but not limited to, roto-tags (cattle tags), button tags, VHF radio tags, satellite tags, passive integrated transponder (PIT) tags, D-tags, code division multiple access tags, pill, time-depth recorders (TDRs), life history transmitters (LHX tags), and Crittercams® (video cameras).

The specific instrument employed will depend on the species being tagged and the research or question being addressed. The method used to attach tags and other instruments depends on the type of tags, the species involved, and the circumstances. Tags have traditionally been attached to cetaceans using bolt, buoy, punch, harness, suction cup, implant, or ingestion. Tags have traditionally been attached to pinnipeds using glue, bolt, punch, harness, suction cup, surgical implant, or ingestion.

Tags are generally attached to free-swimming cetaceans by crossbow, compound bow, rifles, spear guns, slingshot (or throwing device), pole or jab spears. Attachments are temporary and occur via a suction cup device or implant. Scientific instruments attached to suction cups include, but are not limited to D-tags, TDRs, VHF tags, satellite tags, and Crittercams®.

Large, slow moving whales have traditionally been tagged using suction cups and a pole delivery system that is cantilevered on the bow of a boat. Bow-riding animals have been tagged using hand-held poles. Fast-swimming toothed whales have traditionally been tagged using crossbows. Tags are attached on the dorsal surface of the animal behind the blowhole, closer to the dorsal fin. Tag placement ensures that the tag will not cover or obstruct the whale's blowhole, even if the cup migrates after placement (movement would be toward the tail).

Implantable tags are attached to free-swimming animals by mounting the instrument on an arrow tip or other device designed to penetrate the skin of the animal. Tags typically attached by crossbow include, but are not limited to satellite tags, VHF tags, and TDRs. Buoys are used to attach VHF or satellite tags to gear on entangled whales. Buoys may also be attached to increase drag in an attempt to slow the whale for disentanglement.

For animals in hand, tags may be attached for longer deployments. Roto-tags may be attached to cetaceans with a plastic pin to the trailing edge of the dorsal fin. Button tags are plastic disks attached with a bolt through the dorsal fin. VHF tags (roto-radio tags) may also be bolted through the trailing edge of the dorsal fin. The bolts on each type of tag are held in place by corrodible nuts, so that the tag will eventually be released.

Satellite or VHF tags can be mounted on a molded plastic or fabric saddle that would be bolted through the dorsal fin (Geraci and Lounsbury 2005) or dorsal ridge. Plastic saddles would be padded on the inside to reduce skin irritation. Saddles would be attached to the dorsal fin with two or three Delrin pins secured with magnesium nuts. The nuts would corrode in seawater, allowing the package to be released within a few days or weeks.

Dorsal ridge "spider tags" are currently used on beluga whales (NMFS Permit No. 782-1719) (Litzky et al. 2001). Up to four holes are bored in the region of the anterior terminus of the dorsal ridge using a coring device (trochar) with a diameter of no more than 1 cm. Each insertion and exit point for the trochars would be prepared by cleaning with an antiseptic wipe, or equivalent. Rods of nylon or other non-reactive material, not greater than 1 cm in diameter and 50 cm in length, would then be pushed through the holes and attached to the wire cables or fabric flange or straps of the satellite tags or through bolt holes in the tag. The wire cables would be tightened to hold the tag against the back of the animal to minimize tag movement and drag, but would not be put under significant tension to avoid pressure necrosis around the pin insertion points. The other attachment systems would be manipulated to achieve the best possible fit depending on their design. Excess rod would then be cut off. All equipment would be sterilized in cold sterile solution, alcohol, or equivalent, and kept in air- and water-tight containers prior to use. Trochars and rods would be coated with antiseptic gel prior to insertion and each trochar would only be used for one hole before it is cleaned, sharpened, and resterilized. Where more than one instrument is to be attached, the number of pins would be limited to four.

For pinnipeds, a fast drying epoxy adhesive is used to glue scientific instruments in place. Instruments may be attached to the dorsal surface, head, or flippers and will release when the animal molts. A harness can be used to attach scientific instruments. Roto-tags can be attached to flippers using a single plastic pin. Tags can also be surgically implanted into the body cavity or muscle of pinnipeds. Implanted tags include PIT and LHX tags.

A PIT tag is a glass-encapsulated microchip, which is programmed with a unique identification code. When scanned with an appropriate device, the microchip transmits the code to the scanner, enabling the used to determine the exact identity of the tagged animal. PIT tags are biologically inert and are designed for subcutaneous injection using a syringe or similar injecting device. The technology is well established for use in fish and is being used successfully on sea otters (Thomas *et al.* 1987), manatees (Wright et al. 1997), and southern elephant seals (Galimberti *et al.* 2000). PIT tags are also commonly used to identify domestic animals. PIT tags may be injected just below the blubber in the lumbar area, approximately 5 inches lateral to the dorsal midline and approximately 5 inches anterior to the base of the tail. Tags may also be injected at alternative sites on a pinniped's posterior, but only after veterinary consultation. The injection area would be cleansed with Betadine (or equivalent) and alcohol prior to PIT tag injection. PIT tags are currently being used in Hawaiian monk seals (NMFS Permit No. 10137).

LHX tags are satellite linked, delayed transmission life history transmitters. The tag allows continuous monitoring from up to five built in sensors. The tag is implanted into the abdominal cavity of a pinniped. When the animal dies, the tag is released from the body and transmits the data to a satellite. The battery life of an LHX tag is well over five years. LHX tags are being used under current NMFS research permits for California sea lions and Steller sea lions.

Marking

Marking methods for marine mammals during research activities include, but are not limited to: bleach, crayon, zinc oxide, paint ball, notching, and freeze branding. Hot branding will not be used as a marking method. Crayons, zinc oxide, and paint balls can be used on cetaceans and pinnipeds for temporary, short-term marking. Human hair bleach or dye may be used to mark pinnipeds. The marks are temporary, with the length of time dependent on molting. Notching can be used to permanently mark cetaceans by cutting a piece from the trailing edge of the dorsal fin. Notching in pinnipeds removes a piece of skin from the hind flipper of phocids (true or earless seals) and the foreflipper of otariids (sea lions and fur seals).

Cetaceans can be marked using freeze branding, typically on both sides of the dorsal fin or just below the dorsal fin. Freeze branding is used during health assessment studies to mark all animals for post-release monitoring. Freeze branding uses liquid nitrogen to destroy the pigment producing cells in skin. Each brand (typically 2" numerals) is super-cooled in liquid nitrogen and applied to the dorsal fin for 15-20 seconds. After the brand is removed, the area is wetted to return the skin temperature to normal. Brands will eventually re-pigment, but may remain readable for five years or more.

Freeze brands provide long-term markings that may be important during subsequent observations for distinguishing between two animals with similar fin shapes of natural markings. Freeze branding may be used to produce two types of marks on pinnipeds. Short contact by the branding iron destroys pigment producing cells, leaving an unpigmented brand. Longer contact with the brand destroys these cells and the hair, leaving a bald brand (Merrick *et al.* 1996). During health assessments, each animal is photographed and videotaped to record the locations of freeze brands. Freeze bands are photographed as they are applied, as they rapidly disappear following application.

Biopsy Sampling

The MMHSRP proposes to conduct biopsy sampling to collect skin, blubber, or other tissue samples. Sampling would occur on free ranging animals, animals captured for health assessment studies, and animals in rehabilitation. Skin and blubber biopsy sampling from a vessel would be conducted using crossbows, compound bows, dart guns, or pole spears. A crossbow would be used to collect a sample from animals within approximately 5 to 30 m of the bow of the vessel. The depth of the biopsy tip penetration would vary depending on the species being sampled and the depth of their blubber layer. For small cetaceans, such as bottlenose dolphins, the biopsy tip used to collect blubber for contaminant analysis penetrates to a depth of approximately 1.0-2.5 cm. Shorter tips may be used when only skin sampling is required. Sloughed skin can aggregate in the wake behind a moving animal, the slick "footprint" after a whale submerges, or in the water following surface active behaviors, such as breaching. This skin may be collected for analyses. Skin may also be collected from the suction cup used to temporarily attach scientific instruments to cetaceans.

Blubber biopsy samples would be taken during health assessment studies. These samples are necessary for the analyses of environmental contaminants, biotoxins, and fatty acids. An elliptical wedge biopsy is obtained from each animal. For small cetaceans, the sampling site is located on the left side of the dolphin, just below the posterior insertion of the dorsal fin. Local anesthetic (typically Lidocaine) is injected in an L-block at the biopsy site. A veterinarian then uses a clean scalpel to obtain a sample that is approximately 5 cm long and 3 cm wide, through nearly the full depth of blubber (approximately 1.5- 2.0 cm). A cotton plug soaked with ferric subsulfate is inserted into the site once the sample is removed in order to stop bleeding. The sample is then partitioned into separate containers for each project. Skin obtained with the blubber biopsy is used for genetic analyses. Skin scrapings, biopsy samples, or needle aspirates will be collected for clinical diagnoses from sites of suspected lesion. These samples are processed by various diagnostic laboratories and a sub-sample is sent to the National Marine Mammal Tissue Bank. Blubber and muscle biopsies may be collected from pinnipeds. Prior to sampling, investigators would inject animals with local anesthetics (using subcutaneous and intramuscular injections), clean the site with a topical antiseptic, make small incisions with a sterile scalpel blade, and push a sterile biopsy punch through the blubber and into the muscle layer to obtain ~ a 50 mg tissue sample. Investigators would apply pressure and irrigate the wound but would not close the wound with sutures.

The proposed permit does not authorize investigators associated with the MMHSRP to take biopsy samples of large whale calves that are less than 6 months in age or mothers attending such calves.

Blood Sampling

The MMHSRP proposes to collect blood for diagnostic and research purposes. For cetaceans, the MMHSRP would collect blood samples from the dorsal fin, caudal peduncle, pectoral flipper, or flukes. At any of these sites, blood would be sampled using an 18- gauge 4-cm needle, with a scaled down needle bore for calves, Dall's porpoise, and harbor porpoise. For phocid seals and otariids, blood samples would be collected through the bilaterally divided extradural vein, which overlies the spinal cord. Otariids may also be sampled using the caudal gluteal vein. Sampling would be done with a 20-gauge, 4-cm needle for small animals and an 18-gauge, 4-cm needle for larger animals. Phocids may be sampled by inserting a needle into the metatarsal region of the hind flipper (Geraci and Lounsbury 2005).

Blood sampling small cetaceans during health assessment studies may occur in the water before an animal is brought aboard a research vessel or once the animal has been brought aboard the vessel. Typically, blood samples are drawn from blood vessels on the ventral side of the fluke, using an 18-20 gauge catheter. About 200-350 cubic centimeters (cc) of blood are removed from each individual.

Samples are placed in a variety of Vacutainers or other containers if analyses require different storage. Samples are generally stored in coolers until they are transported to a laboratory, although some samples may be processed on deck with a portable centrifuge system. Samples are separated and prepared for: standard chemistry, hematology, and hormonal analysis; contaminant analyses; immune function studies; aliquots for culturing for assessment of pathogens; and other preparations as necessary.

Breath Sampling

The MMHSRP proposes to sample the breath of cetaceans or pinnipeds to assess their nutritional status and health. A specially designed vacuum cylinder would be used to collect breath samples. Samples would be collected from free ranging cetaceans by positioning a funnel at the end of a pole (which is connected to the vacuum cylinder via plastic tubing) over the blowhole of the surfacing animal. The cylinder valve would be manually opened during exhalation. An algal culture plate inside the funnel would be used for bacterial cultures of the breath. The culture plate would be sealed and transported to a laboratory for analysis. The equipment typically would not touch the animal, although in some instances there may be brief (less than 10 seconds) contact. An individual animal may be approached up to three times to obtain a sample. Samples may also be collected during health assessments or on any live captured animal. The samples will then be examined using gas chromatography-mass spectrometry for volatile compounds to evaluate respiratory disease, nutritional status, and physical condition.

Ultrasound Sampling

The MMHSRP proposes to use ultrasound to examine free-ranging animals and animals captured during emergency response or research studies. Ultrasound may be used to evaluate blubber thickness, wounds, lesions, pregnancy, reproductive organs, and blood vessels. During health assessment studies, a diagnostic ultrasound is used to examine the condition of the internal organs and to measure testis length and diameter to assess male maturity. Females are also examined by a veterinarian during the initial evaluation for pregnancy and the presence of developing follicles. Females determined to be in late-term pregnancy (late 2nd and 3rd trimester) are tagged with a roto-tag so they can be avoided in subsequent sets, and then immediately released. The ultrasound operates at a frequency of about 2.5-5.0 MHz, well above the hearing of most cetaceans. The examinations are recorded on video and audio tape, and thermal prints are made of features of interest. In addition, digital video thermography is used to measure skin temperature.

Other Sampling

The MMHSRP proposes to conduct other sampling, including: tooth extraction, urine, blowhole, fecal, milk, and sperm. Colonic temperature measurements may also be conducted. Most of these samples are collected during health assessment studies. During health assessment studies, the age determination of animals is conducted using the deposition of growth layer groups in teeth. Tooth extraction is conducted by a veterinarian trained in this procedure. The tissue surrounding the tooth (usually #15 in the lower left jaw) is infiltrated with Lidocaine without epinephrine (or equivalent local anesthetic), applied through a standard, high-pressure, 30 gauge needle dental injection system. Once the area is anesthetized, the tooth is elevated and extracted using dental extraction tools. A cotton plug soaked in Betadine, or equivalent, solution is inserted into the alveolus (pit where the tooth was) as a local antibiotic and to stop bleeding. This plug is removed prior to release. This procedure is modified from that described by Ridgway *et al.* (1975), wherein the entire mandible was anesthetized. The revised procedure has been used in captivity and in live capture and release sampling for many years. Extracted teeth are sectioned, stained, and growth layer groups are counted.

Urine analyses are diagnostically useful to evaluate the urinary system (kidneys, ureters, bladder, and urethra). Important diagnoses can be made by determining the color, pH, turbidity, chemical constituents, presence or absence of blood, and by identifying any bacteria or yeast present in the urine. These diagnoses would likely be missed without such an examination. During health assessment studies, urine may be collected opportunistically, by holding an open sterile container in the urine stream. Samples may also be collected using urinary catheterization. A veterinarian experienced with cetaceans and a qualified veterinary technician perform the catheterization procedure. The dolphin would be lying on its side on the foam-covered deck of the boat serving as the veterinary laboratory. Wearing sterile surgical gloves, the assistant gently retracts the folds of the genital slit to allow visualization of the urethral orifice. The veterinarian (wearing sterile gloves) carefully inserts a sterile urinary catheter, lubricated with sterile lubricating gel, into the bladder via the urethra. A 50 ml collection tube without additive is used to aseptically collect the urine as it flows from the catheter. The catheter is removed after the urine is collected.

Swab samples from the blowhole and rectum are collected from each individual. A sterile swab is inserted into the blowhole during a breath, gently swabbed along the wall of the blowhole, and removed during the next breath. Fecal samples are obtained either from a small catheter inserted about 10 cm into the colon or from a sterile swab of the rectum. Cetacean feces may also be collected in the water column either from a vessel or a diver in the water. Pinniped feces may be collected directly from haul-out or rookery sites. The samples are sent to a diagnostic laboratory for culturing and species identification.

Milk samples are collected to measure the levels of lipophilic organic contaminants and to determine composition. All adult females are checked for lactation and milk samples are collected from all lactating females. A "breast-pump" apparatus is used to obtain the sample. Milk is expressed with gentle manual pressure exerted on the mammary gland while suction is provided by a 60 cc syringe attached by tubing to another 12 cc syringe placed over the nipple. Samples of up to 30-50 ml may be collected.

Colonic temperature is measured to understand vascular cooling and reproductive status (Rommel *et al.* 1992, 1994). Temperature measurements are obtained with a linear array of thermal probes interfaced to a laptop computer. The probes are housed in a 3 mm flexible plastic tube. The probe is sterilized, lubricated, and then inserted into the colon through the anus to a depth of 0.25-0.40 m depending on the size of the animal. Temperature is continuously monitored.

Skin biopsies may be obtained from individuals displaying indications of skin disease. Gastric samples may be obtained using a standard stomach tube to evaluate health and evidence of brevetoxin exposure. Standard length and girth measurements may be taken and a series of ultrasonic measurements of blubber layer thickness may be obtained (the larger the animal, the more measurements). Investigators may also take samples of hair, nails, and vibrissae from pinnipeds: vibrissae are pulled from the root while nails and hair are simply clipped.

Administration of Drugs

The MMHSRP proposes to administer drugs to sedate or chemically restrain marine mammals during stranding response and disentanglement activities. They propose to use anesthetics and analgesics during research before performing biopsies, tooth extractions, and other procedures. They also propose to administer antibiotics, antifungal agents, and other medicines during response and rehabilitation. They would administer these drugs orally, by injection, intubation, or inhalation. Orally administered medications are typically hidden in fish but may also be given via stomach tube.

The MMHSRP proposes to deliver the drug via subcutaneous, intravenous, intramuscular, and intraperitoneal injections. All of these methods would require some level of animal restraint. Subcutaneous injections are made in the interface between the blubber layer and the skeletal muscle layer. Animals must be maintained in a certain position for prolonged periods of time. The most common site for subcutaneous injections in pinnipeds is the craniodorsal thorax between the scapulae. Subcutaneous injections would not be used in cetaceans.

In general, intravenous injections are complicated and rarely used in marine mammals. In cetaceans, medications may be injected in the fluke vessel if the volume is low and the medicine is not harmful if delivered perivascularly. An indwelling catheter may be used if repeated administration or slow infusion occurs (McBain 2001).

Intramuscular drug injections require longer needles because of the thickness of skin and blubber. Caution is taken to avoid accidental injection into the blubber, which may cause sterile abscess formation or poor absorption (Gulland *et al.* 2001). Injection into the blubber also has different drug-partitioning properties than muscle. This may result in the failure to activate a systemic distribution of highly lipid soluble medications (Stoskopf *et al.* 2001). Injection sites for phocids are the muscles surrounding the pelvis, femur, and tibia. These sites, as well as the large muscles overlying the scapulae, are appropriate for otariids (Gulland *et al.* 2001). Intramuscular injections in cetaceans may be made off the midline, slightly anterior to, parallel to, or just posterior to the dorsal fin. Caution is taken to avoid the thoracic cavity if the injection is anterior to the dorsal fin (McBain 2001). Multiple injection sites may be used and the volume per site should be reasonable depending on the animal.

Intraperitoneal injections deliver medications into the abdominal cavity. Non-irritating drugs may be delivered by this method. During injection, caution must be taken to avoid damaging major organs. A contaminated needle or puncturing the gastrointestinal tract could introduce bacteria into the abdominal cavity (Gulland *et al.* 2001).

Euthanasia

The MMHSRP proposes to euthanize marine mammals that have irreversibly poor condition (i.e., moribund as determined by a veterinarian) and for whom rehabilitation would not be possible, rescue would be impossible, or no rehabilitation facility is available. Animals may be euthanized at a rehabilitation facility when veterinarians conclude that an animal cannot be released and cannot be placed in permanent captivity. Euthanasia procedures would only be carried out by an attending, experienced, and licensed veterinarian or other qualified individual. Sedation may precede the administration of euthanasia drugs. Pinnipeds are typically euthanized using a lethal injection of barbiturates or other agent normally used to euthanize domestic species. Smaller cetaceans can be euthanized by injecting barbiturates or other lethal agent into a vein of the flippers, dorsal fin, flukes, or caudal peduncle. It may also be injected directly into the heart of abdominal cavity using an indwelling catheter.

Small cetaceans may be sedated before they are injected. For large cetaceans, a method is currently being developed to sedate the animal via intramuscular injection and then deliver euthanasia agents using intravenous injection. Large cetaceans may be euthanized by lethal injection directly into the heart. Injection into a vein of the flippers or flukes would likely be unsuccessful. Large whales may also be euthanized by using ballistics (shooting) or by exsanguination (Geraci and Lounsbury 2005).

Radiography

Radiography may be conducted on ESA-listed species during response activities including free ranging animals, animals captured during emergency response, animals undergoing rehabilitation; or, on any species in the wild, in rehabilitation, or in captivity during research studies. Animals of any age/sex could be radiographed, including pregnant females.

Radiographic methods include radiographs, computed tomography (CT), and magnetic resonance imaging (MRI). Radiographs, CT and MRI may be used for a variety of reasons including, but not limited to, assessment of: entanglements, ingested foreign objects (e.g., hooks), wounds, lesions, the detection of wounds/lesions/infection, pregnancy, bone density, and dental health including age and lesions/infection. Additionally, radiographs, CT and MRI may also be used to evaluate cardiac function, other internal organs, and the presence of fat or gas emboli.

Any standard diagnostic radiograph unit including digital, portable field, and dental units would be used to examine marine mammals. Plate and film type will depend on the area of interest and the size of the patient. Any CT or MRI would be used to examine marine mammals, this usually involves transport of the patient to a veterinary or human facility (e.g., for brain scans, bone scans, specialized cardiac scans, etc.). Chapter 25 of the *CRC Handbook of Marine Mammal Medicine* will be used as a reference for equipment and methods of radiography for marine mammals (Van Bonn et al. 2001). For some species, sedation and/or anesthesia may be necessary for the comfort of the animal and to limit movement for radiography; or, imaging may be conducted concurrently with other scheduled medical procedures requiring sedation or anesthesia. The level of sedation/restraint is at the discretion of the attending veterinarian.

The MMHSRP provided the following example of research use of radiographs (drafted by Deb Faquier and emailed from Amy Sloan on January 7, 2014). During health assessment studies of bottlenose dolphins, standard dental radiographs are used to examine the condition of the teeth and jaws to assess for existing trauma and/or disease conditions and additionally, radiographs are used for both teeth and flipper bones to evaluate bone density. For dental radiographs a mouth plate will be used under manual restraint. The mouth plate and holder measures1/8 inch thick and usually 4 to 8 exposures per dolphin will be taken on deck or in the water. Additionally for dental radiographs an aluminum wedge will be used as a quality control for the radiograph generator output and exposure quality. Aluminum approximates the density of bone very closely. A step wedge of aluminum of 1mm to 9mm can easily be incorporated into a plexi-glass holder similar to the one already used for dolphin digital radiographs. The only difference in the design is that the holder containing the wedge is thicker, which translates to a holder that is about 1/2 inch thick rather than 1/8 inch thick. The extra thickness will actually add stability to the holder and the animal's mouth is only slightly more open when closed down on the plate, which is within the limits of acceptance by bottlenose dolphins. Only one exposure per animal will be added. Utilizing the wedge will allow for exposure quality control between animals and also as an added benefit will allow for relative bone quality comparisons between animals.

An example of emergency response requiring radiographs follows. Recently Hawaiian monk seals have been presenting with ingested fish hooks/gear. In these cases the seals are captured using standard techniques then either radiographed in the field using a portable radiograph unit or transported to a nearby veterinary clinic for radiography. Seals may be sedated with midazolam or other drug combinations to limit mobility during the radiographic procedure. Animals will be monitored by veterinary staff during the procedure. Based upon the radiographic findings the animals may be admitted to rehabilitation or treated and released in the field.

An example of rehabilitation requiring MRI follows. California sea lions are known to suffer from domoic acid intoxication. Some animals may have permanent brain damage from the toxin leading to impaired memory and decreased release success. MRI has been used by rehabilitation facilities to determine the presence and extent of brain damage in domoic acid exposed sea lions. A California sea lion would be transported to the veterinary or human medical MRI facility following standard techniques. The sea lion would be restrained and anesthetized with an appropriate drug combination (midazolam, butorphanol, isoflurane). The sea lion would then be intubated, instrumented, and vital signs would be monitored by veterinary staff during the MRI procedure. The MRI procedure for a brain scan usually lasts 30-45 minutes, after the scan the animal would be recovered from anesthesia and transported back to the rehabilitation facility.

Auditory Brainstem Response/Auditory Evoked Potential

The MMHSRP proposes to conduct auditory brainstem response and auditory evoked potential procedures to evaluate the hearing abilities of individual animals or species. These procedures may be conducted on stranded animals, animals in rehabilitation, or animals captured during studies. Electrodes are used for obtaining evoked potential signals in pinnipeds. Procedures on odontocetes (i.e., toothed whales) are non-invasive and can be conducted in short time frames. An animal may be resting at the surface or may be physically restrained (held by researchers) during the procedure. For odontocetes, sounds are presented through a jawphone attached to the lower jaw via suction cup.

Recording, ground, and reference suction cup electrodes are attached along the dorsal midline, starting approximately 6 cm behind the blowhole. Evoked potentials are recorded from the electrodes. Frequencies used for testing range from 5 to 120 kHz and the maximum sound pressure level is less than 160 decibels re μPa. Procedures would only be conducted on odontocetes and pinnipeds.

<u>Active and Passive Acoustics</u>

In addition to Auditory Brainstem Response procedures, the MMHSRP proposes to conduct both active and passive acoustic activities. Passive recordings may be conducted using a hydrophone placed in the water directly off of a vessel or in a pool to record animal vocalizations and background noise. Investigators may use active acoustic playbacks to expose both cetaceans and pinnipeds to social sounds and feeding calls of the subject species during capture/release and rehabilitation; the physiological and physical response of the animals would be measured. Playbacks may be used to assess hearing to determine if animals undergoing rehabilitation are suitable for being returned to the wild. In addition, in some cases, playbacks of the subject species may be used to lure out-of-habitat animals to their natural habitat, or predatory sounds or other deterrents may be played to deter or haze animals from harmful situations, as described below.

Hazing

The MMHSRP proposes to haze ESA-listed marine mammals that are in the vicinity of an oil or hazardous material spill, harmful algal bloom, sonar, or any other potentially harmful situation. Methods include acoustic deterrent and harassment devices, visual deterrents, vessels, physical barriers, and capture and relocation. Acoustic deterrents used on cetaceans may include, but are not limited to, pingers, bubble curtains, Oikomi pipes, seal bombs, airguns, mid- and low-frequency sonar, predator calls, and aircraft. Other non-lethal deterrents such as booms or line in the water, or fire hoses may be used. Pinniped acoustic deterrents include seal bombs, Airmar devices, predator calls, bells, firecrackers, and starter pistols. Visual deterrents for pinnipeds include flags, streamers, flashing lights; barriers such as net or fencing may also be used to exclude or deter pinnipeds.

Acoustics

The Permits Division does not currently authorize the use of the auditory evoked potential method on any mysticete whale. However, if the Permits Division allows investigators to use this procedure for mysticete whales during the 5-year period of the proposed permit, the MMHSRP proposes to use this procedure to conduct research.

Import and Export of Marine Mammals or Marine Mammal Parts

The MMHSRP proposes to export marine mammal parts to provide specimens to the international scientific community for analyses or as control or standard reference materials. Similarly, the MMHSRP proposes to import specimens obtained legally outside the United States for archival in the National Marine Mammal Tissue Bank or for real time analyses. Imported samples would be legally obtained from:

1. Any marine mammal directly taken in fisheries for such animals in countries and situations where such taking is legal;
2. Any marine mammal killed in subsistence harvest by native communities;
3. Any marine mammal killed incidental to commercial fishing operations;
4 Any marine mammal stranded live or dead; and
5. Captive animals, when sampling is beyond the scope of normal husbandry practices.
6. Samples taken from live animals conducted under other permitted studies.

Unlimited numbers and kinds of marine mammal specimens, including cell lines, would be imported and/or exported (worldwide) at any time during the year. Specimens would be taken from cetaceans and pinnipeds (except walrus), including threatened and endangered species. Specimens from species under the jurisdiction of the USFWS including walrus, polar bear, sea otter, marine otter, manatees, and dugongs may be received, analyzed, curated, and imported/exported. Specimen materials may include, but are not limited to: earplugs; teeth; bone; tympanic bullae; ear ossicles; baleen; eyes; muscle; skin; blubber; internal organs and tissues; reproductive organs; mammary glands; milk or colostrums; serum or plasma; urine; tears; blood or blood cells; cells for culture; bile; fetuses; internal and external parasites; stomach and/or intestines and their contents; feces; flippers; fins; flukes; head and skull; and whole carcasses. Specimens would be acquired opportunistically; therefore specific numbers and kinds of specimens, the countries of exportation, and the countries of origin cannot be predetermined.

Sample Collection and Analysis

The MMHSRP proposes to take specimens from cetaceans and pinnipeds (except walrus), including threatened and endangered species. Specimen materials include, but are not limited to: earplugs, teeth, bone, tympanic bullae, ear ossicles, baleen, eyes, muscle, skin, blubber, internal organs and tissues, reproductive organs, mammary glands, milk or colostrums, serum or plasma, urine, tears, blood or blood cells, cells for culture, bile, fetuses, internal and external parasites, stomach and/ or intestines and their contents, feces, air exhalate, flippers, fins, flukes, head and skull, and whole carcasses. Specimens would be acquired opportunistically with ongoing studies or prospective design plans; therefore specific numbers and kinds of specimens cannot be predetermined. Because all specimens will be acquired opportunistically, the MMHSRP will have minimal control over the age, size, sex, or reproductive condition of any animals that are sampled.

Specific methods for biopsies, blood, breath, ultrasound, and other sampling are described previously. Marine mammal specimens collected for analysis or archiving would be legally obtained from the following sources:

1. On-going live animal capture/release programs;
2. Live animal capture/release as part of a disease, emergency response, or die-off investigation;
3. Live animals stranded or in rehabilitation;
4. Captive animals, when sampling is beyond the scope of normal husbandry
5. Animals found dead on the beach or at sea;
6. Animals directly taken in fisheries in countries where taking of such animals is legal;
7. Animals killed during subsistence harvests by native communities;
8. Animals killed incidental to recreational and commercial fishing operations;
9. Animals killed incidental to other human activities;
10. Animals found dead as part of National Oceanic and Atmospheric Administration (NOAA) investigations (*e.g.* harmful algal blooms, oil spills, etc.);
11. Soft parts sloughed, excreted, or discharged by live animals (including blowhole exudate);
12. Live animals during surveillance
13. Bones, teeth, or ivory found on the beach or on land within ¼ mile of the ocean;
14. Confiscated animals (*e.g.*, as part of enforcement action); or
15. Animals legally taken in other permitted research activities in the United States or abroad.

Specimen and data collection from marine mammal carcasses may follow the necropsy protocols for pinnipeds (Dierauf 1994), right whales (and other large cetaceans) (McLellan *et al.* 2004), and killer whales (Raverty and Gaydos 2004). These protocols describe how samples would be stored, transported, and analyzed. During live animal response or research, specimen and data collection protocols would depend on the samples being collected and the intended analyses.

Permit Terms and Conditions

The Terms and Conditions are explicitly stated the draft permit (No. 932-1905-01/MA-009526). To evaluate the effects of the proposed action on ESA-listed species, we summarize the Terms and Conditions, as follows:

The activities authorized by the Permit must occur by the means, in the areas, and for the purposes set forth in the permit application, and as limited by the Terms and Conditions specified in the permit, including all appendices. Any permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

Duration of Permit

1. The permit extension expires on June 30, 2015 and is non-renewable. Personnel listed in the permit may conduct authorized activities through the expiration of the permit. Co-investigators (CIs) are limited by the Terms and Conditions of the CI authorization provided by the Permit Holder or Principal Investigator (PI).

2. Personnel authorized under the permit must suspend a particular activity identified in Tables 1-2 in the event serious injury or mortality[3] of protected species reaches the level specified for that activity in Tables 1-2. The Permit Holder must contact the Chief of the Permits Division by phone (301-713-2289) within two business days. The Permit Holder must also submit a written incident report. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of the permit.

3. If authorized take (Tables 1-2) is exceeded, personnel must cease all permitted activities, and the Permit Holder or PI must notify the Chief, Permits Division by phone (301-713-2289) as soon as possible, but no later than within two business days. The Permit Holder must also submit a written incident report. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of the permit.

Number and Kind(s) of Protected Species, Location(s) and Manner of Taking

1. Tables 1-2 outline the number of animals, by species, authorized to be taken, and the locations, manner, and time period in which they may be taken.

2. Detailed protocols for research takes of NMFS species authorized in Table 2 must be submitted to the Permits Division 30 days in advance of the proposed activities for non-ESA listed marine mammals and 3 months in advance for ESA-listed marine mammals. As necessary, the protocols will be reviewed in consultation with the Marine Mammal Commission, the U.S. Department of Agriculture Animal and Plant Health Inspection Service, and the NMFS Office of Protected Resources Endangered Species Division. Approvals for specific research projects

[3] This permit allows for unintentional serious injury and mortality caused by the presence or actions of authorized personnel up to the limit in Tables 1-2. This includes, but is not limited to; deaths of dependent young by starvation following research-related death of a lactating female; deaths resulting from infections related to sampling procedures; and deaths or injuries sustained by animals during capture and handling, or while attempting to avoid researchers or escape capture. Note that for marine mammals, a serious injury is defined by regulation as any injury that will likely result in mortality.

will be granted at the discretion of the Chief, Permits, Conservation and Education Division, or as necessary, the Director, Office of Protected Resources.

3. This condition does not apply to investigations related to UMEs. The Permit Holder or PI may conduct health assessment research on populations affected by UMEs, including apparently healthy animals, after consulting with the Working Group on Marine Mammal Unusual Mortality Events for advice on any live animal investigative activity.
4. As applicable, personnel authorized under the permit must comply with the Conditions in the Permit appendices for conducting permitted activities on live marine mammals under NMFS jurisdiction.

Qualifications, Responsibilities, and Designation of Personnel

1. The following personnel may participate in the conduct of the permitted activities in accordance with their qualifications and the limitations specified herein:
    a. PI – Dr. Teri Rowles;
    b. CI – Dr. Janet Whaley and NMFS Regional Stranding Coordinators; additional CIs may be authorized; and
    c. Research Assistants (RAs)– personnel identified by the PI or CI and qualified to act pursuant to Conditions of the permit. RAs are individuals who work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI.

2. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities. The Permit Holder is ultimately responsible for all activities of any individual who is operating under the authority of the permit. Where the Permit Holder is an institution/facility, the Responsible Party is the person at the institution/facility who is responsible for the supervision of the Principal Investigator.

3. Personnel involved in permitted activities must be reasonable in number and essential to conduct of the permitted activities. Essential personnel are limited to:

    a. Individuals who perform a function directly supportive of and necessary to the permitted activity (including operation of any vessels or aircraft essential to conduct of the activity);

    b. Individuals included as backup for those personnel essential to the conduct of the permitted activity; and

    c. Individuals included for training purposes.

Reports

1. The Permit Holder must submit annual, final, and incident reports, and any papers or publications resulting from the activities authorized herein to the Chief, Permits Division.

2. Written incident reports related to serious injury and mortality events or to exceeding authorized takes, must be submitted to the Chief, Permits Division within two weeks of the incident. The incident report must include a complete description of the events and identification of steps that will be taken to reduce the potential for additional mortality or exceeding authorized take.

3. Research results must be published or otherwise made available to the scientific community in a reasonable period of time.

Modification, Suspension, and Revocation

1. All permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR part 904 and/or 50 CFR Parts 13, 17 and 18 for USFWS species.

2. The Director, NMFS Office of Protected Resources may modify, suspend, or revoke the permit in whole or in part:

   a. In order to make the permit consistent with any change made after the date of permit issuance with respect to any applicable regulation prescribed under section 103 of the MMPA and section 4 of the ESA;

   b. In any case in which a violation of the terms and conditions of the permit is found;

   c. In response to a written request[4] from the Permit Holder;

   d. If NMFS determines that the application or other information pertaining to the permitted activities (including, but not limited to, reports pursuant to Section E of the permit and information provided to NOAA personnel pursuant to Section G of the permit) includes false information; and

   e. If NMFS determines that the authorized activities will operate to the disadvantage of threatened or endangered species or are otherwise no longer consistent with the purposes and policy in Section 2 of the ESA.

[4] The Permit Holder or PI may request changes to the permit related to: the objectives or purposes of the permitted activities; the species or number of animals taken; and the location, time, or manner of taking or importing protected species. Such requests must be submitted in writing to the Chief, Permits Division in the format specified in the application instructions.

Penalties and Permit Sanctions

1. Any person who violates any provision of the permit, the MMPA, ESA, or the regulations at 50 CFR Part 13, 50 CFR Part 17, 50 CFR Part 18, 50 CFR 216 and 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the MMPA, ESA, and 15 CFR part 904 and 50 CFR Part 13.

2. NMFS shall be the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in the permit. The Permit Holder must contact the Permits Division for verification before conducting the activity if they are unsure whether an activity is within the scope of the permit. Failure to verify, where NMFS subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the MMPA, the ESA, and applicable regulations in any enforcement actions.

3.0 Action Area

As described in the biological opinion on the original permit, the action area encompasses the coastal waters and Exclusive Economic Zone (EEZ) of the United States, its territories, and possessions, and adjacent marine waters.

As described in the PEIS, the action area includes all areas where MMHSRP activities may occur. The action area encompasses the coastal waters and EEZ of the U.S., its territories, and possessions, and adjacent marine waters. The coastal zone includes coastal waters, adjacent shorelands, intertidal areas, salt marshes, wetlands, and beaches. The action area also includes the marine mammal rehabilitation facilities of the stranding network.

4.0 Approach to the Assessment

Section 7(a)(2) requires every Federal agency, in consultation with and with the assistance of NMFS, to insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any ESA-listed species or result in the destruction or adverse modification of designated critical habitat. During our Section 7(a)(2) consultation and analyses, we follow a series of steps to make this determination.

We first review all relevant information provided by the Permits Division and MMHSRP to describe the action, including interrelated and interdependent actions. Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions have no independent utility apart from the proposed action. We also describe the action area, which includes all areas affected directly and indirectly by the action.

Second, we evaluate the current status of ESA-listed and proposed species and designated and proposed critical habitat. We also evaluate the environmental baseline (i.e., past and present anthropogenic impacts within the action area).

Third, we evaluate the direct and indirect effects of the action on the species and its designated critical habitat. Indirect effects are caused by the proposed action and are later in time, but still are reasonably certain to occur. We assess the exposure to physical, chemical, or biotic stressors produced by the proposed action, whether such exposure is likely to reduce the survival and reproduction of individuals, and whether fitness reductions would threaten the viability of populations and species. We assess whether the action is likely to reduce the conservation value of critical habitat. We do not rely on the regulatory definition of "destruction or adverse modification of critical habitat (50 CFR 402.02); instead, we rely upon the statutory provisions of the ESA to complete our critical habitat analysis. We also search for data on cumulative effects of non-Federal activities (i.e., State and private) that are reasonably certain to occur within the action area. For all analyses, we use the best available scientific and commercial data.

For this consultation, we relied on information submitted by the Permits Division and MMHSRP, government reports (including previously issued biological opinions), peer-reviewed scientific literature, and other information. To determine probable responses to the action, we used *Google Scholar* to search for information on the species, stressors, and possible effects. When the information presented contradictory results, we described all results, evaluated the merits or limitations of each study, and explained how each was similar or dissimilar to the proposed action to come to our own conclusion.

We used the above steps to help formulate our biological and conference opinion. Because we are consulting on the issuance and implementation of a Federal permit, which authorizes many activities, conducted over a vast geographic areas and long periods of time, there is substantial uncertainty about the number, location, timing, frequency, and intensity of individual activities. Therefore, we performed a programmatic consultation to determine whether the Permits Division and MMHSRP has insured that the issuance and implementation of the permit is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Specifically, we asked the following questions:

1. Have the agencies structured the Permit and the Program (MMHSRP) to identify, inform, encourage, and screen permit applicants for potential eligibility under or participation in the permitting activity?

2. Have the agencies structured the Permit and the Program to reliably estimate the probable number, location, and timing of individual activities?

3. Have the agencies structured the Permit and the Program to know or reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of activities?

4. Have the agencies structured the Permit and the Program to minimize likely adverse effects of such activities on ESA-listed species and designated critical habitat?

5. Have the agencies structured the Permit and the Program to continuously monitor and evaluate likely adverse effects on ESA-listed species and critical habitat?

6. Have the agencies structured the Permit and the Program to encourage, monitor/evaluate,

and enforce compliance?

7. Have the agencies structured the Permit and the Program to allow changes, if deemed necessary, to minimize unanticipated impacts on ESA-listed species and critical habitat?

We used the answers to these questions, developed during the consultation and in reviewing the Permit, to determine whether and to what extent the agencies structured the Permit and Program to minimize impacts to ESA-listed resources, monitor impacts of the action on listed resources, and modify their activities, if necessary, to avoid jeopardizing species and to avoid the destruction or adverse modification of critical habitat.

5.0 Status of the Species

Table 3 describes the ESA-listed and proposed species and designated and proposed critical habitat that occur within in the action area.

Table 3. Listed species and critical habitat (*) that may occur in the action area. Proposed critical habitat denoted by double asterisk.

Common name (Distinct population segment, evolutionarily significant unit, or subspecies)	Scientific name	Status
Cetaceans		
Blue whale	*Balaenoptera musculus*	Endangered
Bowhead whale	*Balaena mysticetes*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Killer whale (Southern Resident*)	*Orcinus orca*	Endangered
North Atlantic right whale*	*Eubalaena glacialis*	Endangered
North Pacific right whale*		
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Beluga whale (Cook Inlet)*	*Delphinapterus leucas*	Endangered
False killer whale (Hawaiian insular)	*Pseudorca crassidens*	Endangered
Pinnipeds		
Guadalupe fur seal	*Arctocephalus townsendi*	Threatened
Hawaiian monk seal*,**	*Monachus schauinslandi*	Endangered
Steller sea lion (Western*)	*Eumetopias jubatus*	Endangered
Bearded seal (Beringia)	*Erignathus barbatus nauticus*	Threatened
Ringed seal (Arctic)	*Phoca hispida hispida*	Threatened
Sea turtles		
Green sea turtle (Florida & Mexico's Pacific coast colonies)	*Chelonia mydas*	Endangered
Green sea turtle (all other areas*)		Threatened
Hawksbill sea turtle*	*Eretmochelys imbricate*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle*	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle (North Pacific Ocean)	*Caretta caretta*	Endangered
Loggerhead sea turtle (Northwest Atlantic Ocean**)		Threatened
Olive ridley sea turtle (Mexico's Pacific coast breeding colonies)	*Lepidochelys olivacea*	Endangered
Olive ridley sea turtle (all other areas)		Threatened

5.1 Species and Critical Habitat Not Further Considered in the Opinion

The purpose of the proposed action is to issue and implement the amended and extended Permit. Some of the activities authorized under the rule are not likely to adversely affect species or critical habitat because the effects would be insignificant or discountable. Insignificant effects relate to the size of impact and do not result in take; discountable effects are unlikely to occur. These species are not considered further in this Opinion.

5.1.1 Sea turtles

The MMHSRP proposed activities overlap with the ranges of threatened and endangered sea turtles. The USFWS has jurisdiction over sea turtles on land and in near-shore waters. Therefore, we do not analyze the action's effects on sea turtles on land in this Opinion.

The MMHSRP proposes to conduct aerial surveys. They would not hover or circle over sea turtles. Their flights may pass unknowingly over submerged sea turtles; however, any disturbance would be transient and minimal. We conclude that the distant sight and noise of the aircraft would have an insignificant impact on the behavior of ESA-listed sea turtles and are not likely to adversely affect these species.

Similarly, the researchers would not intentionally approach sea turtles during their proposed vessel surveys. The small boats and research vessel would operate at slow speeds and abide by safe boating guidelines. In addition to the captain or boat driver, there would be observers aboard to watch out for sea turtles. To date, no disturbances or collisions with sea turtles have occurred during MMHSRP activities. We conclude that the likelihood of vessel disturbance or collision with sea turtles in the next year (2014 – 2015) is discountable, i.e., extremely unlikely to occur, and not likely to adversely affect listed sea turtles.

5.1.2 Critical habitat

Some of the emergency responses, research and enhancement activities may occur in an area that has been designated as critical habitat; however, the proposed research or enhancement activities do not produce physical, chemical, or biotic stressors that would affect the quantity, quality, or availability of the physical or biological features that contribute to the conservation value of designated critical habitat for some species. As a result, we conclude that the proposed emergency responses, research, and enhancement activities are not likely to adversely affect the conservation value of the critical habitat for the species identified below:

Cook Inlet beluga whale critical habitat

On April 11, 2011, NMFS designated critical habitat for the Cook Inlet beluga whale that includes two areas. Area 1 encompasses the upper Inlet, a 1,909 km^2 area bounded by the Municipality of Anchorage, the Matanuska-Susitna Borough, and the Kenai Peninsula borough. This area hosts a high concentration of belugas from spring through fall. It provides shallow tidal flats and river mouths or estuarine areas, important to foraging and calving. Mudflats and shallow areas adjacent may allow for molting and escape from predators. Area 2 consists of 5,891 km^2 south of Area 1 including: Tuxedni, Chinitna, and Kamishak Bays on the west coast, a portion of Kachemak Bay on the east coast, and south of Kalgin Island. During the fall and winter, Belugas typically occur in smaller densities or deeper waters of this feeding and transit area. Areas 1 and 2 contain the following physical or biological features essential to the conservation of this DPS (76 FR 20180):

(1) Intertidal and subtidal waters of Cook Inlet with depths less than 30 feet (9.1 m) and within 5 miles (8 km) of high and medium flow anadromous fish streams.
(2) Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.
(3) Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.
(4) Unrestricted passage within or between the critical habitat areas.
(5) Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

Southern Resident killer whale critical habitat
On November 29, 2006, NMFS designated critical habitat for the Southern Resident killer whale (71 FR 69054). The critical habitat consists of approximately 6,630 km^2 in three areas: the Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. It provides the following physical and biological features: water quality to support growth and development; prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and inter-area passage conditions to allow for migration, resting, and foraging.

North Atlantic right whale critical habitat
On June 3, 1994, NMFS designated critical habitat for the North Atlantic right whale (59 FR 28805). Northern designated areas (Great South Channel, Massachusetts Bay, Cape Cod Bay, and Stellwagen Bank) include complex oceanographic features that drive prey density and distribution. Southern areas (waters from the coast out 15 nautical miles between the latitudes of 31°15' N and 30°15' N and from the coast out five nautical miles between 30°15' N and 28°00' N) were designated to protected calving and breeding grounds.

North Pacific right whale critical habitat
In 2008, NMFS designated critical habitat for the North Pacific right whale, which includes an area in the Southeast Bering Sea and an area south of Kodiak Island in the Gulf of Alaska (73 FR 19000). These areas are influenced by large eddies, submarine canyons, or frontal zones which enhance nutrient exchange and act to concentrate prey. These areas are adjacent to major ocean currents and are characterized by relatively low circulation and water movement. Both critical habitat areas support feeding by North Pacific right whales because they contain the designated primary constituent elements, which include: nutrients, physical oceanographic processes, certain species of zooplankton, and a long photoperiod due to the high latitude (73 FR 19000). Consistent North Pacific right whale sights are a proxy for locating these elements.

Hawaiian monk seal critical habitat
Hawaiian monk seal critical habitat was originally designated on April 30, 1986 (51 FR 16047) and was extended on May 26, 1988 (53 FR 18988). It includes 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 (37 m) around the Northwestern Hawaiian Islands (NWHI) breeding atolls and islands. The marine component of this habitat serves as foraging areas, while terrestrial habitat provides resting, pupping and nursing habitat. On June 2, 2011, NMFS published a proposed rule to revise critical habitat for Hawaiian monk seals (76 FR 32026), extending the current designation in the NWHI out to the 500 m depth contour (including Sand Island at Midway Atoll) and designating six new areas in the Main Hawaiian Islands (i.e., MHI; terrestrial and marine habitat from 5 m inland from the shoreline extending seaward to the 500 m depth contour around Kaula, Niihau, Kauai, Oahu, Maui Nui, and Hawaii Islands). A final rule has not yet been published.

5.2 Species and Critical Habitat Likely to Be Adversely Affected by the Action

5.2.1 Cetaceans

Cook Inlet beluga whale

Species description

The beluga whale (*Delphinapterus leucas*) is a small, toothed, white whale. The DPS resides year-round within Cook Inlet, in the Gulf of Alaska. It was listed as endangered under the ESA, effective December 22, 2008 (73 FR 62919). We used information available in the final rule, the 2008 Status Review (Hobbs et al. 2008), and recent stock assessment reports (Allen and Angliss 2011) to summarize the status of the DPS, as follows.

Life history

The Cook Inlet DPS is reproductively, genetically, and physically discrete from the four other known beluga populations in Alaska (i.e., those north of the Alaska Peninsula). Its unique habitat experiences large tidal exchanges, with salinities varying from freshwater to marine at either end of the estuary. Belugas occur in mid-Inlet waters in the winter. During spring, summer, and fall, they concentrate in the upper Inlet (a contraction of its range), which offers the most abundant prey, most favorable feeding topography, best calving areas, and best protection from predation. Cook Inlet belugas focus on specific prey species when they are seasonally abundant. During the spring, they focus on eulachon; in the summer, as the eulachon runs diminish, their focus shifts to salmonids. These fatty, energy-rich prey are critical to pregnant and lactating belugas. Calves are born in the summer and remain with their mothers for about 24 months. The calving interval ranges from 2 – 4 years. Females reach sexual maturity at 4 to 10 years, and males mature at 8 to 15 years. Life expectancy exceeds 60 years.

Population dynamics

The most recent abundance estimate for the Cook Inlet DPS is 345 (CV = 0.13) belugas, based on an average of population estimates from 2008 to 2010 (Allen and Angliss 2011). There were an estimated 1,300 whales in 1979. Subsistence removals led to a 47 percent decline from 1994 to 1998 (from 653 to 347 whales). From 1999 to 2008, the population has declined an average of 1.5 percent per year, despite restriction on subsistence harvest since 1999 (0 – 2 whales harvested annually; 5 total). The Cook Inlet beluga whale DPS is endangered as a result of over-exploitation. A brief commercial whaling operation in the 1920s harvested 151 Cook Inlet belugas in 5 years. Cook Inlet belugas were harvested by Alaska Natives and for sport prior to the enactment of the MMPA in 1972. Annual subsistence take by Alaska Natives during 1995 – 1998 averaged 77 whales, with 20 percent of the population harvested in 1996. Though subsistence removals through the 1990s are sufficient to account for the declines in abundance, other factors now threaten the DPS. Since the early 1990s, over 200 belugas have stranded along the mudflats in upper Cook Inlet, often resulting in death; the cause is uncertain but may be linked with the extreme tidal fluctuations, predator avoidance, or pursuit of prey. Additional threats include: coastal development, oil and gas development, seismic exploration, point and non- point source discharge of contaminants, contaminated waste disposal, water quality standards, activities that involve the release of chemical contaminant and/or noise, vessel operations, and research (73 FR 62919).

Acoustics
Beluga whales have a well-developed sense of hearing and echolocation. They hear over a large range of frequencies, from about 40 Hz to 100 kHz, although their hearing is most acute from 10 – 75 kHz (Richardson et al. 1995). They call at frequencies of 0.26- 20 kHz and echolocate at frequencies of 40-60 kHz and 100-120 kHz (Blackwell and Greene 2002). Their diverse vocal repertoire has earned them the nickname of "sea canaries."

Status summary
The Cook Inlet beluga whale DPS is an endangered "species" that continues to decline in abundance despite removal of the initial cause of endangerment (i.e., over-exploitation). Its resilience to future perturbation is low because of the following factors: the population is small (N = 345) and has not grown as expected with the cessation of harvest; as a result of the range contraction, the population is more vulnerable to catastrophic events; and if the current DPS is extirpated, it is unlikely other belugas would repopulate Cook Inlet (Hobbs et al. 2008).

Southern Resident killer whale
Species description
Killer whales (or orcas) are distributed worldwide, but populations are isolated by region and ecotype (i.e., different morphology, ecology, and behavior). Southern Resident killer whales occur in the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait during the spring, summer and fall. During the winter, they move to coastal waters primarily off Oregon, Washington, California, and British Columbia. The DPS was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). We used information available in the final rule, the 2011 Status Review (NMFS 2011), and the 2011 Stock Assessment Report (http://www.nmfs.noaa.gov/pr/pdfs/sars/po2011whki-pensr.pdf) to summarize the status of this species, as follows.

Life history
Southern Resident killer whales are geographically, matrilineally, and behaviorally distinct from other killer whale populations (70 FR 69903). The DPS includes three large, stable pods (J, K, and L), which occasionally interact (Parsons et al. 2009). Most mating occurs outside natal pods, during temporary associations of pods, or as a result of the temporary dispersal of males (Pilot et al. 2010). Males become sexually mature at 10 – 17 years of age. Females reach maturity at 12 – 16 years of age and produce an average of 5.4 surviving calves during a reproductive life span of approximately 25 years. Mothers and offspring maintain highly stable, life-long social bonds, and this natal relationship is the basis for a matrilineal social structure. They prey upon salmonids, especially Chinook salmon (Hanson et al. 2010).

Population dynamics

The most recent abundance estimate for the Southern Resident DPS is 86 whales in 2010. This represents an average increase of 0.4 percent annually since 1982 when there were 78 whales. Population abundance has fluctuated during this time with a maximum of approximately 100 whales in 1995 (http://www.nmfs.noaa.gov/pr/pdfs/sars/po2011whki-pensr.pdf). As compared to stable or growing populations, the DPS reflects a smaller percentage of juveniles and lower fecundity (NMFS 2011). The Southern Resident killer whale was listed as endangered in 2005, in response to the population decline from 1996 – 2001, small population size, and reproductive limitations (i.e., few reproductive males and delayed calving). Threats to its survival and recovery include: contaminants, vessel traffic, and changes in prey availability. Chinook salmon populations have declined due to degradation of habitat, hydrology issues, harvest, and hatchery introgression; such reductions may require an increase in foraging effort. In addition, these prey contain environmental pollutants (e.g., flame retardants; polychlorinated biphenuls or PCBs; and dichlorodiphenyltrichloroethane or DDT). These contaminants become concentrated at higher trophic levels and may lead to immune suppression or reproductive impairment (70 FR 69903). The inland waters of Washington and British Columbia support a large whale watch industry, commercial shipping, and recreational boating; these activities generate underwater noise, which may mask whales' communication or interrupt foraging.

Acoustics

Killer whales have a hearing range of 0.5 to 120 kHz. Their hearing is most sensitive in the 18 – 42 kHz range (which overlaps with their echolocation clicks) and is less sensitive at higher frequencies (Szymanski et al. 1999)

Status summary

The Southern Resident killer whale DPS is an endangered "species" that has demonstrated weak growth in recent decades. The factors that originally endangered the species persist throughout its habitat: contaminants, vessel traffic, and reduced prey. Its resilience to future perturbation is reduced as a result of its small population size (N = 86); however, it has demonstrated the ability to recover from smaller population sizes in the past and has shown an increasing trend over the last several years. NMFS is currently conducting a status review prompted by a petition to delist the DPS based on new information, which indicates that there may be more paternal gene flow among populations than originally detected (Pilot et al. 2010).

False killer whale (Hawaiian insular)

Species description

The Hawaiian Islands insular false killer whale is a geographically, genetically, and behaviorally defined DPS of a widely distributed toothed whale. The DPS was listed as endangered on November 28, 2012 (77 FR 70915). We used information available in the status review (Oleson 2010) and recent stock assessment reports to summarize the status of the species, as follows.

Life history

The Hawaiian insular DPS appears to be genetically distinguishable from pelagic false killer whales, the result of a unique social system, reproductive isolation, and/or habitat specialization. The gestation period of false killer whales is 14 – 16 months, and calves are nursed for 18 – 24 months. They reach sexual maturity at 12 years of age, and the average calving interval is 7 years. False killer whales eat fish, primarily. Social foraging and prey sharing has been observed.

Population dynamics
In 1989, aerial surveys indicated three large groups of Hawaiian insular false killer whales, with 470, 460, and 380 individuals. Now, the total abundance is estimated to be 151 – 170 individuals. The DPS has declined at an average annual rate of nine percent annually since 1989. The major threat to the species is fisheries interactions, including: reduced prey availability, entanglement, hookings, and intentional harm by fishermen. The small population size is also problematic, leading to low genetic diversity and possible Allee effects.

Status summary
The Hawaiian insular false killer whale is an endangered DPS with a total abundance of 151 – 170 individuals. The population is declining. Though relatively little is known about the DPS, its resilience to additional perturbations is assumed to be small due to its small and declining population size.

Bowhead whale
Species description
Bowhead whales only occur at high latitudes in the northern hemisphere and have a disjunctive circumpolar distribution. Four stocks have been identified, but only the Western Arctic population occurs in U.S. waters (i.e., waters of northern and western Alaska). The species was originally listed as endangered on December 2, 1970 (35 FR 18319). We used information available in the most recent stock assessment (NMFS 2011) to summarize the status of the species, as follows.

Life history
The gestation period of bowhead whales is approximately 12 – 16 months. The calving interval is 3.5 – 7 years. Bowhead whales reach sexual maturity at approximately 20 years of age. Bowhead whales are closely associated with sea ice. Following the movement of the ices, the stock migrates annually from wintering areas in the northern Bering Sea, through the Chukchi Sea in the spring, to the Beaufort Sea, where they spend most of the summer, before returning to the Bering Sea in the fall to overwinter. Bowhead whales feed on concentrations of zooplankton throughout their range.

Population dynamics
The 2004 population estimate of the Western Arctic stock of bowhead whales whales was 12,631 individuals, representing an annual increase of 3.4 percent from 1978 to 2001. Population abundance has doubled since the 1970s, from approximately 5,000 individuals to over 10,000 individuals. The species is endangered as a result of past commercial whaling, which started in the early 16th century near Labrador and spread to the Bering Sea by the mid-19th century. Prior to commercial whaling, the minimum global population estimate was 50,000 whales, with 10,400 – 23,000 in the Western Arctic stock. Commercial whaling reduced this stock to less than 3,000 individuals by the mid-20th century. Commercial whaling no longer occurs, but bowhead whales are killed by entanglement in fishing gear (minimum average annual entanglement rate = 0.2) and subsistence harvest (average annual take = 38 whales). Other

concerns include climate change and oil and gas development in the Arctic, likely leading to ship strikes, pollution, and noise.

Acoustics
Bowhead whales produce songs of an average source level of 185 ±2 dB rms re 1 mPa @ 1 m centered at a frequency of 444 ±48 Hz (Roulin et al. 2012). Given background noise, this allows bowheads whales an active space of 40-130 km (Roulin et al. 2012).

Status summary
The bowhead whale is an endangered species, with a U.S. population abundance of approximately 12,631 whales and an increasing population trend. The major threat to its continued existence, commercial whaling, has ceased. Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats; however, it has not recovered to pre-exploitation levels, and new threats (such as climate change and increased vessel traffic in the Arctic) are likely to reduce the species resilience in the near future.

Blue whale
Species description
The blue whale is the largest animal on earth. Three subspecies comprise the species, which occurs in coastal and pelagic waters in all oceans. The species was originally listed as endangered on December 2, 1970 (35 FR 18319). We used information available in the recovery plan (NMFS 1998) and recent stock assessment and status reports (NMFS 2011; Sears and Calambokidis 2002) to summarize the status of the species, as follows.

Life history
The gestation period of blue whales is approximately 10 – 12 months, and calves are nursed for 6 – 7 months. The average calving interval is 2 – 3 years. Blue whales reach sexual maturity at 5 – 15 years of age. Parturition and mating occurs in lower latitudes during the winter season, and weaning probably occurs in or en route to summer feeding areas in higher, more productive latitudes. Blue whales forage almost exclusively on krill (i.e., relatively large euphausiid crustaceans) and can eat approximately 3,600 kg daily. Feeding aggregations are often found at the continental shelf edge, where upwelling produces concentrations of krill at depths of 90 – 120 m.

Population dynamics
There are an estimated 5,000 – 12,000 blue whales worldwide. Three stocks occur in U.S. waters: the eastern North Pacific, the western North Atlantic, and Hawaii. For the eastern North Pacific stock, the best estimate of abundance is 2,497 whales, with an estimated annual growth rate of approximately three percent annually. The western North Atlantic stock has a minimum population size of 440 individuals, and abundance appears to be increasing, though there are insufficient data to provide reliable population trends. Blue whale sightings are rare in Hawaii, and no data are available from which to estimate abundance or trends. The species is endangered as a result of past commercial whaling. In the North Atlantic, at least 11,000 blue whales were taken from the late 19th to mid-20th centuries. In the North Pacific, at least 9,500 whales were killed between 1910 and 1965. Commercial whaling no longer occurs, but blue whales are threatened by ship strikes, entanglement in fishing gear, pollution, and noise.

Acoustics
Direct studies of blue whale hearing have not been conducted, but it is assumed that blue whales can hear the same frequencies that they produce (low-frequency) and are likely most sensitive to this frequency range (Ketten 1997; Richardson et al. 1995c). Blue whales produce prolonged low-frequency vocalizations that include moans in the range from 12.5-400 Hz, with dominant frequencies from 16-25 Hz, and songs that span frequencies from 16-60 Hz that last up to 36 sec repeated every 1 to 2 min (see Cummings and Thompson 1971b; Cummings and Thompson 1977; Edds-Walton 1997a; Edds 1982; McDonald et al. 1995a; Thompson and Friedl 1982b).

Status summary
The blue whale is an endangered species with worldwide abundance of 5,000 – 12,000 individuals. The major threat to its continued existence, commercial whaling, has ceased. Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats; however, it has not recovered to pre-exploitation levels.

Fin whale
Species description
The fin whale is a large, widely distributed baleen whale, comprised of two (or possibly three) subspecies. The species was originally listed as endangered on December 2, 1970 (35 FR 18319). We used information available in the recovery plan (NMFS 2010), the five-year review (NMFS 2011), and recent stock assessment reports to summarize the status of the species, as follows.

Life history
The gestation period of fin whales is less than one year, and calves are nursed for 6 – 7 months. The average calving interval is 2 – 3 years. Fin whales reach sexual maturity at 6 – 10 years of age. Parturition and mating occurs in lower latitudes during the winter season. Intense foraging occurs at high latitudes during the summer. Fin whales eat pelagic crustaceans (mainly euphausiids or krill) and schooling fish such as capelin, herring, and sand lance. The availability of sand lance, in particular, is thought to have had a strong influence on the distribution and movements of fin whales along the east coast of the United States.

Population dynamics
There are over 100,000 fin whales worldwide. Though only two subspecies are recognized (Northern Hemisphere and Southern Hemisphere), North Atlantic, North Pacific, and Southern Hemisphere fin whales appear to be reproductively isolated. Of the 3 – 7 stocks in the North Atlantic (N ~ 50,000), one occurs in U.S. waters, where the best estimate of abundance is 3,985 whales. There are three stocks in U.S. Pacific waters: Alaska (N_{min} =5,700), Hawaii (N_{min} = 101), and California/Oregon/Washington (N_{min} = 3,269). Abundance appears to be increasing in Alaska (4.8 percent annually) and possibly California. Trends are not available for other stocks due to insufficient data. Abundance data for the Southern Hemisphere stock are limited; however, there were an estimated 85,200 whales in 1970. The species is endangered as a result of past commercial whaling. In the North Atlantic, at least 55,000 fin whales were killed between 1910 and 1989. In the North Pacific, at least 74,000 whales were killed between 1910 and 1975. Approximately 704,000 whales were killed in the Southern Hemisphere from 1904 to 1975. Fin whales are still killed under the International Whaling Commission's "aboriginal

subsistence whaling" in Greenland, under Japan's scientific whaling program, and via Iceland's formal objection to the Commission's ban on commercial whaling. Additional threats include: ship strikes, reduced prey availability due to overfishing or climate change, and noise.

Acoustics
Direct studies of fin whale hearing have not been conducted, but it is assumed that blue whales can hear the same frequencies that they produce (low) and are likely most sensitive to this frequency range (Ketten 1997; Richardson et al. 1995c). Fin whales produce a variety of low-frequency sounds in the 10-200 Hz range (Edds 1988; Thompson et al. 1992a; Watkins 1981; Watkins et al. 1987b). Au (2000) reported moans of 14-118 Hz, with a dominant frequency of 20 Hz, tonal vocalizations of 34-150 Hz, and songs of 17-25 Hz (Cummings and Thompson 1994; Edds 1988; Watkins 1981). Source levels for fin whale vocalizations are 140-200 dB re 1μPa·m (Clark and Ellison. 2004; Erbe 2002b)

Status summary
The fin whale is an endangered species with worldwide abundance of more than 100,000 individuals. Though the original cause of endangerment remains, whaling has been significantly reduced. Its large population size may provide some resilience to current threats, but trends are largely unknown.

Sei whale
Species description
The sei whale is a widely distributed baleen whale. The species was originally listed as endangered on December 2, 1970 (35 FR 18319). We used information available in the recovery plan (NMFS 2011), the five-year review (NMFS 2012), and recent stock assessment reports to summarize the status of the species, as follows.

Life history
The gestation period of sei whales is 10 – 12 months, and calves are nursed for 6 – 9 months. The average calving interval is 2 – 3 years. Sei whales reach sexual maturity at 6 – 12 years of age. They winter at relatively low latitudes and summer at relatively higher latitudes. Throughout their range, sei whales occur predominantly in deep water; they are most common over the continental slope. Sei whales in the North Atlantic reportedly feed primarily on calanoid copepods, with a secondary preference for euphausiids. In the Pacific, they also feed on fish (e.g., anchovies, saury, whiting, lamprey, and herring).

Population dynamics
There are ~80,000 sei whales worldwide, in the North Atlantic, North Pacific, and Southern Hemispere. Three stocks occur in U.S. waters: Nova Scotia (N = 357), Hawaii (N_{min} = 37), and Eastern North Pacific (N_{min} = 83). Population trends are not available due to insufficient data. The species is endangered as a result of past commercial whaling. There are no estimates of pre-exploitation abundance for the North Atlantic. Models indicate that total abundance declined from 42,000 to 8,600 individuals between 1963 and 1974, in the North Pacific. In the Southern Hemisphere, pre-exploitation abundance is estimated at 65,000 whales, with recent abundance estimated at 9,700 whales. Now, only a few individuals are taken each year by Japan; however, Iceland has expressed an interest in targeting sei whales. Current threats include ship strikes,

fisheries interactions (including entanglement), climate change (habitat loss and reduced prey availability), and noise.

Acoustics

Source levels of 189 ±5.8 dB re 1μPa at 1m have been established for sei whales in the northeastern Pacific (Weirathmueller et al. 2013). Vocalizations from the North Atlantic consisted of paired sequences (0.5-0.8 s, separated by 0.4-1.0 s) of 10-20 short (4 ms) FM sweeps between 1.5-3.5 kHz (Thomson and Richardson 1995a).

Status summary

The sei whale is an endangered species with worldwide abundance of ~80,000 individuals. Commercial whaling, the original cause of endangerment, no longer occurs. Its large population size may provide some resilience to current threats, but trends are largely unknown.

Humpback whale

Species description

The humpback whale is a widely distributed baleen whale, distinguishable by its long flippers. The species was originally listed as endangered on December 2, 1970 (35 FR 18319). On August 29, 2013, NMFS initiated a status review of the North Pacific population to determine whether to identify the population as DPS and to delist it. We used information available in the recovery plan (NMFS 1991) and recent stock assessment reports to summarize the status of the species, as follows.

Life history

The gestation period of humpback whales is 11 months, and calves are nursed for 12 months. The average calving interval is 2 – 3 years and sexual maturity is reached at 5 – 11 years of age. Humpback whales inhabit waters over or along the continental shelf and oceanic islands. They winter at low latitudes, where they calf and nurse, and summer at high latitudes, where they feed. Humpbacks exhibit a wide range of foraging behaviors and feed on a range of prey types, including: small schooling fishes, euphausiids, and other large zooplankton.

Population dynamics

There are over 60,000 humpback whales worldwide, occurring primarily in the North Atlantic, North Pacific, and Southern Hemisphere. Current estimates indicate approximately 20,000 humpback whales in the North Pacific, with an annual growth rate of 4.9 percent (Calambokidis 2010). Stocks in U.S. waters include: American Samoa, California/Oregon/Washington, and Central North Pacific. As of 1993, there was an estimated 11,570 humpback whales in the North Atlantic, growing at a rate of three percent annually (Stevick et al. 2003). The Southern Hemisphere supports more than 36,000 humpback whales and is growing at a minimum annual rate of 4.6 percent (Reilly et al. 2008). The species is endangered as a result of past commercial whaling. Prior to commercial whaling, hundreds of thousands of humpback whales existed. Global abundance declined to the low thousands by 1968, the last year of substantial catches (Reilly et al. 2008). Humpback whales may be killed under "aboriginal subsistence whaling" and "scientific permit whaling" provisions of the International Whaling Commission. Additional threats include ship strikes and fisheries interactions (including entanglement), and noise.

Acoustics
Humpback whale vocalization is much better understood than is hearing. Different sounds are produced that correspond to different functions: feeding, breeding, and other social calls (Dunlop et al. 2008). Males sing complex sounds while in low-latitude breeding areas in a frequency range of 20 Hz to 4 kHz with estimated source levels from 144-174 dB (Au 2000; Au et al. 2006; Frazer and Mercado 2000; Payne 1970; Richardson et al. 1995c; Winn et al. 1970). Males also produce sounds associated with aggression, which are generally characterized as frequencies between 50 Hz to 10 kHz and having most energy below 3 kHz (Silber 1986; Tyack 1983). Such sounds can be heard up to 9 km away (Tyack and Whitehead 1983). Other social sounds from 50 Hz to 10 kHz (most energy below 3 kHz) are also produced in breeding areas (Richardson et al. 1995c; Tyack and Whitehead 1983).

Status summary
The humpback whale is an endangered species with worldwide abundance of ~60,000 individuals. Originally endangered by commercial whaling, the threat is now significantly reduced. Its large population size and increasing trends indicate that the species is resilient to current threats, and one population (North Pacific) is currently being considered for delisting.

North Atlantic right whale
Species description
The North Atlantic right whale is a narrowly distributed baleen whale, distinguished by its stocky body and lack of a dorsal fin. The species was originally listed as endangered on December 2, 1970 (35 FR 18319). We used information available in the 5-year review (NMFS 2012) and recent stock assessment reports to summarize the status of the species, as follows.

Life history
The gestation period of North Atlantic right whales is 12 – 13 months, and calves are nursed for 8 – 17 months. The average calving interval is 3 – 5 years. Right whales reach sexual maturity at 9 years of age. They migrate to low latitudes during the winter to give birth in shallow, coastal waters. In the summer, they feed on large concentrations of copepods in the high latitudes.

Population dynamics
Right whales occur in the eastern and western North Atlantic; however, less than 20 individuals exist in the eastern North Atlantic, and the population may be functionally extinct. There are at least 396 individuals in the western North Atlantic population. Despite two periods of increased mortality, the species has demonstrated overall growth rates of two percent over 17 years (1990 – 2007). Pre-exploitation abundance has been estimated at more than 1,000 individuals, distributed throughout temperate, subarctic, coastal and continental shelf waters of the North Atlantic Ocean. Commercial whaling reduced the population size to ~50 individuals and truncated the range of the species. Whaling is now prohibited. The two major threats to the survival of the species are ship strike and fisheries interactions (including entanglement).

Acoustics
The total hearing range for the North Atlantic right whale predicted from anatomical modeling is 10 Hz–22 kHz with functional ranges probably between 15 Hz–18 kHz (Parks et al. 2007). The source levels for sound production range from 137 to 162 dB rms *re* 1 μPa-m for tonal calls and

174 to 192 dB rms for broadband "gunshot" sounds (Parks and Tyack 2005).

Status summary
The North Atlantic right whale is an endangered species with an overall abundance of 396 individuals. While population trends are positive, the species' resilience to future perturbations is low due to its small population size and continued threats of ship strike and entanglement.

North Pacific right whale
Species description
The North Pacific right whale is a baleen whale, distinguished by its stocky body and lack of a dorsal fin. The species was originally listed with the North Atlantic right whale (i.e., "Northern" right whale) as endangered on December 2, 1970 (35 FR 18319). It was listed separately as endangered on March 6, 2008 (73 FR 12024). We used information available in the 5-year review (NMFS 2012) and recent stock assessment reports to summarize the status of the species, as follows.

Life history
The gestation period of North Pacific right whales is approximately 1 year, and calves are nursed for approximately 1 year. Right whales reach sexual maturity at 9 – 10 years of age. Little is known about migrating patterns, but whales have been observed in lower latitudes in the winter (Japan, California, and Mexico). In the summer, they feed on large concentrations of copepods in the Alaskan waters.

Population dynamics
The North Pacific right whale remains one of the most endangered whale species in the world, likely numbering fewer than 1,000 individuals. Pre-exploitation abundance has been estimated at more than 11,000 individuals. Commercial whaling resulted in the decline; current threats to the survival include poaching, ship strike, fisheries interactions (including entanglement).

Acoustics
The hearing range for the North Pacific right whale is likely similar to that of the North Atlantic right whale: 10 Hz–22 kHz with functional ranges probably between 15 Hz–18 kHz (Parks et al. 2007). The source levels for sound production range are also likely similar: from 137 to 162 dB rms *re* 1 μPa-m for tonal calls and 174 to 192 dB rms for broadband "gunshot" sounds (Parks and Tyack 2005).

Status summary
The North Pacific right whale is an endangered species with an overall abundance of less than 1,000 individuals. The species' resilience to future perturbations is low due to its small population size and continued threats of poaching, ship strike, and entanglement.

Sperm whale
Species description
The sperm whale is the largest toothed whale. It is largely distributed throughout the world's oceans, from the equator to the edges of polar pack ice, with populations in the Atlantic, Pacific, and Indian Oceans. The species was listed as endangered on December 2, 1970 (35 FR 18319).

We used information available in the final recovery plan (NMFS 2010) to summarize the status of the species, as follows.

Life history
The gestation period of sperm whales is 1 – 1.5 years, and calves are nursed for approximately 2 years. The calving interval is 4 – 6 years. Female sperm whales reach sexual maturity at 7 – 13 years of age; males reach full maturity in their 20s. Breeding occurs in the spring. Females maintain stable, long-term associations with other females and their young male offspring. Males eventually leave these groups to join other males in "bachelor schools" until they reach their breeding prime, at which point they become essentially solitary. Sperm whales feed primarily on squid; other prey items include octopus and demersal fish (including teleosts and elasmobranchs).

Population dynamics
The sperm whale is the most abundant of the large whale species, with total abundance estimates between 200,000 and 1,500,000. The higher estimates may be approaching population sizes prior to commercial whaling, the reason for ESA listing. Commercial whaling is no longer allowed, however, illegal hunting may occur at biologically unsustainable levels. Other threats include: collision with vessels, entanglement in fishing gear, reduced prey availability due to overfishing, habitat degradation, pollution, and disturbance from anthropogenic noise.

Acoustics
The anatomy of the sperm whale ear indicates hearing tailored for ultrasonic (>20 kilohertz (kHz)) reception. Its inner ear is primarily adapted for echolocation, and the ears have exceptional frequency discrimination abilities. The sperm whale may also possess better low frequency hearing than some of the other toothed whales, although not as low as many baleen whales. The only data on the hearing range of sperm whales are evoked potentials from a stranded male neonate, which suggest that neonatal sperm whales respond to sounds from 2.5 to 60 kHz, with best sensitivity at 5, 10, and 20 kHz.

Status summary
The sperm whale is an endangered species that was subject to commercial whaling for more than two and a half centuries and in all parts of the world. Although the aggregate abundance worldwide is probably at least several hundred thousand individuals, the extent of depletion and degree of recovery of populations are uncertain. Continued threats to sperm whale populations include collisions with vessels, direct harvest, and possibly competition for resources, loss of prey base due to climate change, and disturbance from anthropogenic noise. Given its current, large population size, it is somewhat resilience to additional perturbation.

5.2.2 Pinnipeds

Steller sea lion (Western DPS)
Species description
The Steller sea lion ranges from Japan, through the Okhotsk and Bering Seas, to central California. It consists of two morphologically, ecologically, and behaviorally distinct DPSs: the Eastern DPS, which includes sea lions in Southeast Alaska, British Columbia, Washington,

Oregon and California; and the Western DPS, which includes sea lions in all other regions of Alaska, as well as Russia and Japan. On May 5, 1997, NMFS issued a final determination to list the western DPS as endangered under the ESA (62 FR 24345). We used information available in the final listing (62 FR 24345) and the 2010 stock assessment report (http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2011slst-w.pdf) to summarize the status of the western DPS, as follows.

Life history

Within the western DPS, pupping and breeding occurs at numerous major rookeries from late May to early July. Male Steller sea lions become sexually mature at 3 – 7 years of age. They are polygynous, competing for territories and females by age 10 or 11. Female Steller sea lion become sexually mature at 3 – 6 years of age and reproduce into their early 20s. Most females breed annually, giving birth to a single pup, but nutritional stress may result in reproductive failure. About 90% of pups within a given rookery are born within a 25-day period, as such they are highly vulnerable to fluctuations in prey availability. Most pups are weaned in 1 – 2 years.

Females and their pups disperse from rookeries by August – October. Juveniles and adults disperse widely, especially males. Their large aquatic ranges are used for foraging, resting, and traveling. Steller sea lions forage on a wide variety of demersal, semi-demersal, and pelagic prey, including fish and cephalopods. Some prey species form large seasonal aggregations, including endangered salmon and eulachon species. Others are available year round.

Population dynamics

As of 2010, the best estimate of abundance of the western Steller sea lion DPS in Alaska was 50,035 (N_{min} = 42, 366). This represents a large decline since counts in the 1950s (N = 140,000) and 1970s (N = 110,000). Trend site counts have decreased 40 percent from 1991 to 2000, an average annual decline of 5.4 percent. Trends since 2000 are difficult to characterize as a result of the increasing presence of eastern DPS seal lions at the trend sites. In 2007 and 2008, over 19,000 Steller sea lions were counted in Russia (http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2011slst-w.pdf). The species was listed as threatened in 1990 because of significant declines in population sizes (55 FR 49204). At the time, the major threat to the species was thought to be reduction in prey availability. To protect and recovery the species, NMFS established the following measures: prohibition of shooting at or near sea lions; prohibition of vessel approach to within 3 nautical miles of specific rookeries, within 0.5 miles on land, and within sight of other listed rookeries; and restriction of incidental fisheries take to 675 sea lions annually in Alaskan waters.

In 1997, the western DPS was reclassified as endangered because it had continued to decline since its initial listing in 1990 (62 FR 24345). Despite the added protection (and an annual incidental fisheries take of approximately 26 individuals), the DPS is likely still in decline (though the decline has slowed or stopped in some portions of the range). The reasons for the continued decline are unknown but may be associated with nutritional stress as a result of environmental change and competition with commercial fisheries.

Acoustics

Steller sea lions hear within the range of 0.5 – 32 kHz (Kastelein et al. 2005).

Status summary
The Steller sea lion western DPS is listed as endangered under the ESA. Despite protections, it continues to decline in abundance. Though the total population size is still relatively large (N > 70,000), the causes for the decline remain unknown. The DPS appears to have little resilience to future perturbations.

Critical habitat
In 1997, NMFS designated critical habitat for the Steller sea lion (58 FR 45269). The critical habitat includes specific rookeries, haulouts, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species.

In Alaska, areas include major Steller sea lion rookeries, haulouts and associated terrestrial, air, and aquatic zones. Critical habitat includes a terrestrial zone extending 3,000 feet (0.9 km) landward from each major rookery and haulout; it also includes air zones extending 3,000 feet (0.9 kin) above these terrestrial zones and aquatic zones. Aquatic zones extend 3,000 feet (0.9 km) seaward from the major rookeries and haulouts east of 144°W.

In addition, NMFS designated special aquatic foraging areas as critical habitat for the Steller sea lion. These areas include the Shelikof Strait (in the Gulf of Alaska), Bogoslof Island, and Seguam Pass (the latter two are in the Aleutians). These sites are located near Steller sea lion abundance centers and include important foraging areas, large concentrations of prey, and host large commercial fisheries that often interact with the species.

Guadalupe fur seal
Species description
Guadalupe fur seals (*Arctocephalus townsendi*) occur primarily in the waters surrounding Guadalupe Island, Mexico, though individuals have been observed in the Channel Islands in recent years. The species was listed as threatened under the ESA in 1985 (50 FR 51252). We used information available in the final listing, the 2000 stock assessment report, and the IUCN Red List (http://www.iucnredlist.org/details/2061/0) to summarize the status of the species, as follows.

Life history
Guadalupe fur seal rookeries are located on Guadalupe Island and San Benitos Islands in Mexico. Polygynous males establish territories occupied by an average of six females, which give birth to a single pup during the summer and nurse for 9 – 11 months (http://www.iucnredlist.org/details/2061/0).

Population dynamics
Prior to commercial harvest, the population was estimated at 20,000 to 100,000 individuals. The species was hunted to near extinction in the 19th century. Since commercial exploitation has ended, the species has since made a partial recovery, from an estimated 200 – 500 individuals in 1954, to 15,000 – 17, 000 individuals in 2008. The population is increasing at a rate of 13.7 percent annually. A small rookery at San Benitos was discovered in 1997; 1,566 animals were recorded in a 2007 census. A single pup was born on San Miguel Island, Channel Islands,

California, in 1997 (SAR 2008; http://www.iucnredlist.org/details/2061/0). In 1985, the species was listed as threatened (i.e., likely to become endangered in the foreseeable future). This listing reflected the species' extreme reduction as a result of 19th century commercial harvest and its small population size at the time of listing (approximately 1,600). Specific recovery criteria include: population size of 30,000 animals; establishment of at least one rookery (in addition to the Guadalupe rookery); and growth to maximum net productivity. Critical habitat has not been designated.

Acoustics
Though there has been no auditory assessment of the Guadalupe fur seal, its hearing likely falls within a similar range as that of the Northern fur seal, 2-40 kHz (Moore & Schusterman 1987).

Status summary
In summary, the Guadalupe fur seal continues to show a steady increase in abundance. At least one new rookery has been established (San Benitos) since listing. The species appears to be on the path of recovery and is likely resilient to further perturbation.

Hawaiian monk seal
Species Description
The Hawaiian monk seal is a large phocid that inhabits the NWHI and MHI. It was listed as endangered under the ESA in 1976 (41 FR 51611). We used information available in the 2007 5-year review (Hobbs et al. 2008), the 2011 stock assessment report (Allen and Angliss 2011), and unpublished NMFS data to summarize the status of this species, as follows.

Life History
Monk seals are generally born between February and August. They nurse for 5 – 6 weeks, during which time the mother does not forage. Upon weaning, the mothers return to sea, and the pups are left unattended on the beaches. Females spend approximately 8 – 10weeks foraging at sea before returning to beaches to molt. They mature at 5 – 10 years of age. Males likely mature at the same age but may not gain access to females until they are older. Males compete in a dominance hierarchy to gain access to females (i.e., guarding them on shore). Mating occurs at sea, however, providing opportunity for female mate choice. Though some females mate every year after first parturition, most do not. Overall reproductive rates are low, especially in the NWHI. For example, the pooled birth rate at Laysan and Lisianski was 0.54 pups per adult female per year (Johanos et al. 1994). The low birth rates may reflect low prey availability. Monk seals are considered foraging generalists that feed primarily on benthic and demersal prey. They forage in subphotic zones either because these areas host favorable prey items or because these areas are less accessible by competitors (Parrish 2009). Juvenile seals may not have the experience, endurance, or diving capacity to make such deep dives, leaving them more susceptible to starvation.

Population dynamics
As of 2011, ~1,055 Hawaiian monk seals remained in the wild (NMFS, unpublished data). As of 2011, a total of 146 seals were documented in the MHI, where the subpopulation is growing at a rate of seven percent annually. The majority of seals ($N = 909$) still reside in the NWHI, though this population continues to decline at an annual rate of ~3.3 percent. The species has declined in abundance by over 68% since 1958. Birth rates in the NWHI declined dramatically in the

1990s, possibly reflecting unfavorable environmental conditions. Concurrently, there was a rapid increase in the number of monk seal sightings and births in the MHI. Hawaiian monk seals were once harvested for their meat, oil and skins, leading to extirpation in the MHI and near-extinction of the species by the 20th century (Hiruki and Ragen 1992, Ragen 1999). The species experienced a partial recovery by 1960, when hundreds of seals were counted on NWHI beaches. Since then, however, the species has declined in abundance. Though the ultimate cause(s) for the decline remain unknown, threats include: starvation; predation by sharks; competition with fish and fisheries; entanglement in marine debris; male aggression; beach erosion; and environmental changes that reduce prey availability. In the MHI, additional threats include disturbance of nursing pups and illegal killing, which likely reflects conflict over actual or perceived fisheries interactions (Watson 2011, McAvoy 2012).

Acoustics
The Hawaiian monk seal's hearing is most sensitive between 12 and 28 kHz. Below 8 kHz, the Hawaiian monk seal's hearing was less sensitive, and high□frequency sensitivity dropped off sharply above 30 kHz (Thomas et al. 1990).

Status summary
The Hawaiian monk seal is a critically endangered species that continues to decline in abundance, presumably as a result in changes to their foraging base. With only ~1,000 individuals remaining the species' resilience to further perturbation is low. Other species in the same genus have gone extinct (i.e., Caribbean monk seal) or have been extirpated from the majority of their previous range (i.e., Mediterranean monk seal). We conclude that the Hawaiian monk seal's resilience to further perturbation is low, and its status is precarious.

Ringed seal (Arctic DPS)
Species description
The ringed seal (*Phoca hispida*) is a small, Northern Hemisphere ice seal. It is divided into five subspecies, including the Arctic subspecies (*Phoca hispida hispida*). On December 20, 2012, NMFS issued a final determination to list the Arctic DPS as threatened under the ESA. We used information available in the final listing (as filed), the proposed listing (75 FR 77476), and the status review report (Kelly et al. 2010) to summarize the status of the species, as follows.

Life history
Ringed seals are uniquely adapted to living on the ice. They use stout claws to maintain breathing holes in heavy ice. They excavate lairs in the snow cover above these holes to provide warmth and protection from predators while they rest, pup, and molt. Females give birth in March – April to a single pup annually; they nurse for 5 – 9 weeks. During this time, pups spend an equal amount of time in the water and in the lair. Females attain sexual maturity at 4 – 8 years of age, males at 5 – 7 years. The average lifespan of a ringed seal is 15 – 28 years. They are trophic generalists, but prefer small, schooling prey that form dense aggregations (Kelly et al. 2010).

Population dynamics
The best estimated population size of the Arctic DPS is low millions; there are likely 1 million ringed seals in the Chukchi and Beaufort Seas (Kelly et al. 2010). The DPS's broad distribution,

seasonal movements, subsurface behavior, and remote, varying habitat prevent reliable estimates of population size or trends. The Arctic ringed seal DPS was listed as threatened, i.e., likely to become endangered in the foreseeable future. Warming climate trends are likely to result in the loss of essential sea ice and snow cover, and ocean acidification may alter prey populations (Kelly et al. 2010). The reduced snow cover throughout portions of its range would prevent the excavation of lairs, essential to resting, molting, and pupping. Earlier warming and break-up of ice in the spring would shorten the length of time pups have to grow and mature in a protected setting, which has been shown to reduce overall fitness. The large range and population size of the Arctic DPS, however, make it less vulnerable to other perturbations (75 FR 77476). Therefore, ESA section 4(d) protective regulations and section 9 prohibitions were deemed unnecessary for the conservation of the species (http://www.nmfs.noaa.gov/pr/pdfs/species/ringedseal_frn_filed.pdf).

Acoustics
Ringed seals can hear frequencies of 1 – 40 kHz (Richardson et al. 1995, Blackwell et al. 2004). Though they may be able to hear frequencies above this limit (Terhune and Ronald 1976); their sensitivity to such sounds diminishes greatly above 45 kHz (Terhune and Ronald 1975).

Status summary
In summary, the Arctic ringed seal DPS has a large population size and is likely resilient to immediate perturbations. It is, however, threatened by future climate change, specifically the loss of essential sea ice and snow cover, and as a result, is likely to become endangered in the future.

Bearded seal (Beringia DPS)
Species description
The bearded seal (*Erignathus barbatus*) is a large, Northern Hemisphere ice seal. It is divided into two subspecies. The Pacific subspecies (*E. b. nauticus*) is further divided into two geographically and ecologically discrete DPSs. The Beringia DPS inhabits the continental shelf waters of the Bering, Chukchi, Beaufort, and East Siberian Seas. On December 20, 2012, NMFS issued a final determination to list the Beringia DPS as threatened under the ESA (as filed). We used information available in the final listing, the proposed listing (75 FR 77496), and the status review report (Cameron et al. 2010) to summarize the status of the species, as follows.

Life history
In the spring and early summer, bearded seals rely on sea ice to rest, molt, and pup. Females mature at 5 – 6 years of age; they give birth to a single pup annually. The pups enter the water within hours of birth and begin to forage while still nursing, which lasts approximately 3 weeks. Males reach sexual maturity at 6 – 7 years of age. Bearded seals have a lifespan of 20 – 30 years. They feed primarily on benthic organisms, but they are also able to forage on schooling pelagic fishes (Cameron et al. 2010).

Population dynamics
The estimated population size of the Beringia bearded seal DPS is 155,000 individuals (75 FR 77496). There is substantial uncertainty around this estimate, however, and population trends for the DPS are unknown. An estimate of bearded seals in the western Bering Sea (63,200 95% CI

38,400 – 138,600) from 2003 – 2008 appears to be similar in magnitude to an estimate from 1974 – 1987 (57,000 – 87,000; Cameron 2010). The Beringia bearded seal DPS was listed as threatened, i.e., likely to become endangered in the foreseeable future. Warming climate trends are likely to result in the loss of essential sea ice habitat, and ocean acidification may alter prey populations (75 FR 77496). To adapt, bearded seals would likely shift their nursing, rearing, and molting areas to ice covered seas, potentially increasing the risks of disturbance, predation, and competition. The large range and population size of the Beringia DPS make it less vulnerable to other perturbations. Therefore, ESA section 4(d) protective regulations and section 9 prohibitions were deemed unnecessary for the conservation of the species (http://www.nmfs.noaa.gov/pr/pdfs/species/beardedseal_frn_filed.pdf).

Acoustics
Male bearded seals vocalize during the breeding season (March – July), with a peak in calling during and after pup rearing. Their complex vocalizations range from 0.02 to 11 kHz in frequency. These calls are likely used to attract females and defend their territories to other males (Cameron et al. 2010).

Status summary
In summary, the Beringia bearded seal DPS has a large, apparently stable population size, which makes it resilient to immediate perturbations. It is, however, threatened by future climate change, specifically the loss of essential sea ice and change in prey availability, and as a result, is likely to become endangered in the future.

6.0 Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which are contemporaneous with the consultation in process (50 CFR 402.02).

6.1 Cetaceans

Whaling

Prior to 1900, aboriginal hunting and early commercial whaling on the high seas, using hand harpoons, took an unknown number of whales (Johnson and Wolman 1984). Modern commercial whaling removed approximately 50,000 whales annually. In 1965, the IWC banned the commercial hunting of whales. Although commercial harvesting no longer targets whales in the proposed action area, prior exploitation may have altered the population structure and social cohesion of species, such that effects on abundance and recruitment continued for years after harvesting has ceased.

Shipping

Ships have the potential to affect cetaceans through strikes, noise (discussed below), and disturbance by their physical presence. Ship strikes are considered a serious and widespread threat to whales. This threat is increasing as commercial shipping lanes cross important breeding and feeding habitats and as whale populations recover and populate new areas or areas where they were previously extirpated (Swingle et al. 1993, Wiley et al. 1995). As ships continue to become faster and more widespread, an increase in ship interactions with cetaceans is to be expected. Studies indicate that the probability of fatal injuries from ship strikes increases as vessels operate at speeds above 14 knots (Laist et al. 2001).

Responses to vessel interactions include interruption of vital behaviors and social groups, separation of mothers and young, and abandonment of resting areas (Kovacs and Innes. 1990, Kruse 1991, Wells and Scott 1997, Samuels and Gifford. 1998, Bejder et al. 1999, Colburn 1999, Cope et al. 1999, Mann et al. 2000, Samuels et al. 2000, Boren et al. 2001, Constantine 2001, Nowacek et al. 2001). Whale watching, a profitable and rapidly growing business with more than 9 million participants in 80 countries and territories, may increase these types of disturbance and negatively affect the species (Hoyt 2001).

Noise

Noise generated by human activity adversely affects cetaceans in the action area. Noise is generated by commercial and recreational vessels, aircraft, commercial sonar, military activities, seismic exploration, in-water construction activities, and other human activities. These activities occur within the action area to varying degrees throughout the year. Whales generate and rely on sound to navigate, hunt, and communicate with other individuals. Anthropogenic noise can interfere with these important activities. The effects of noise on whales can range from behavioral disturbance to physical damage (Richardson et al. 1995).

Commercial shipping traffic is a major source of low frequency anthropogenic noise in the oceans (NRC 2003). Although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships above 2 kHz, which may interfere with important biological functions of cetaceans (Holt 2008). Commercial sonar systems are used on recreational and commercial vessels and may affect marine mammals (NRC 2003). Although little information is available on potential effects of multiple commercial sonars to marine mammals, the distribution of these sounds would be small because of their short durations and the fact that the high frequencies of the signals attenuate quickly in seawater (Richardson et al. 1995).

Seismic surveys using towed airguns also occur within the action area and are the primary exploration technique to locate oil and gas deposits, fault structure, and other geological hazards. Airguns generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of 10-20 seconds for extended periods (NRC 2003). Most of the energy from the guns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235-240 dB at dominant frequencies of 5-300 Hz (NRC 2003). Most of the sound energy is at frequencies below 500 Hz.

Navy activities

The Navy conducts military readiness activities, which can be categorized as either training or testing exercises, throughout the action area. During training, existing and established weapon systems and tactics are used in realistic situations to simulate and prepare for combat. Activities include: routine gunnery, missile, surface fire support, amphibious assault and landing, bombing, sinking, torpedo, tracking, and mine exercises. Testing activities are conducted for different purposes and include at-sea research, development, evaluation, and experimentation. The Navy performs testing activities to ensure that its military forces have the latest technologies and techniques available to them. Navy activities are likely to produce noise and visual disturbance to cetaceans throughout the action area.

Fisheries

Whales are known to feed on several species of fish that are harvested by humans (Waring et al. 2008). Therefore, competition with humans for prey is a potential concern. Reductions in fish populations, whether natural or human-caused, may affect the survival and recovery of several populations.

Entrapment and entanglement in fishing gear is a frequently documented source of human-caused mortality in marine mammals (see Dietrich et al. 2007). These entanglements also make animals more vulnerable to additional dangers (e.g., predation and ship strikes) by restricting their agility and swimming speed. Cetaceans that die from entanglement in commercial fishing gear often sink rather than strand ashore thus making it difficult to accurately determine the extent of such mortalities.

Pollution

Contaminants cause adverse health effects in cetaceans. Contaminants may be introduced by rivers, coastal runoff, wind, ocean dumping, dumping of raw sewage by boats and various industrial activities, including offshore oil and gas or mineral exploitation (Grant and Ross 2002, Garrett 2004, Hartwell 2004). The accumulation of persistent pollutants through trophic transfer may cause mortality and sub-lethal effects in long-lived higher trophic level animals (Waring et al. 2008), including immune system abnormalities, endocrine disruption, and reproductive effects (Krahn et al. 2007). Recent efforts have led to improvements in regional water quality and monitored pesticide levels have declined, although the more persistent chemicals are still detected and are expected to endure for years (Mearns 2001, Grant and Ross 2002).

Exposure to hydrocarbons released into the environment via oil spills and other discharges pose risks to marine species. Cetaceans are generally able to metabolize and excrete limited amounts of hydrocarbons, but exposure to large amounts of hydrocarbons and chronic exposure over time pose greater risks (Grant and Ross 2002). Cetaceans have a thickened epidermis that greatly reduces the likelihood of petroleum toxicity from skin contact with oils (Geraci 1990), but they may inhale these compounds at the water's surface and ingest them while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability.

Cetaceans are also impacted by marine debris, which includes: plastics, glass, metal, polystyrene foam, rubber, and derelict fishing gear (Laist 1997). Marine debris is introduced into the marine environment through ocean dumping, littering, or hydrologic transport of these materials from land-based sources. Even natural phenomena, such as tsunamis and continental flooding, can cause large amounts of debris to enter the ocean environment. Cetaceans often become entangled in marine debris (Johnson et al. 2005). They may also ingest it while feeding, potentially leading to digestive problems, injury, or death (Jacobsen et al. 2010).

Aquatic nuisance species are aquatic and terrestrial organisms, introduced into new habitats throughout the United States and other areas of the world, that produce harmful impacts on aquatic ecosystems and native species (http://www.anstaskforce.gov). They are also referred to as invasive, alien, or nonindigenous species. Introduction of these species is cited as a major threat to biodiversity, second only to habitat loss (Wilcove et al. 1998). They have been implicated in the endangerment of 48% of the species listed under ESA (Czech and Krausman 1997). Over 250 nonindigenous species of invertebrates, algae, and microorganisms have established themselves in the coastal marine ecosystems of California, whose waters have been the subject of most in-depth analyses of aquatic invasions in the United States.

Scientific research

Scientific research permits, issued by NMFS, authorize the study of listed resources in the action area. The primary objective of these studies is generally to monitor populations or gather data for behavioral and ecological studies. Activities authorized include: aerial and vessel surveys, photo-identification, biopsy sampling, and attachment of scientific instruments. These activities may result in harassment, stress, and injury.

Whale watching

Although considered by many to be a non-consumptive use of cetaceans with economic, recreational, educational and scientific benefits, whale watching is not without negative impacts. It has the potential to harass whales by altering feeding, breeding, and social behavior or even injury if the vessel gets too close. Another concern is that preferred habitats may be abandoned if disturbance levels are too high. Several studies have specifically examined the effects of whale watching, and investigators have observed a variety of short-term responses from animals, including: no apparent response; changes in vocalizations; duration of time spent at the surface; swimming speed, angle, or direction; respiration rate; dive time; feeding behavior; and social behavior (NMFS 2006b). Responses appear to be dependent on factors such as vessel proximity, speed, and direction, as well as the number of vessels in the vicinity (Watkins 1986, Corkeron 1995, Au and Green. 2000, Erbe 2002, Magalhaes et al. 2002, Williams et al. 2002a, Williams et al. 2002b, Richter et al. 2003, Scheidat et al. 2004). Foote et al. (2004) reported that Southern Resident killer whale call duration in the presence of whale watching boats increased by 10-15 percent between 1989-1992 and 2001-2003, indicating compensation for a noisier environment. Disturbance by whale watch vessels has also been noted to cause newborn calves to separate briefly from their mothers' sides, which leads to greater energy expenditures by the calves (NMFS 2006b). Although numerous short-term behavioral responses to whale watching vessels are documented, little information is available on whether long-term negative effects result from whale watching (NMFS 2006b).

Climate change

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine ecosystems in the near future. From 1880 to 2012, averaged global surface temperatures have risen 0.85° C and continue to rise at an accelerating pace (IPCC 2013). The direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, patterns of precipitation, and sea level.

Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Climate change is most likely to have its most pronounced effects on species whose populations are already in tenuous positions (Isaac 2008). As such, we expect the extinction risk of listed species to rise with global warming. Cetaceans with restricted distributions linked to water temperature may be particularly exposed to range restriction (Learmonth et al. 2006, Issac 2009). MacLeod (2009) estimated that, based upon expected shifts in water temperature, 88 percent of cetaceans would be affected by climate change, 47 percent would be negatively affected, and 21 percent would be put at risk of extinction. Of greatest concern are cetaceans with ranges limited to non-tropical waters and preferences for shelf habitats (Macleod 2009).

Burning fossil fuels has increased atmospheric carbon dioxide concentrations by 35 percent with respect to pre-industrial levels, with consequent climatic disruptions that include a higher rate of global warming than occurred at the last global-scale state shift (the last glacial-interglacial transition, approximately 12,000 years ago; Barnosky et al. 2012). Higher carbon dioxide concentrations have also caused the ocean rapidly to become more acidic, evident as a decrease in pH by 0.05 in the past two decades (Doney 2010). Climate models predict that climates found at present on 10–48% of the planet will disappear within a century, and novel climates that contemporary organisms have never experienced are likely to cover 12–39% of the Earth (Williams et al. 2007).

Already observable biotic responses include vast 'dead zones' in the near-shore marine realm (Jackson 2008), as well as the replacement of 40 percent of Earth's formerly biodiverse land areas with agricultural or urban landscapes (Ellis 2011). Worldwide shifts in species ranges, phenology, and abundances are concordant with ongoing climate change and habitat transformation (Parmesan 2006). Recent and projected extinction rates of vertebrates far exceed empirically derived background rates (Hoffman 2010; Barnosky et al. 2011; Pereira et al. 2010).

Summary of environmental baseline for cetaceans

Numerous factors have contributed to the endangered status of cetaceans, including: whaling, shipping, noise, Navy activities, fisheries, pollution, scientific research, marine mammal viewing, and climate change. Though the threat of whaling has declined dramatically over time, the other threats remain and will continue into the future. Such threats must be considered as part of the baseline when evaluating the effects of the action on the viability of the species.

6.2 Pinnipeds

Hunting

In the nineteenth and twentieth centuries, seals, sea lions, and fur seals were hunted for their fur, meat, and oil. Two species (Caribbean monk seal and Japanese sea lion) were hunted to extinction, others were hunted to near extinction (including the Hawaiian monk seal and Guadalupe fur seal), and many species were severely depleted. While hunting was previously the primary cause of population decline, it is no longer a major threat. Hunting of Hawaiian monk seals and Guadalupe fur seals is illegal. Limited subsistence hunting of Steller sea lions, bearded seals, and ringed seals is allowed.

Fisheries interactions

Fisheries interactions are a major threat to pinnipeds through several mechanisms: prey reduction, shootings, incidental bycatch, and entanglement in fishing gear. Reduced quantity or quality of prey appears to be a major threat to several pinniped species, as evidenced by population declines, reduced body size/condition, low birth rates, and high juvenile mortality rates (Trites and Donnelly 2003; Baker et al. 2008). Pinnipeds are shot in response to actual or perceived competition with fishermen. An estimated 50-1180 Steller seal lions are shot annually (Atkinson et al. 2008); six monk seals have been killed in recent years. Commercial fishing incidentally kills ~30 Steller sea lions, annually (Atkinson et al. 2008). Hookings and entanglement in fishing gear are major threats to Hawaiian monk seals.

Environmental variability
Limited prey availability, which is a major threat to several pinniped species, may be the result of reduced ecosystem productivity, caused by cyclic climate events. Declines in Steller sea lion populations overlap temporally and geographically with oceanic regime shifts (Trites et al. 2007). Reduction in juvenile monk seal survival is also correlated with a large-scale climate event (Polovina 1994).

Climate change
As described for cetaceans, climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine ecosystems in the near future (IPCC 2013). For pinnipeds, the major threats of climate change are reduced prey availability and loss of habitat. Warming sea surface temperatures and ocean acidification are likely to further reduce the availability of prey (Polovina et al. 2008). Sea level rise would reduce available beach habitat for Hawaiian monk seals. For the ice seals (i.e., ringed and bearded seals), climate change is the greatest threat to species survival because of their dependence upon pack ice for breeding, nursing, and resting.

Pollution
As described for cetaceans, pollutants and contaminants cause adverse health effects in pinnipeds. Acute toxicity events may result in mass mortalities; repeated exposure to lower levels of contaminants may result in immune suppression and/or endocrine disruption (Atkinson et al. 2008). In addition to hydrocarbons and other persistent chemicals, pinnipeds may become exposed to infectious diseases (e.g., Chlamydia and leptospirosis) through polluted waterways (Aguirre et al. 2007).

Scientific research
Scientific research permits, issued by NMFS, authorize the study of listed resources in the action area. The primary objective of these studies is generally to monitor populations or gather data for behavioral and ecological studies. Activities authorized include: surveys, marking, tagging, biopsy sampling, and attachment of scientific instruments. These activities may result in harassment, stress, and, in limited cases, injury or morality.

Summary of environmental baseline for pinnipeds
Numerous factors have contributed to the endangered status of pinnipeds, including: hunting, fisheries interactions, environmental variability, climate change, pollution, and scientific research. Though the threat of hunting was once the primary causes of population declines, it is no longer a major threat. Instead, fisheries interactions, environmental variability, and climate

change appear to be the major threats to the survival and recovery of pinniped species. These threats are likely to continue, and worsen, in the future. Such threats must be considered as part of the baseline when evaluating the effects of the action on the viability of the species.

7.0 Effects of the Action

Pursuant to Section 7(a)(2) of the ESA, Federal agencies are required to ensure that their actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Using the best available scientific and commercial information, we describe: the potential physical, chemical, or biotic stressors associated with the proposed actions; the probability of individuals of listed species being exposed to these stressors; and the probable responses of those individuals (given exposure). For this consultation, we are particularly concerned about responses that are likely to result in a reduction of fitness of an individual. This includes behavioral disruptions that may result in an individual's failure to survive or breed successfully. If responses are likely to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), we evaluate the risk posed to the viability of the listed population. The ultimate purpose of this assessment is to determine whether the proposed action is expected to reduce the species' likelihood of surviving and recovering in the wild.

Our "destruction or adverse modification" determinations must be based on an action's effects on the conservation value of habitat that has been designated as critical to threatened or endangered species. If an area encompassed in a critical habitat designation is likely to be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary constituent elements included in the designation (if there are any) or physical, chemical or biotic phenomena that give the designated area conservation value are likely to respond to that exposure.

7.1 Potential Stressors

The Permits Division proposes to authorize and the MMHSRP proposes to implement the activities identified in Tables 1 and 2, which include enhancement and research activities. Enhancement activities include responses to health emergencies involving marine mammals that were caused by other natural or anthropogenic phenomena. The physical, chemical, or biotic stressors produced by these activities are likely to be less severe than the stressors that caused the health emergency in the first place (this is further described in the *Response* section). The research activities include studies and other investigations that may or may not be conducted on animals that are in distress. Because they may be conducted on animals that are not in distress, these investigations pose new or additional risks to endangered or threatened marine mammals.

While the purpose of each activity is to either study or enhance the survival of the species, several activities are likely to produce stressors to individual animals. We list these here and evaluate the potential responses to such stressors in the *Response* section. One common stressor is simulation of predatory behavior ("predation"). By this we mean that the activity (e.g., emergency response, close approach, or capture/handling/restraint is likely to resemble predatory behavior from the perspective of the animal; such behavior includes focused observation, pursuit, approach, and capture. We also identify activities that are not likely to cause stressors; we do not consider these activities further.

- Emergency response: "predation," pain, or injury
- Aerial survey: disturbance
- Vessel survey: disturbance
- Close approach: "predation"
- Capture/handling/restraint: "predation," potential for injury or mortality
- Transport: no stressors identified beyond those of capture/handling/restraint
- Tagging/instrumentation: pain, potential for injury, potential for infection, increased drag, potential for entanglement
- Marking: disturbance, potential for injury, potential for infection
- Biopsy sampling: pain, potential for injury, potential for infection
- Blood sampling: pain, potential for injury, potential for infection
- Other sampling: pain, potential for injury, potential for infection
- Ultrasound: no stressors identified beyond those of capture/handling/restraint
- Administration of drugs: potential for chemical reaction or overdose
- Euthanasia: mortality
- Radiography: x-ray exposure
- Auditory: disturbance
- Import/export: no stressors identified; no further consideration
- Sample collection/analysis: no stressors identified; no further consideration

7.2 Exposure Analysis

The Permits Division proposes to authorize and the MMHSRP proposes to conduct emergency response and health assessment research activities on marine mammals. The number of takes authorized by the Permits Division for each activity is summarized in Tables 1 and 2; however, these numbers do not reflect the number of individuals that are likely to be taken during emergency response and health assessment research activities. To estimate the likely exposure of threatened and endangered marine mammals to the proposed activities in the upcoming year, we evaluate previous data collected on MMHSRP activities.

During responses to health emergencies, the Permit would authorize the MMHSRP to expose injured, sick, entangled, or stranded marine mammals to the stressors associated with aerial and vessel surveys, close approaches, disentanglements, treatment, capture/restraint/handling, tagging, sampling, radiography, and administration of drugs. The proposed permit would also authorize the MMHSRP to euthanize marine mammals in irreversibly poor condition (i.e., moribund as determined by a veterinarian).

Though we cannot predict the number, location, or details of health emergencies, we can use previous response data to describe past exposure, which helps us to estimate exposure in the next year of the amended/extended permit. Summarized from annual reports, Table 4 identifies the threatened and endangered species that the MMHSRP interacted with from 2003 – 2007 and 2009 – 2011 during disentanglements.

Table 4. Number of annual takes (disentanglement) by MMHSRP. Data from 2003 – 2007 were provided by the Provincetown Center for Coastal Studies and the Hawaiian Islands Humpback Whale National Marine Sanctuary; data from 2009 – 2011 are from MMHSRP annual take reports. Mean is rounded up to the nearest whole number.

Species	2003	2004	2005	2006	2007	2009	2010	2011	Total	Mean
Fin whale	1	3	0	1	0	0	0	0	**5**	**1**
Humpback whale	16	6	13	16	7	7	47	24	**136**	**17**
North Atlantic right whale	5	2	2	0	2	2	8	68	**89**	**12**
Sei whale	0	0	0	1	0	0	0	3	**4**	**1**
Cetacean total	**22**	**11**	**15**	**18**	**9**	**9**	**55**	**95**	**234**	**30**
Hawaiian monk seal	NA	NA	NA	NA	NA	3	8	14	**25**	**9**
Steller sea lion	NA	NA	NA	NA	NA	0	0	1	**1**	**1**
Pinniped total	**NA**	**NA**	**NA**	**NA**	**NA**	**3**	**8**	**15**	**26**	**9**
Marine mammal total	**22**	**11**	**15**	**18**	**9**	**12**	**63**	**110**	**260**	**33**

Two species — humpback whales and North Atlantic right whales — represented the majority of the MMHSRP's disentanglement efforts overall and almost every year (Table 4). There were also several disentanglements of Hawaiian monk seals. There appears to be an increase in disentanglements during recent years, likely a result of increased reporting, additional effort, or possibly a reflection of increased entanglements.

Table 5 identifies the number of stranding events involving endangered or threatened species from 2001 and 2005 (NMFS 2007). On average, 132 endangered or threatened marine mammals stranded each year between 2001 and 2005, including an average of 70 cetaceans (primarily humpback whales, fin whales, sperm whales, and Southern resident killer whales) and 62 pinnipeds (primarily Hawaiian monk seals and Steller sea lions). We assume that these whales and pinnipeds consisted of any age, gender, reproductive condition, or health condition.

Table 5. Number of stranding events documented by MMHSRP from 2001 – 2005 (NMFS 2007).

Species	2001	2002	2003	2004	2005	Total	Mean
Blue whale	0	0	0	0	0	**0**	**0**
Bowhead whale	0	0	1	1	1	**3**	**1**
Fin whale	9	7	8	6	5	**35**	**7**
Humpback whale	17	47	50	34	64	**212**	**42**
Southern resident killer whale	29	3	0	1	0	**33**	**7**
North Atlantic right whale	4	5	0	5	5	**19**	**4**
North Pacific right whale	0	0	0	0	0	**0**	**0**
Sei whale	3	2	2	2	0	**9**	**2**
Sperm whale	7	10	10	7	5	**39**	**8**
Cetacean total	**69**	**74**	**71**	**56**	**80**	**350**	**70**
Guadalupe fur seal	1	0	0	4	2	**7**	**1**
Hawaiian monk seal	23	28	27	24	40	**142**	**28**
Steller sea lion	13	22	40	33	52	**160**	**32**
Pinniped total	**37**	**50**	**67**	**61**	**94**	**309**	**62**

Marine mammal total	**106**	**124**	**138**	**117**	**174**	**659**	**132**

Based on the data available, Hawaiian monk seals, Steller sea lions, fin whales, humpback whales, Southern resident killer whales, North Atlantic right whales, and sperm whales appear most likely to be exposed to Emergency Response Actions of the MMHSRP over the next year of the proposed permit. The MMHSRP is not likely to interact with blue whales or North Pacific right whales over the one-year extension of the proposed permit, although such interactions are possible if a health emergency involving one or more of these species occurs. The MMHSRP is also less likely to interact with the species that have been recently listed on the ESA, including: Cook Inlet beluga whale, Hawaiian insular false killer whale, ringed seal, and the bearded seal.

The MMHSRP also proposed to conduct health assessment research activities on stranded animals and free-ranging animals that occur in areas with known health concerns or in areas of previous health concerns. Marine mammals that are captured for these health assessments may have visible health problems (for example, skin lesions), they may have been exposed to known toxins, or they may have been exposed to other physical, chemical, or biotic stressors that are known to produce adverse health outcomes in marine mammals. Tables 1 and 2 describes the number of takes authorized by the Permits Division. For example, the proposed permit would authorize representatives of the MMHSRP to approach, tag, and sample up to 100 large cetaceans, 200 small cetaceans, and 300 pinnipeds (including ice seals, not including other ESA-listed pinnipeds) in the next year.

To determine the number of takes that are actually likely to occur, as a result of MMHSRP emergency response and health assessment research activities, we summarize the data described in the 2009 – 2011 annual reports, and data from the tables above. We based our estimates of small cetacean takes on previous work performed by the MMHSRP on the Southern resident killer whale; we predict that the MMHSRP is likely to take Cook Inlet beluga whales and Hawaiian insular false killer whales at a similar frequency to that of Southern resident killer whales in past years. We based our estimates of pinniped takes on previous work performed by the MMHSRP on the Steller sea lion and Hawaiian monk seal; we predict that the MMHSRP is likely to take bearded and ringed seals at a similar frequency to that of Steller sea lions and Hawaiian monk seals in past years. We present these results as "expected exposure" in Table 6. We also include the take authorized in the Permit (summarized from Tables 1 and 2) for comparison. The number of expected takes is generally lower than the number of takes authorized by the Permits Division; however, our estimates are substantiated based on previous data, whereas the authorized take numbers are not. Therefore, we have confidence in our expected exposure estimates and use those in our effects analysis. Based on previous data, the species most likely to be exposed to MMHSRP activities are: Hawaiian monk seals, Steller sea lions, fin whales, humpback whales, Southern resident killer whales, North Atlantic right whales, and sperm whales. In addition, the MMHSRP may perform health assessments on recently listed species, including: Cook Inlet beluga whales, Hawaiian insular false killer whales, ringed seals, and bearded seals. The MMHSRP is not likely to conduct investigations on blue whales, bowhead whales, or North Pacific right whales over the next year of the proposed permit, although such investigations are possible.

Table 6. Expected exposure of threatened and endangered marine mammals to MMHSRP activities, based on previous data; authorized take summarized from Tables 1 and 2.

Proposed Action	Authorized Take	Expected exposure
Cetaceans and pinnipeds: emergency response	As warranted	165
Small cetaceans: close approach, aerial and vessel surveys	Unlimited	21
Small cetaceans: capture (net or hand), restraint, handling, tagging, marking (including freeze branding), sample collection, release; ultrasound and X-ray; and acoustic sampling, recording, and playbacks	Up to 200 annually (total)	21
Small cetaceans: incidental mortality during capture activities	3 annually (total)	0
Large whales: harassment from close approach, aerial and vessel surveys	Up to 4,900 annually (total)	100
Large whales: close approach, aerial and vessel surveys, tagging and sample collection (including biopsy and respiratory gases), acoustic sampling (including recording and playback experiments), collection of feces, photo-identification (for visual health assessment and identification)	Up to 100 annually (total)	100
Pinnipeds (except Guadalupe fur seal, Hawaiian monk seal, Steller sea lion): close approach, aerial and vessel surveys	Unlimited	142
Pinnipeds (except Guadalupe fur seal, Hawaiian monk seal, Steller sea lion): capture (net or hand), restraint, handling, tagging, marking (excluding hot branding), sample collection (including biopsy), release; and acoustic sampling, recording, and playbacks	Up to 300 annually (total for all species)	142
Pinnipeds (except Guadalupe fur seal, Hawaiian monk seal, Steller sea lion): incidental mortality during capture activities	3 annually (total for all species)	0

7.3 Response Analysis

In this section, we evaluate likely responses of ESA-listed resources to the activities. We describe likely responses of an individual. Specifically, we determine whether an individual's fitness is likely to be reduced as a result of the action. If so, we determine whether fitness reductions are likely to diminish population viability. If so, we determine whether diminished population viability is likely to jeopardize the species. We also determine whether the action will adversely affect critical habitat. If so, we determine whether the adverse effects are likely to reduce the conservation value of critical habitat, resulting in its adverse modification or destruction.

7.3.1 Responses to Emergency Response Activities

The MMHSRP responds to life-threatening health emergencies involving marine mammals caused by marine debris entanglement, illness, injury, and stranding (none of which are caused by the MMHSRP). For these analyses, we define a "stranded marine mammal" as "any dead marine mammal on a beach or floating nearshore; any live cetacean on a beach or in water so shallow that it is unable to free itself and resume normal activity; any live pinniped which is unable or unwilling to leave the shore because of injury or poor health" (Gulland *et al.* 2001, Wilkinson 1991).

An "emergency" response activity is one that involves the mitigation of life-threatening or otherwise fitness-limiting scenarios. Therefore, the subject animal is likely to be exposed to injury, illness, and physiological stress responses prior to MMHSRP involvement (and not the result of MMHSRP activities). One of the most common emergency response activities, disentanglement, is likely to reduce the likelihood of drowning, inadequate foraging, excessive drag (increased metabolic output), or other impairments to the fitness of an individual. Disentanglement is likely to involve close approach, capture, cutting or pulling of marine debris, administration of drugs, and/or tagging. The animal's likely response to each of these activities is described more fully below, under the section on research activities; however, it is safe to say that disentanglement is likely to result in avoidance behavior by the animal (i.e., a distressed animal is likely to experience a "fight or flight" response due to the approach of a human, which is perceived to be additional danger). The question we need to address is whether the increased stress associated with the avoidance behavior reduces the individual's fitness, relative to their entangled condition. To address this question, we review examples presented in the 2009 – 2011 annual reports to investigate the fitness of individuals prior to and after disentanglement. Then, we consider the fitness costs, if any, of avoidance behavior or other responses to MMHSRP. Finally, we compare the fitness benefits, as a result of MMHSRP involvement, to fitness costs associated with MMHSRP, to determine whether overall fitness improves as a result of MMHSRP emergency response activities.

The following examples are summarized from the 2009 – 2011 MMHSRP annual reports. We do not include the many examples of entangled marine mammals that were not approached for disentanglement, either due to evasion or because the entanglement was not life-threatening.

> In Hawaii, on December 1, 2009, a yearling humpback whale (MMD09224Mn-259) was reported entangled in heavy gauge polyline through the mouth and over the back. The animal was assessed and tagged with a telemetry buoy. On December 2, the team re-attached the buoy and removed 200 ft of line. On December 6, the animal was traveling with his mother and a male escort near Haleiwa Harbor, Oahu. The response team used kegging buoys to slow down the whale. After four hours, they were able to remove over 450 ft of gear from the whale. The whale was in good condition and likely survived.
>
> In Hawaii, on December 25, 2009, a sub-adult humpback (MMD09229Mn-267) was sighted with several wraps of small gauge line around the base of the tail and an anchor hanging below the whale in a small bundle of gear. Most, if not all, of the gear was removed from the animal, and it swam away rapidly.
>
> Near Provincetown, MA, on September 4, 2009, a 45 ft North Atlantic right whale (Mavynne, WR-2009-25) was disentangled. The entanglement consisted of three wraps of synthetic rope around the whale's upper jaw and a wrap of rope around its body, leading to heavy gear beneath it. Much of the entangling gear was well below the surface, beneath the whale. The team used an extendible pole with a hook-shaped knife affixed to the end to cut the ropes. All entangling gear was removed.
>
> In Cape Cod Bay, on September 26, a right whale (WR-2009-29) was disentangled. The whale had a relatively thin line just forward of the blowholes. The angle and tightness of this line suggested that the whale had a complete wrap around the head with gear suspended beneath or that the entanglement involved the mouthline at the area of the

gape, near the eyes. The mouth was slightly ajar, with the lower lip not quite closing to the upper lip line. The team set the grapple forward of the chin, perpendicular to the path of the whale. A 60 ft tether and an A4 buoy were let go and the whale immediately changed its behavior, traveling in circles just below the surface. When the animal did surface, it rose steeply and pitched to the right. The whale dove steeply, taking the buoy under and five minutes later the buoy rose to the surface. The team retrieved the buoy and 75 ft of line attached to a single wire mesh pot, as well as 120 ft of varied line (draped around the pot and line). The whale eventually resurfaced later heading out of Cape Cod Bay. Approaching the whale was extremely difficult, but during one dive a bullet-type buoy appeared in the footprint of the whale. This buoy and 45 ft of line were retrieved and found to be the remaining portion of the buoy line (matching numbers to the pot, same line make and covered in whale lice). Over the next two hours, the team made two approaches and confirmed that the whale was gear-free.

In southern Stellwagen Bank, in 2009, a humpback whale (WR-2009-31) was disentangled. The animal had a line and buoy attached, with the line through the mouth. A grapple was thrown into the trailing line and a large buoy was attached to the gear. The whale dove but did not bring the large buoy under; the team could see that the whale was changing directions rapidly underwater. Within a few minutes the buoy stopped moving; the whale surfaced at a distance and began to travel at speed. The team stayed with the whale for 45 minutes to confirm that it was gear-free.

In Hawaii, on April 7, 2010, a sub-adult humpback whale (ID# MMD10278-326) was anchored in gear off Haleiwa, Oahu. The disentanglement team determined that the animal was entangled by both of its flippers in locally set crab pot (trap) gear. After assessing the animal and entanglement, the team grappled the anchoring line and used it to pull themselves up to the animal while avoiding the animal's tail. Using a hooked knife on the end of 15-foot pole, the team made two cuts to the wraps on the left flipper, which successfully freed the animal of all gear.

In Alaska, on September 2, 2010, a response to an entangled humpback (Animal ID# MMD100902) was mounted. The team tagged the animal with a telemetry buoy. On September 3, the team was able to completely disentangle the animal.

Near Jacksonville, FL, on December 25, 2010, an aerial team sighted an entangled right whale calf (the 2009 calf of #2611, WR-2010-21). An on-water response team assessed the entanglement and tagged the animal with a telemetry buoy. The animal had loops of line anchored in the mouth and both of the flippers were involved in the entanglement. The animal had line trailing behind it about five whale lengths. The animal had poor body condition, and the entanglement was deemed life threatening. The response team attempted to set a control line, but due to the whale's evasiveness, the sea state, and amount of daylight, the operation was called off. On December 29, the animal was documented off St. Augustine Inlet, FL. The response team attached buoys and a drogue in an attempt to remove gear. The animal avoided vessel approaches. On December 30, the team untangled a mass of lines behind the flukes and cut a large loop of line. On January 15, 2011, the animal was finally disentangled, but its carcass was found on February 2, 2011.

In Massachusetts, on May 13, 2010, an entangled humpback whale (#2470, PCCS ID# WR-2010-03) was spotted. The whale had line around the base of the flukes and trailing approximately three whale lengths aft of the flukes. The team set a control line and attached a balloon buoy to the end of the gear. After the animal was tagged, it stopped feeding and traveled at or just below the surface, away from the vessel. After a series of attempts, both wraps were cut, and all of the gear came free as the whale worked its flukes up and down.

Near Chatham, MA, on July 27, 2010, an entangled humpback (the 2007 calf of Nocturne, WR-2010-11) was spotted. The team spent over 4.5 hours attempting to access the entanglement. There was a very thin line over its back and appeared to angle towards the mouth. The team did not intervene at that time. On August 12, the team again responded to the animal. The animal had a complete wrap around the body between the head and flippers and was twisted in a tangle under the right flipper. The team was unsuccessful at cutting the line. On August 30, the animal was spotted off Chatham, MA. It was now towing a small balloon buoy. The team set the work line and attempted to slow the whale down. The whale was very agitated and began swimming quickly, pumping/slashing its flukes. The team was able to completely disentangle the animal.

In Hawaii, on March 18, 2011 a juvenile sei whale was reported entangled. The animal was entangled in heavy gauge, likely 1 in diameter, yellow, polypropylene line. The entangling line had a heavy growth of gooseneck barnacles making it appear even larger. There were multiple line scars around the body both forward and behind the level of pectoral flippers. The animal was in poor condition, and the entanglement was life threatening. The animal was eventually freed of all gear.

Near Shelter Island, AK, on August 17, 2011, there was a report of a humpback whale mother/calf pair with the calf entangled with a single orange, plastic barrel buoy. The entanglement was determined to be a single wrap around rostrum tip with a single twist near the right pectoral flipper. Line to what was believed to be a pot (trap) trailed deeper, while buoy line trailed along the right side of the animal. A response effort was mounted, and the whale was successfully disentangled.

In Hawaii, in 2009, three Hawaiian monk seals (RT10, RW06, and RA36) were dehooked and entangling gear was removed from a monk seal (RO12), while the animal was asleep on the beach in Oahu.

In Seward Harbor, AK, on September 17, 2010, two Steller sea lions were reported entangled and tethered together in buoy line. Entangling gear was grappled to relieve tension, and the animals were able to free themselves.

In Yakutat, AK, on April 25, 2011, a subadult Steller sea lion was reported entangled in a gill net. Responders were able to completely free the sea lion from the gill net, and the animal swam away.

We provide this list of examples to illustrate the following points. First, entangled animals often exhibit reduced body condition or their situation is described as "life-threatening," indicating that individuals are experiencing potentially extreme fitness reductions as a result of the entanglement. Without disentanglement, it is likely that these individuals would die or experience other fitness reductions, such as reduced foraging, increased drag, or inability to reproduce. Second, entangled animals often respond to MMHSRP intervention with avoidance, i.e., diving or fleeing; however, these responses appear to be temporary (i.e., the stress response ends after the disentanglement procedures end). Third, most disentanglements result in fitness benefits to an individual, recovering from "life-threatening" disentanglements and being freed of all gear; however, one individual (the 2009 right whale calf of #2611, WR-2010-21) died despite eventual disentanglement. The death is not likely a result of disentanglement, but rather the result of chronic reduced body condition due to weeks of entanglement.

We use the data in the MMHSRP annual reports (2009 – 2011) to summarize individual responses to disentanglement, including avoidance behavior. In general, animals that were approached for assessment only showed no outward signs of evasiveness. Nearly all animals that were closely approached for the purposes of disentanglement exhibited evasive behavior, including fleeing, diving, increasing swimming speed, and changing direction. The avoidance behavior appears to be temporary, with animals returning to normal foraging, resting, or swimming behavior once the MMHSRP retreats. Therefore, there do not appear to be fitness costs associated with this evasiveness. Furthermore, the MMHSRP takes measures to minimize avoidance responses, including: reducing time spent in proximity to animals as much as possible; a gradual increase in vessel approaches and disentanglement activities; and clearly assessing entanglements prior to disentanglement actions. In addition, the MMHSRP properly maintains and cleans tools that are likely to come into contact with animals to avoid the possibility of infection. No problems or unforeseen effects were encountered during the disentanglement activities. No animals were injured or killed during any disentanglement activities.

To summarize, in all but once instance, disentanglement increased the chances of survival for individuals. The avoidance behavior did not appear to reduce the fitness of any individual, relative to their pre-existing entangled condition. Therefore, we conclude that disentanglement is likely to improve the fitness of individuals and increase the viability of populations.

Disentanglement activities are among the most common health emergency response activity performed by the MMHSRP. Other activities include responding to strandings or unusual mortality events (UMEs). Generally, strandings or UMEs involve dead or moribund animals. When possible, the MMHSRP treats and recovers animals; otherwise, the MMHSRP relieves the pain and suffering of a moribund animal through euthanasia, described in the section below on research activities.

Starting in 2011, there was a UME in Alaska involving ice seals (e.g., ringed and bearded seals). These seals exhibit a variety of skin-associated lesions (ulcers/erosion) on the eyes, snout, hind flippers, tail, and trunk. The skin lesions are often associated with patchy hair loss and/or delayed molt. Affected seals display uncommon behaviors such as unusual approachability, lethargy, and increased tendency for hauling out on land. In some animals respiratory signs are prominent. Gross pathological and histopathological findings indicate significant pathologic involvement of lung, liver, the immune system, and the skin associated vascular bed. All age classes have been affected. As with other UMEs, the MMHSRP is treating animals, when possible.

Strandings and UMEs generally involve moribund or seriously ill individuals, whose fitness (likelihood of survival and reproduction) is effectively zero. The MMHSRP responses are designed to treat the illness of the individual (improving fitness) or alleviate suffering (no change in fitness from the moribund condition). We are unable to identify an instance in which MMHSRP treatment, rather than the underlying problem, resulted in the death of a viable individual. Therefore, we conclude that the MMHSRP response to strandings and UMEs is not likely to reduce the fitness of any individual but is likely to reduce the suffering from moribund individuals.

7.3.2 Responses to Prospective Health Assessment Research Activities

The MMHSRP conducts research on stranded animals and free-ranging animals that occur in areas with known health concerns or in areas of previous health concerns. Marine mammals that are captured for these health assessments may have visible health problems (for example, skin lesions) or they may have been exposed to known toxins. Below, we evaluate the responses of individuals to the stressors caused by research activities.

Aerial Survey

The MMHSRP utilizes aerial surveys to identify and monitor stranded and free-ranging animals for health assessment or response. The stressor likely to result from this activity is disturbance, including visual and auditory disturbance. We evaluated data presented in the 2009 – 2011 MMHSRP annual reports to determine likely responses of marine mammals to aerial surveys (Table 7).

Table 7. Marine mammal responses to aerial surveys.

Year	Location	Number surveys	Purpose	Number responses
2009	Provincetown	Not specified	Photo identification	0
2009	Hawaii	2	Distressed animals	0
2010	Hawaii	2	Distressed animals	0
2011	Alaska	1	Entangled animal	0

As described in Table 7, the MMHSRP did not observe any marine mammal responses to the visual or auditory disturbances of aerial surveys. The sample size is low, and it is possible that responses were not recorded or not observed. Therefore, we consider other data sources on the behavioral responses of marine mammals to aerial surveys. In a study of male sperm whales in the presence of whale-watching aircraft, Richter et al. (2006) did not observe any differences in spatial orientation, blow interval, time at surface or time to first click.

Patenaude et al. (2002) observed the responses of bowhead and beluga whales to aircraft during four spring seasons. Few bowheads (2.2%) or belugas (3.2%) reacted to overhead flights at altitudes 60–460 m. Of 507 observed bowhead whale groups, only 11 (2.2 percent) reacted; responses included two dives, one turn and eight unusually brief surfacings (Patenaude et al. 2002). Of 760 beluga sightings, 24 (3.2 percent) reacted; responses included 10 dives, six turns, five looking at aircraft, and one unrecorded reaction (Patenaude et al. 2002). The authors conclude that while the disturbances may result in short-term behavioral reactions, it is unlikely that aerial surveys cause prolonged displacement or long-term deleterious effects.

We expect that other threatened and endangered cetacean species are likely to react in a similar manner as the species described above. Combining these datasets, we conclude that visual and auditory disturbances from aircraft may result in temporary behavior changes in a small percentage of individuals (0 – 3 percent) for some species. Because these behavior changes are temporary, we do not expect any fitness losses in any cetaceans as a result of aerial surveys.

We expect threatened and endangered pinnipeds species to respond to aircraft disturbance by looking up at the aircraft, entering the water, or diving (if already in the water). Looking up and diving are normal activities of pinnipeds and are not expected to result in fitness reductions of any individual. Entering the water can be dangerous in a rookery, where stampedes may occur. This is not a problem for ice seals (ringed and bearded seals), Guadalupe fur seals, or Hawaiian monk seals, which are relatively solitary; however, it is a major concern for Steller sea lions.

Snyder et al. (2001) studied the effect of aircraft disturbance on 10 Steller sea lion rookeries in the Gulf of Alaska and Southeast Alaska during two pupping seasons (1997 and 1998). They counted a total of 9,975 – 10,820 Steller sea lions during their surveys. Many sea lions were observed looking up at the plane, but there were no instances of "spooking" or stampeding to the water. Observers at Fish and Marmot Islands in 1998 did not see any disturbance responses. The authors conclude that aerial surveys do not disturb Steller sea lion rookeries (Snyder et al. 2001). Therefore, we do not expect aerial surveys conducted by the MMHSRP to result in fitness reductions in any individuals.

Steller sea lion (Western DPS) critical habitat includes an air zone extending 3,000 feet (0.9 km) above rookery areas historically occupied by sea lions to avoid stampedes as a result of aircraft disturbance. The MMHSRP would avoid such areas during their aerial survey. Therefore, we do not expect aerial surveys to reduce the conservation value of Steller sea lion critical habitat.

Vessel Survey

The MMHSRP proposed to use vessel surveys to evaluate the potential condition of entangled, injured, stranded, or other marine mammals. Vessels surveys are likely to produce visual and auditory disturbance. We do not include ship strike as a possible stressor because the purpose of vessel surveys is to look for marine mammals; therefore, we expect slow travel speeds, high visibility, fish finders, and many observers aboard watching out for marine mammals. Under these conditions, a ship strike is unlikely.

As described in the 2009 – 2011 MMHSRP annual reports, none of the whales exhibited evasive behavior in response to vessel surveys for the purpose of assessment and documentation. It is possible that responses were not recorded or not observed. Therefore, we consider other data sources that describe the behavioral responses of marine mammals to vessel surveys.

Marine mammals exhibit a variety of responses to vessel disturbances including short-term changes in swimming and feeding behaviors, as well as extended diving and submergence (Baker & Herman. 1987; Best et al. 2005; Brown et al. 1991; Clapham & Mattila 1993; Jahoda et al. 1997; Malme et al. 1984; Patenaude et al. 2002; Richardson et al. 1985; Watkins et al. 1981). Sperm whales and humpback whales change their behavior in the presence of whale watching vessels (Corkeron 1995; Richter et al. 2006); however, humpback whale responses are minimal and short-lived when vessel approaches are slow (Clapham & Mattila 1993). Watkins (1986b) found that several species of baleen whales ignore weak vessel noises.

Beluga whales are likely to respond to the visual disturbance of vessels by avoidance; Stewart (2010) observed evasive swimming behavior and more time spent underwater, in the presence of vessels. Native Alaskan whalers report that Cook Inlet belugas are very sensitive to boat noise and will leave areas subjected to high use; however, they may habituate to vessel noise in more heavily trafficked areas (Norman 2011). Belugas are known to increase their levels of vocalization as a function of background noise by increasing call repetition and amplitude, shifting to higher frequencies, and changing structure of call content (Lesage et al. 1999; Scheifele et al. 2005).

Southern Resident killer whales spend significantly less time foraging and more time travelling in the presence of vessels (Lusseau et al. 2009, Williams et al. 2009). They are expected to respond to vessel noise with increased call durations or amplitude (Foote et al. 2004, Holt 2008, Holt et al. 2009). They are also likely to avoid areas of high vessel traffic (Erbe 2002).

Our data review indicates that visual and auditory disturbances are likely to adversely affect individuals of all threatened and endangered cetacean species and result in behavioral changes; however, these changes are likely to be temporary and rare. The MMHSRP would be careful to avoid disrupting important behaviors, such as feeding, mating, or nursing. Therefore, we do not expect fitness costs to any individual cetacean as a result of vessel disturbances.

Sea lions in water tolerate close and frequent approaches by vessels and sometimes congregate around fishing vessels. Those hauled out on land are more responsive to vessel disturbance but rarely react unless the vessel approaches within 100 – 200 m (Richardson et al. 1995). The MMHSRP would be careful to avoid approaching Steller sea lion rookeries to within 200 m to avoid the possibility of a stampede.

Though we do not have information exclusively on vessel surveys, Hawaiian monk seals responded to monitoring surveys (vessel and foot surveys) as follows. In 2012, 1.4 percent raised their head, 0.15 percent moved away (a distance of < 2 body lengths), and 0.36 percent entered the water (NMFS 2013). Between 2003 and 2007, there were 126,912 sightings of seals in the NWHI (NMFS, unpublished data). Of these, only 3,746 (2.95 percent) resulted in disturbances. Only 690 sightings (0.54 percent) resulted in movement into the water. Seals did not respond to the vast majority of sightings (123,166 or 97.05 percent). These findings are consistent over longer time frames (1997-2007), in which the overall rate of response approaches is also 2.95 percent, with less than one percent entering the water (NMFS 2008). Therefore, it is likely that less than three percent of all future monitoring activities are likely to result in disturbance and less than one percent is likely to result in the most severe response (movement into the water).

We expect Guadalupe fur seals and ice seals (bearded and ringed seals) to react similarly to Steller sea lions and monk seals, respectively. We expect few behavioral changes, and the responses that occur are likely to be mild (i.e., entering the water or diving) and temporary. Therefore, we do not expect any fitness reductions to any individual pinnipeds as a result of vessel surveys.

Steller sea lion critical habitat includes aquatic zones that extend 3,000 feet (0.9 km) seaward from the major rookeries and haulouts east of 144°W. The MMHSRP would avoid such areas during their vessel surveys. Therefore, we do not expect vessel surveys to reduce the conservation value of Steller sea lion critical habitat.

Close Approach
The MMHSRP proposes to approach marine mammals to perform health treatments and assessments. Close approaches are likely to increase the potential for collision and a stress response.

Some responses to close approach are benign. For example, a separated calf attempted to suckle from the hull of a vessel during a close approach, as described in the MMHSRP annual report from 2011. In one study, 71% of the 42 whales that were closely approached (within 10 m) showed no observable reaction; when reactions occurred, they included lifting of the head or flukes, arching the back, rolling to one side, rolling to one side and beating the flukes, or performing a head lunge (Baumgartner and Mate 2003).

Some whales respond to close approach by faster swimming, submergence, and changes in diving duration (Baker et al. 1983). Watkins et al. (1981) found that both finback and humpback whales appeared to react to vessel approach by increasing swim speed, exhibiting a startled reaction, and moving away from the vessel with strong fluke motions. Bauer (1986) and Bauer and Herman (1986) noted changes in humpback whale respiration, diving, swimming speed, social exchanges, and other behavior, depending on the social status of the whales being observed (single males when compared with cows and calves). Smaller pods of whales and pods with calves seemed more responsive to approaching vessels. Studies of other baleen whales, specifically bowhead and gray whales document similar patterns of short-term, behavioral disturbance in response to a variety of actual and simulated vessel activity and noise (Richardson et. al, 1985; Malme et al. 1983). Jahoda et al. (2003) studied the response of 25 fin whales in feeding areas in the Ligurian Sea to close approaches by inflatable vessels and biopsy samples. They concluded that close vessel approaches caused these fin whales to stop feeding and swim away from the approaching vessel. Beale and Monaghan (2004) concluded that the level of disturbance was a function of the distance of humans to the animals, the number of humans making the close approach, and the frequency of the approaches.

Summarizing the available information, close approaches are likely to result in stress responses for some individuals and little or no responses from other individuals. Clapham and Matilla (1993) conclude that the stress responses are not likely to have long-term behavioral changes that would result in fitness reductions for individual whales. We agree with this assessment and do not expect fitness reductions in any individual.

Pinnipeds are likely to respond to close approach with avoidance behaviors, such as diving. Similar to cetaceans, we expect the close approaches to produce short- to mid-term stress responses that have no long-term behavioral changes. Therefore, we do not expect fitness reductions in any individuals.

Capture, Handling, and Restraint

The MMHSRP may need to capture marine mammals to assess their health or perform a treatment; during capture and restraint, the MMHSRP is likely to collect samples, attach tags or scientific instruments, or perform other assessments. Capture and restraint procedures constitute "one of the most stressful incidents in the life of an animal, and intense or prolonged stimulation can induce detrimental responses" (Fowler 1978). Attempts to escape could lead to injuries (such as contusions, lacerations, abrasions, hematomas, concussions, and fractures) or death. Stress responses could also lead to hyperthermia (excessively high body temperature which could lead to muscle rigidity, brain damage, or death) and myopathy from increased muscle activity.

Capture, handling, and restraint is likely to result in a stress response in marine mammals. Capture myopathy is a possible consequence of the stress associated with chase, capture, and handling in numerous mammal species (Fowler 1978). Capture myopathy is characterized by degeneration and necrosis of striated and cardiac muscles and usually develops within 7 to 14 days after capture and handling. It has been observed both in animals that exert themselves maximally and those that remain relatively quiet, and occurs with either physical or chemical restraint. Fear, anxiety, overexertion, repeated handling, and constant muscle tensions such as may occur in protracted alarm reaction are among the factors that predispose an animal to this disease. A variety of factors may function in concert or individually. The muscle necrosis is likely due to acidemia resulting from a build up of lactic acid following profound muscle exertion: once necrosis has occurred, the prognosis for recovery is not favorable. The number of times an animal is captured, the method(s) of restraint, as well as the age and general condition of the animal are all factors that will affect an animal's response to capture. Continuous stimulation of the adrenal cortex, as from stress associated with chronic disturbance or repeated capture, can cause muscle weakness, weight loss, increased susceptibility to bacterial infections, and poor wound healing, and can lead to behavioral changes including increased aggressive and antisocial tendencies (Fowler 1986).

To determine the effects of capture and restraint ("handling") on Hawaiian monk seals, Baker and Johanos (2002) compared the survival, migration, and condition of handled seals (N = 549) and non-handled "control" seals (N = 549) between 1983 and 1998. There were no significant differences in survival (i.e., resighting rates of 80 – 100 percent), observed migration, and body condition between handled seals and controls. Similarly, Henderson and Johanos (1988) determined that capture, brief restraint without sedation, and flipper tagging had no effect on subsequent behavior of weaned pups.

The MMHSRP is aware of the risks involved with capture, handling, and restraint. Therefore, they take the following precautions:

- Care is taken during capture, restraint and handling to minimize adverse effects
- The protocols have been streamlined to minimize restraint and handling time
- At the sign of any problems, the individual will be released
- If medical attention is needed, a veterinarian is on hand to provide emergency care
- There have been no fitness reductions in previously captured individuals

These precautions have been effective in the past: there have been no reported injuries or death associated with capture, handling, or restraint by the MMHSRP in recent years. The Permits Division does not authorize the accidental mortality of any threatened or endangered species by the MMHSRP, which means that any mortality would be a violation of the permit. We do not expect any injuries or mortalities as a result of capture, handling or restraint in the upcoming year. Because the capture and restraint will be conducted only as warranted on threatened and endangered species (reducing exposure), and because any stress response would be temporary, we do not expect fitness reductions in any individual.

Tagging and Attachment of Scientific Instruments

The MMHSRP proposes to tag marine mammals and attach a variety of scientific instruments to collect data. The likely stressors caused by tagging and attachment include: pain, potential for injury, potential for infection, increased drag, potential for entanglement

Tags and instruments are often attached to cetaceans via suction cup or dermal attachments. These have been evaluated in previous section 7 consultations on research permit Nos. 774-1714, 14097, and 1058-1733. These permits and section 7 consultations concluded that:

- 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 suction cup assembly to the animal's size and weight would be such that any additional energetic demand created by hydrodynamic drag would likely be insignificant;
- The round cap midway along the anchor would ensure that the tag or anchor does not migrate deeper (i.e. muscle layer) into the whale after deployment; and
- None of the attachment types would be likely to injure individuals or elicit more than a minimal, short-lived response from whales.

Baumgartner et al. (submitted) conducted field trials of dermal attachment tags; they report a mild reaction (tail flick) to close boat approach and tagging in one humpback whale, but no reaction from the other four humpback whales. Whales tagged with the dermal attachment tags swam at comparable speeds to those tagged with suction cup tags, and their diving behavior was likewise similar to suction-cup tagged whales. Of eight bowhead whales tagged with the dermal attachment tag, only one had a mild reaction (tail flick); in all other cases, there was no overt reaction to close boat approach or tagging. Three of the eight whales had unusually long dives upon tagging (4-10 minutes), indicating that some whales clearly had an immediate response, albeit relatively mild, to the tagging process. Respiration rates were monitored for both the tagged bowhead whales and four undisturbed whales. For the five whales tagged for roughly 1.5 hours or more, respiration rates were significantly higher in the first hour than in the second hour, but respiration rates during the second hour were comparable to those of undisturbed whales. These results suggest the response of whales to tagging lasts approximately one hour, but afterward, the whales behave (at least physiologically) like undisturbed whales (Baumgartner et al. submitted). We interpret these findings to indicate that dermal attachments have minimal short-term effects on whales.

During a detailed photographic follow-up study of the humpback whales tagged with dermal attachment tags, Baumgartner et al. (submitted) report that the tag site looked good within the few hours following tagging, with the delrin stop resting snugly against the skin and with no sign of swelling, depression, bruising, protruding tissue, or damage to nearby skin. For two of the humpback whales, shedding of the anchor was documented within 2 and 5 days. Photographs within a day of anchor shedding indicated the wound site was very small (no larger than the needle itself), and was healing well. Photographs taken over the ensuing weeks and months indicated complete healing. Over the three months following tagging, all of the whales were re-sighted within 30 km of the location at which they were originally tagged. Confirmed re-sightings of three of the four whales persisted within 30 km of the tagging location for nearly five months after tagging. All were re-sighted in the same area the following year. Moreover, two of the tagged whales were reproductively mature females, and both produced calves in years following the tagging. One of these females calved during the winter following tagging, and was therefore pregnant when tagged (Baumgartner et al. submitted). We interpret these findings to indicate that dermal attachments do not have long-term effects on whales.

Shedding of tags is expected to minimize drag and the potential for entanglement. For archival tags, only the needle remains attached to the whale after detachment. The needle is expected to produce a foreign body response, resulting in rejection (i.e., expulsion of the needle from the skin), as documented in implanted satellite tags (Mate et al. 2007). Shedding of the needle is anticipated to occur within a few days of implantation. The suction-cup tags were designed to remain attached for at most several days. They can release from the whale in at least three ways: first, the animal can dislodge it by rapid movements, breaching, rubbing it on the seafloor, or by contact with another animal; second, the tag can simply release on its own due to slow leakage of the seal between the cup and the animal's skin, repeated diving (i.e., pressure changes) working the suction cup loose, some other mechanical failure, or releasing with sloughed skin; third, the tag has a release mechanism that uses an electrically corrosive wire assembly to release the tag package from the whale. If the tag became entangled in fishing gear or marine debris, it is highly likely that the tag would become detached from the whale. It is therefore, unlikely to entangle the whale in fishing gear. Although both tags (dermal and suction-cup) would create drag, the proportion of this tag to a whale's size and weight is such that any drag effects would be insignificant. Any drag caused by the tags would not interfere with movement or foraging. Therefore, we do not expect suction cup or dermal attachment tags to reduce the fitness of any individuals.

PIT tags have been used on a wide variety of animal species, including cetaceans, seals, sea lions, and fur seals. When PIT tags are inserted into animals that have large body sizes relative to the size of the tag (e.g., cetaceans and pinnipeds), empirical studies have demonstrated that the tags have no adverse effect on the growth, survival, reproductive success, or behavior of individual animals (Brännäs *et al.* 1994, Clugston 1996, Elbin and Burger 1994, Hockersmith et al. 2003, Jemison et al. 1995, Keck 1994, Skalski et al. 1998).

Plastic tags have also been used a wide variety of species, including Hawaiian monk seals. To ensure that this practice did not have negative effects, Henderson and Johanos (1988) conducted a study at Lisianski Island to compare the early survival, behavior, and movements of tagged and untagged weaned pups. They found no differences in any of these metrics between tagged and untagged pups. For most Hawaiian monk seals, initial tagging at weaning is the only time in their lives they are handled by humans. However, some seals may be captured, restrained and retagged at an older age if their flipper tags become lost, worn or broken. Baker and Johanos (2002) compared the survival, migration, and condition of 437 seals during the year subsequent to retagging to an equal number of matched controls with pre-existing tags. It was important to choose control seals that were already tagged, so that probability of resighting would not be biased between the two groups. They found no differences in survival, migration, or condition between the retagged and control groups.

The MMHSRP also proposes to mount Crittercams® on some individuals. Littnan et al. (2004) assessed the effects of Crittercam® on the foraging behavior of immature Hawaiian monk seals. Crittercams®, time-depth-recorders, and VHF radio transmitters were affixed to seals, and after 3-10 days (mean duration 5.7 days) the Crittercams® were removed (TDR and VHF remained until 4-48 days later). Descent and ascent on dives was slower with the Crittercam®, possibly indicating energetic costs to individuals, but the results were not statistically significant. Seals did not appear to significantly modify their dive behavior when fitted with Crittercam®; however, the sample size of the study was small (7 seals). Crittercams® have been deployed on Hawaiian monk seals for longer periods (1-12 days; Parrish et al. 2005), but the effects of instrumentation were not assessed. Abernathy and Siniff (1998) found that monk seals fitted with TDRs dove to the same range of depths as seals equipped with cameras.

Based on the best information available, there is a risk that instrumentation, especially larger equipment such as Crittercams®, could cause hydrodynamic drag, reducing foraging abilities and/or increasing the energy cost to the animals. However, the greater effect of the Crittercam® would be mitigated by the relatively short duration of its attachment (less than one week). Littnan et al. (2004) did not observe a significant difference in foraging behavior of immature monk seals equipped with Crittercams® compared to those without.

Another potential stressor associated with instrumentation is the increased potential for entanglement. Seals, for example, often forage or investigate marine debris, including fishing nets. Attached instruments could become snagged, trapping the seal. While the researchers have disentangled more than 300 Hawaiian monk seals, for example, none of the entanglements were associated with attached instruments. Furthermore, the instruments are easily detached or shed, limiting the time during which a seal could become entangled.

In summary, tagging and instrumentation is likely to result in a small, temporary increase in drag and may increase the risk of entanglement. Because of the limited duration, and based on previous data, we do not expect this increase to cause significant problems in foraging, diving, or the avoidance of predators. Therefore, tagging instrumentation is not likely to reduce the fitness of any individual.

Marking

The MMHSRP proposes to mark marine mammals for research using methods including: bleach, crayon, zinc oxide, paint ball, notching, and freeze branding. Information on the effects of marks on marine mammals is limited because investigators do not study the acute or chronic effects of marking (Murray and Fuller 2000). In a review of 238 papers that had been published in major ecological journals in 1995, Murray and Fuller (2000) concluded that more than 90 percent of the articles they reviewed either did not specify the potential effects of marking on study subjects or did not appear to consider those effects when reporting study results (see Table 8). Only 7 percent of the articles they reviewed explicitly considered the effects of marking on study subjects. As a result, the information we would need to assess the effects of marking on marine mammals, particularly of cetaceans, is not available. Fortunately, many studies use natural markings and photo-identification to monitor and resight cetaceans. Other methods are innocuous, such as zinc oxide, which is regularly used on captive cetaceans to protect their skin from sunburn.

Table 8. Data from a review of papers that had been published in 1995 whose methods involved marking (data from Murray and Fuller 2000)

Journal	Number of Papers Reviewed	No Marking Effects (implicit)	No Marking Effects (explicit)	Marking Tests or Modifications
American Naturalist	4	4	0	0
Animal Behavior	62	59	2	1
Canadian Journal of Zoology	50	46	0	4
Conservation Biology	10	8	0	2
Ecology	31	28	2	1
Journal of Animal Ecology	15	15	0	0
Journal of Wildlife Management	37	30	3	4
Oecologia	12	10	0	2
Oikos	17	15	0	2
Total	**238**	**215**	**7**	**16**
Percentages		**90**	**3**	**7**

There is limited information on the response of marine mammals to freeze branding. Macpherson and Penner (1967) reported that adult and juvenile seals tried to escape their restraints as soon as cold irons were applied to their skin (evidence of pain). Both Lay *et al.* (1992) and Schwartzkopf-Genswein *et al.* (1997) reported that domestic cattle also tried to break free from their restraints during freeze-branding and showed evidence of discomfort or avoidance responses for up to five days after they had been branded. Sherwin et al. (2002) reported that four species of bats experienced "discomfort" during freeze branding, but did not provide more information on the response of these small mammals to the branding procedure.

The researchers have applied many thousands of bleach markings on monk seals and have observed no negative effects other than the occasional minor disturbance (NMFS 2013). Most individuals are approached while sleeping and do not awaken during the process. Bleach marking reduces other adverse effects to seals because it aids in detection of a seal's identity from a greater distance than would be possible with flipper tags alone, thereby reducing the necessary approach distance and consequently the chance of disturbance.

Based on this limited information, we conclude that the marking of marine mammals is likely to result in a range of responses from no response (for minimally invasive techniques, such as bleaching) to acute pain for several minutes to days (for freeze branding). However, we do not expect any marking technique to reduce an individual's fitness.

Biopsy Sampling

Biopsy sampling and analysis provides insight into the causes of strandings and other health emergencies. For example, in 2011, the MMHSRP biopsy sampled an adult that swam up the Klamath River in California. The physical condition of the adult female declined continuously. The MMHSRP biopsied the whale from a distance of ~50 ft using a crossbow and bolt with a biopsy dart, which elicited no reaction or response from the whale. Analysis of the biopsy sample indicated that the skin was deteriorating and the blubber was changing in ways consistent with fasting. Upon her death, necropsy confirmed that the whale likely died of starvation and an infection that became systemic during her time in fresh water.

Most cetaceans exhibit mild behavioral responses to biopsy darting without any long-term adverse effects (International Whaling Commission 1989; Whitehead *et al.* 1990; Brown *et al.* 1991; Weinrich *et al.* 1991, 1992; Barrett-Lennard *et al.* 1996; Weller *et al.* 1997). Gauthier and Sears (1999) studied the behavioral responses of minke, fin, blue, and humpback whales to biopsy samples taken using punch-type tips fired from crossbows. These whales showed no behavioral reaction to 45.2 percent of successful biopsies; whales that responded to biopsy sampling typically resumed their normal behavior immediately or within a few minutes (Gauthier and Sears 1999). When they occurred, behavioral responses included tail flicks and submergence. The authors concluded that biopsy sampling is an efficient method for obtaining high-quality whale skin and blubber samples with limited behavioral disturbance to balaenopterid whales.

Weinrich *et al.* (1992) studied the behavioral responses of humpback whales in the Gulf of Maine (specifically Jeffrey's Ledge and Stellwagen Bank), classifying the responses into the categories: no reaction, low-level reaction (immediate dives but no other overtly forceful behavior), moderate reactions (trumpet blows, hard tail flicks, but no prolonged evidence of behavioral disturbance), and strong reactions (surges, tail slashes, numerous trumpet blows). Out of 71 biopsy attempts, 7.0 percent resulted in no behavioral responses, 26.8 percent resulted in low-level behavioral responses, 60.6% involved a moderate reaction, and 5.6 percent involved a strong reaction. Clapham and Mattila (1993) also concluded that humpback whales exhibited low to moderate reactions to being struck by biopsy darts. They found that 66.6 percent of humpback whales that had been biopsied showed no behavioral reaction or low-level reaction to the procedure. A study by Clapham *et al.* (1993) noted that studies on biopsy procedures showed no evidence of significant impact on cetaceans in either the short or long term.

We were only able to find one example of reduced fitness in a cetacean, as a result of biopsy sampling. A common dolphin in the Mediterranean Sea died following penetration of a biopsy dart and subsequent handling (Bearzi 2000). The dolphin was hit in the dorsal muscle mass below the dorsal fin by a lightweight pneumatic dart fired from a distance of 6 m by a variable-power carbon dioxide dart projector. The methods and equipment had been previously successfully used with minimal effect on common dolphins and other species under similar conditions; however, in the reported event, a dart stuck in the dorsal muscle mass instead of recoiling as expected. Less than 2 minutes after the hit, the dolphin began catatonic head-up sinking; it was recovered by a team member at depth. Basic medical care was given to ensure haemostasis, but the animal died 16 minutes later. Minimal overall bleeding and a small wound in the thick muscle mass were not among the suspected causes of death. Possible causes of death may have included either indirect vertebral trauma or stress (Bearzi 2000).

Considering the large number of cetaceans that have been biopsy sampled in recent decades (tens of thousands), and the number of fitness reductions (one), we do not expect any individuals to experience a loss in fitness as the result of biopsy samples.

The same is true of pinnipeds. To consider the fitness consequences of biopsy sampling, two studies were performed on Hawaiian monk seals. Henderson and Johanos (1988) conducted a study at Lisianski Island to compare the early survival, behavior, and movements of sampled and unsampled weaned pups; they found no differences in any of these metrics between tagged and untagged pups (Henderson and Johanos 1988). Baker and Johanos (2002) compared the survival, migration, and condition of 437 seals during the year subsequent to sampling to an equal number of matched controls; they found no differences in survival, migration, or condition between the sampled and control groups (Henderson and Johanos 1988). Other pinniped species are likely to respond similarly to biopsy sampling. Therefore, we do not expect the loss of fitness of any individual as a result of biopsy sampling.

Blood Sampling

The MMHSRP proposes to collect blood samples a 20-gauge, 4-cm needle for small animals and an 18-gauge, 4-cm needle for larger animals.

The insertion of a needle is likely to cause discomfort to the individual however, it is not expected to cause injury, as the needle entry point is minuscule and would be inserted by an experienced individual. A new or sterilized needle would be used for each individual to avoid infection. Blood removal would cause a temporary increase in blood cell production, resulting in a small metabolic cost to the individual. In studies done on human hospital patients, phlebotomy is associated with a decrease in hemoglobin and hematocrit, and can contribute to anemia (Thavendiranathan et al. 2005). Such responses, however, are expected to be temporary and minor. Therefore, we do not expect the collection of blood samples to reduce the fitness of any individual.

Other Sampling

The MMHSRP proposes to collect other samples from marine mammals, including tooth extraction, urine, blowhole, breath, fecal, milk, sperm, and colonic temperatures. These samples would be collected during health assessment studies, in which the animal has been captured for reasons other than sample collection. Therefore, we do not consider the potential stressors associated with capture and restraint. The time spent collecting biological samples would be minimized to avoid additional stress to the animal.

As with other biological sampling, potential stressors including pain, potential for injury, and potential for infection. The potential for infection is minimized through the use of disposable or sterilized tools and antibiotic. The potential for injury is minimized through the optimization of procedures, the training of staff, and sedation of the animal to minimize stress. The potential for pain ranges from mild discomfort to intense pain (e.g., tooth extraction). The mild discomfort associated with most sampling would dissipate quickly and is not expected to reduce the fitness of any individual. Tooth extraction may result in momentary pain, which is minimized with local anesthetic. After the anesthetic wears off, the residual pain could temporarily interfere with foraging; however, this interference would be temporary and would not cause the individual to become undernourished or emaciated. As with humans, the loss of a single tooth (#15 in the lower left jaw of cetaceans) does not prevent foraging or feeding in the long-term. The risk of infection is small because the veterinarian would apply Betadine and a local antibiotic. Therefore, it is unlikely that tooth extraction, or any other sampling, is likely to reduce the fitness of any individual.

Administration of Drugs

The MMHSRP proposes to administer drugs to sedate or chemically restrain marine mammals during stranding response and disentanglement activities. They may use anesthetics and analgesics during research before performing biopsies, tooth extractions, and other procedures. Alternatively, they may administer antibiotics, antifungals, and other medicines during response and rehabilitation.

The sedation of large whales is a controversial topic: there are obvious advantages to limiting the evasive movements of a whale during disentanglement; however, sedation could result in the sinking and drowning of the whale. Moore et al. (2010) describe sedation trials on two free-swimming right whales. The first whale was given midazolam (0.01 to 0.025 mg/kg) first and then with meperidine (0.17 to 0.25 mg/kg) four times over two hours. The latter dosage resulted in a mild effect in 20–30 minutes, with duration of less than 2 hours; however, evasiveness was not reduced. The second whale was given midazolam (0.03 mg/kg) followed by butorphanol (0.03 mg/kg) an hour later; evasiveness was not reduced. Two months later it was then given midazolam (0.07 mg/kg) and butorphanol (0.07 mg/kg) simultaneously; respiration increased mildly in frequency and decreased in strength. The next day both drugs at 0.1 mg/kg were given as a mixture in two darts 10 minutes apart, resulting in a marked reduction of boat evasion that enabled decisive cuts to entangling gear (Moore et al. 2010).

There are also advantages and disadvantages to the administration of antibiotics. On 16 May 2007, a mother and female calf humpback whale pair were observed at an atypical location, 72 nmi inland in the Port of Sacramento, California (Gulland et al. 2008). Both animals had lacerations, suggesting sharp trauma from a boat strike. Daily photographs showed generalized deterioration of skin condition and necrosis of wound edges in both whales as they remained in fresh water. Based on these observations and the prolonged duration of exposure to fresh water, the whales were treated with antibiotics (ceftiofur) to reduce the risk of septicemia following infection of the necrotic lacerations. The day after treatment, the animals swam to brackish water, and their skin condition noticeably improved 24 hours later. The use of antibiotics is unlikely to have been effective in improving skin conditions within 24 hours (Gulland et al. 2008). It would have been ideal to monitor blood levels of ceftiofur following administration as well as the site of dart penetration to observe any potential post-darting side effects such as tissue necrosis; however, this was logistically unfeasible. This study demonstrates that antibiotic administration is possible and that no anaphylactic response was observed following the use of ceftiofur (Gulland et al. 2008). Further studies of the pharmacokinetics of this drug in cetaceans are warranted. Improvements could be made to the form of drug administration: the 30-cm needle used in these animals was designed for use in right whales to penetrate the blubber and reach the underlying muscle. In the future, a variety of darts should be designed with shorter needles for species with relatively thinner blubber thicknesses. From this study, we conclude that antibiotic treatment is possible and did not result in any adverse effects (such as anaphylaxis).

Moore et al. (2012) describe the necropsy results of a chronically entangled North Atlantic right whale, which was sedated, disentangled to the extent possible, administered antibiotics, and satellite tag tracked for six subsequent days. It was found dead 11 days after the tag ceased transmission. Chronic constrictive deep rope lacerations and emaciation were found to be the proximate cause of death, which may have ultimately involved shark predation. A bent needle, used to administer antibiotics, resulted in cavity formation and hemorrhaging. From this study, we conclude that administration of the antibiotic can cause tissue injury if the needle bends upon hitting the underlying muscle.

Taken together, these studies demonstrate that the MMHSRP is not administering antibiotics liberally; instead, they administer antibiotics in potentially life-threatening cases (i.e., to prevent septicemia in whales whose condition is deteriorating). In such cases, infectious disease is more likely to reduce the fitness of the individual than localized tissue damage, as a result of a bent needle. Therefore, if used conservatively (on animals with deteriorating condition), we conclude that the administration of antibiotics is likely to improve the fitness of an individual, relative to its current state.

The administration of drugs to pinnipeds is more common because they can be easily approached on land; however, sedation has been problematic. Early reports describe the problems associated with anesthetics, including: narrow margins of safety, thermoregulatory disturbances, cardiovascular changes and fatalities (Gales 1989; Gage 1993). Until fairly recently, field-based chemical restraint and anesthesia of pinnipeds have been accomplished with intra-muscular agents, primarily combinations of a cyclohexamine (particularly keramine or tiletamine) and an ataracric (diazepam, zolazepam or xylazine) (Gales et al. 2005). Delivered in this manner, these drugs achieved variable results, exhibited adverse side-effects, and elevated rates of mortality (see reviews by Gales 1989; Lynch *et al.* 1999; Haulena and Heath 2001).

Delivery of anesthesia in pinnipeds can be complicated by their particular anatomical and physiological specializations to the marine environment and by the logistics of working with wild animals. Determining the proper dose is dependent on a fairly accurate assessment of the animal's weight and condition, as miscalculation of an animal's weight can lead to an overdose, which can have lethal consequences (Fowler 1986). The safest injection site for projectile syringes (darts) are in the deep muscle areas of the hind limbs (Scott and Ayars 1980). However, the blubber layer on pinnipeds can make delivery of an injectable drug into the muscle, where needed for proper absorption and distribution, difficult. In addition, inadvertent injection of drugs into the blubber frequently results in aseptic necrosis, sometimes leading to large abscesses (Geraci and Sweeney 1986). Injections into the chest cavity or stomach region can result in puncture of the lungs or stomach, which may kill the animal. The typical induction time for most chemical restraint agents is 10 to 20 minutes following intramuscular injection. As a result, darting can be dangerous because it can spook an animal into the water before the immobilization has taken affect, which can result in drowning. The original biological opinion describes two incidents in 1993 that illustrate these concerns.

In February 1993, under Permit No. 771 issued to the National Marine Mammal Laboratory (NMML), an adult female darted with Telazol died. Although the animal was "one of the farthest from the water" among the animals on the beach, she moved toward the water within 30 seconds of being darted. Within 5 minutes she had rolled over into the surf and appeared unable to swim. By the time the researchers reached the animal she was not breathing and was given Dopram (a respiratory stimulant). She resumed breathing and began moving her head side to side and moving her foreflippers slightly. When these movements on the part of the animal began to interfere with the researcher's efforts to collect samples and attach a transmitter, the animal's head was covered in an attempt to calm her. By the time attachment of the transmitter was nearly completed it was noted that the female had been still for about a minute. Upon removing the rain jacket it was discovered that her pupils were dilated and she had no blink reflex. Attempts at resuscitation were unsuccessful and it was believed that the animal's immersion in sea water after darting may have triggered the dive response (breath holding, decreased heart rate, and reduced peripheral blood flow) and/or she may have aspirated sea water. It was also suggested that covering the animal's head may have contributed to her death by making her condition difficult to monitor and/or by pushing her back into the dive reflex.

In February 1993, under Permit No. 771(64), issued to NMML, a pup that was accidentally darted with Telazol when it unexpectedly moved in front of the target adult animal died, apparently as a result of inadvertent intravenous injection of a drug intended for intramuscular administration in a larger animal. According to the report, the dart struck on the left flank, about 5 inches forward of the hip and about 2 inches off the spine, which apparently, as indicated by necropsy, entered the kidney, effectively causing an intravenous injection. Necropsy also revealed slight trauma to the kidney. The pup had also regurgitated approximately a liter or more of milk following the darting and may have aspirated some, which could have contributed to the death.

To avoid similar problems in the future, the MMHSRP has developed methods to improve the safety and efficacy of sedation methods. For some species, drug performance has been improved by delivery through an intravenous route (McMahon et al. 2000). For other pinnipeds, the most substantial improvements have been achieved by utilizing inhalation anesthesia delivered with field-modified equipment (Gales and Mattlin 1998; Gales et al. 2005).

To minimize adverse effects of sedation on pinnipeds, the MMHSRP has established required protocols, as follows. To avoid respiratory distress, ischemia (restricted blood flow), or nerve damage, animals would be positioned properly (*i.e.*, ventrally recumbent) during anesthesia (Dierauf 1990). Respiration and a measure of carbon dioxide in the blood would be monitored and oxygen administered, as needed to avoid prolonged breath holding during gas anesthesia, which can result in cardiac hypoxia (lack of oxygen to the heart muscle). Qualified personnel would be prepared to control or assist ventilations when using sedatives. An emergency kit would be readily available to respond to complications or emergencies. The animal's body temperature would be closely monitored and steps would be taken to avoid hypo- and hyperthermia. Drug doses would be calculated on the researcher's best estimate of an animal's lean body mass and metabolic rate. Using these methods, there have been no accidental deaths or injuries associated with the sedation of pinnipeds during MMHSRP activities.

We are also concerned with the stress response associated with sedation of pinnipeds. Petrauskas et al. (2008) used serum and fecal cortiosteroid analysis to study the stress response of California and Steller sea lions. They found that sedation does not elicit a significant stress response in these species; however, handling and restraint (without sedation) consistently resulted in a large stress response, as indicated by elevated fecal corticosterone concentrations, serum cortisol levels, and glucocorticois responses (Petrauskas et al. 2008). Similarly, Champagne et al. (2012) found that sedated northern elephant seals did not exhibit a cortisol response; whereas physically restrained seals (without sedation) resulted in a stress response, as indicated by increases in circulating cortisol, epinephrine, and glucose concentrations, as well as increased endogenous glucose production in weanlings (Champagne et al. 2012). Finally, Harcourt et al. (2010) found that administering a light dose of the sedative diazepam significantly ameliorated the cortisol response of handled Weddell seals without affecting testosterone levels; they concluded that mild sedation may reduce acute capture stress responses (Harcourt et al. 2010). From these studies, we conclude that sedation likely reduces the stress response of pinnipeds that must be handled for health assessment.

As with any administration of drugs, there are risk involving dosage, delivery, and side-effects. The Permits Division and MMHSRP would minimize these risks and any discomfort to individuals by using standardized procedures and dosages, allowing only qualified personnel to administer the drugs, and minimizing interactions whenever feasible. The administration of drugs by the MMHSRP has not resulted in the loss of any fitness in any individual in the past, and we do not expect any individual to experience a loss of fitness as a result of drug administration in the upcoming year. In some instances, we expect the administration of drugs to increase the likelihood of survival and reproduction through the treatment of infectious diseases and the minimization of stress responses.

Euthanasia

The MMHSRP would euthanize marine mammals in irreversibly poor condition. We found three examples of euthanized marine mammals in the 2009 – 2011 MMHSRP annual reports.

In 2010, there was a stranded juvenile humpback whale on East Hampton Beach, Long Island, NY. The response took place from April 6-9, 2010. Several attempts were made to sedate the whale via remote darting in order to calm it before euthanasia. On April 7, the whale was given Midazolam at 0.2mg/kg IM/Butorphanol at 0.2mg/kig IM. On April 8, the whale was given Butorphanol 6000 mg IM. On April 9, the whale was euthanized using Beuthanasia-D 600ml IP and 320 ml IV (retrobulbar plexus) after 3 pericranial .577 ballistic rounds.

In 2010, a humpback whale was humanely euthanized and the carcass was buried in the dunes. The humpback whale was severely debilitated from deep line wounds on the peduncle that severed the axial muscle tendons.

In 2011, a humpback whale (VGT 259) was humanely euthanized and necropsied. The whale had 8 propeller wounds on the dorsal surface, evidence of entanglement scars and scoliosis.

These examples illustrate the purpose of euthanasia: to minimize the pain of a moribund marine mammal. Without euthanasia, these whales would have still died, but the process would have taken longer. The obvious response to euthanasia is death; however, population viability is not reduced as a result of these lost individuals because their fitness was already effectively zero (i.e., no chance of survival or reproduction). Therefore, the euthanasia of individuals does not impact the population in any way.

Radiography

The MMHSRP propsoses to use readiography on animals undergoing rehabilitation or during research studies. The proposed radiography procedure is similar to a previously used technique that involved pressing a dental radiograph plate to the mouth for a few seconds. In a few cases, dolphins reacted negatively by dislodging the plate from the mouth. Therefore, the only concern is regarding exposure to radiation.

As with humans, exposure to radiation exposure is only dangerous in high doses or repetitively. Radiographs are often used in small animal practices to diagnose and stage pregnancies. There is little risk to the fetus when radiographing pregnant animals (Toppenberg et al. 1999; http://www.aafp.org/afp/990401ap/990401b.html). The accepted cumulative dose of ionizing radiation during pregnancy is 5 rad, and no single diagnostic study exceeds this maximum; for example, a fetus would receive a dose of 0.00007 rad from a two-view chest x-ray of a mother (Toppenberg et al. 1999).

Only qualified veterinarians or other personnel with sufficient experience in the technique will be allowed to perform these procedures. Appropriate body position will be maintained for cetaceans handled out of the water. Animals will be monitored for hyper and hypothermia and appropriate measures will be taken to mitigate either condition. Procedures on cetaceans that react negatively to the dental radiographic plate will be discontinued if the plate is not tolerated after three attempts. Other radiographic procedures will be discontinued if animals exhibit excessive stress, pain, or suffering during the procedure.

We do not expect any responses beyond the stress caused by the additional time needed in restraint. Therefore, we do not expect any individuals to experience a loss in fitness as a result of radiography.

Acoustic Sampling

The MMHSRP proposed to evaluate the hearing abilities of individual animals or species. These procedures may be conducted on stranded animals, animals in rehabilitation, or animals captured during studies.

In 2010, the MMHSRP conducted Auditory Evoked Potential (AEP) testing on eight cetaceans: five common dolphins, two Atlantic white-sided dolphins, and one harbor porpoise. Though these species are not threatened or endangered, they provide information on how individuals are likely to respond to AEP. During AEP tests, individuals were continuously provided with thermoregulation, foam padding, and quiet conditions to minimize stress. The behavior of the animals was the same prior to, during, and after the AEP testing. Satellite tagging of two of the tested individuals revealed 100 percent survival.

In 2011, the MMHSRP conducted AEP testing on eight stranded cetaceans: two common dolphins, four Atlantic white-sided dolphins, one bottlenose dolphin, and one harbor porpoise.

Again, individuals were provided with continuous thermoregulation, foam padding, and quiet conditions to minimize stress; and again the behavior of all individuals was consistent before, during, and after the AEP exams. Satellite tagging of two of the tested individuals revealed 100 percent survival. A roto tagged animal restranded several days later, likely due to the same causal factor that resulted in the first stranding.

Though the sample size is small (N = 16) and long-term survival was determined in only four individuals, the AEP testing does not appear to alter the behavior of cetaceans. This is confirmed in the scientific literature. AEP testing was conducted on the following species without any adverse effects: false killer whale (Yuen et al. 2005); killer whale (Szymanski et al. 1998); and beluga whale (Mooney et al. 2008). Therefore, we do not expect fitness reductions in any individual of any species, as a result of this procedure.

The MMHSRP would also use acoustic signals to haze individuals away from dangerous locations or situations. This hazing does not always work, as was the case in which a humpback whale and her calf were observed in an atypical location, 72 nmi inland in the Port of Sacramento, CA (Gulland et al. 2008). In other cases, the hazing accomplishes the objectives. A male humpback in the Sacramento River in 1985 was reported to have moved toward the playback of sounds of foraging humpback whale vocalizations. The different reactions observed in these two situations may reflect individual or sex differences in responses to such playbacks of such sounds as well as differences in ambient noise as the wide repertoire of humpback vocalizations suggests a variety of likely uses for different calls (Dunlop et al. 2007). Observations in Hawaii indicate that male humpback whales move toward playbacks of foraging humpback whale sounds, although females do not, possibly due to sexually active males seeking mates (Mobley et al. 1988). The lack of response of humpback whales to the noise of banging pipes, a method which has been shown to be effective in moving killer whales and dolphins (Gulland et al. 2008), may be due to physiological differences between baleen and odontocete whale hearing (Wartzok & Ketten 1999). Regardless of its effectiveness, acoustic hazing does not appear to cause any long-term adverse effects, such as loss of hearing. Because it is only used to move animals away from danger (i.e., preventing fitness-reducing behaviors), we do not expect any individual to experience a loss in fitness as a result of acoustic hazing.

7.4 Aggregate Effects

In the sections above, we have described each proposed activity and the likely responses of threatened and endangered marine mammals to the stressors caused by that activity. We then asked whether that activity would reduce the fitness of any individual

In reality, most activities would not occur in isolation, but rather, would occur during or in addition to other activities. In some cases, an individual would be exposed to all activities during a single capture event. In other cases, an individual would be exposed to numerous activities throughout a year or over its lifespan.

Here we ask whether and how individuals would respond to the aggregate effects of multiple activities, either conducted during a single capture event, or spread out throughout the year. As described above, capture, restraint, and handling procedures result in the greatest stress response of cetaceans and pinnipeds; once restrained, additional activities (such as tagging or sampling) are only stressful in that they prolong restraint. Therefore, the severity of such a stress response is likely to be directly related to the duration and reoccurrence of the activities.

Together, all proposed activities are likely to increase the duration and intensity of individual stress responses; however, the MMHSRP would mitigate such responses by minimizing the approach or capture of previously approached individuals (identified through tags) and minimizing the duration time spent conducting all activities so that restraint/approach times are minimal. Therefore, we do not expect cumulative impacts of the proposed activities to further reduce the fitness of any individuals.

7.5 Programmatic Analysis

Here, we evaluate the framework of the action and how the Permits Division and MMHSRP (the Program) propose to insure that the issuance and implementation of the Program is not likely to jeopardize the continued existence of ESA-listed species or result in the destruction or adverse modification of designated critical habitat. "Insure" means to make certain especially by taking necessary measures and precautions (Merriam-Webster Dictionary). Generally, we conclude that a program has provided the proper precautions when the steps outlined in the programmatic analysis are mandated to occur and are enforceable if not implemented.

7.5.1 Communication

Has the Federal agency structured the program to identify, inform, encourage, and screen permit applicants for potential eligibility under or participation in the permitting activity?

The Permits Division has explicitly stated in the proposed permit what investigators must do to be eligible for participation, using curriculum vitae to screen for qualifications. The Permit also informs the participants of all activities authorized under the Permit. The MMHSRP in turn has structured their program to screen for qualified participants and to inform the participants of accepted protocols and procedures. All participants must obtain, read, and implement all terms and conditions of the Permit, to receive MMPA and ESA authorization. Participants meet with the MMHSRP on an annual basis to discuss response and research activities, report their takes and findings, and to publish results. Therefore, we conclude that the Permits Division and the MMHSRP have structured the Permit and the Program to identify, inform, encourage and screen participants.

7.5.2 Knowledge of Authorized Individual Activities

Has the Federal agency structured the program to know or be able to reliably estimate the probable number, location, and timing of individual activities?

The main objective of the MMHSRP is to carry out response, rescue, rehabilitation and release of threatened and endangered marine mammals under NMFS jurisdiction. The program cannot predict when or where emergencies may occur, or how many individuals will need care. Similarly, the MMHSRP also conducts health-related, *bona fide* scientific research studies on marine mammals; they often perform these studies opportunistically, so the location and timing of these activities may vary from year to year. Using previous data collected by the MMHSRP, we have estimated the number of individuals likely to be exposed to these activities in the upcoming year (Table 6). In addition, the total number of individuals affected by such studies is limited by the number of take authorized by the Permits Division. In this manner, the Permits Division and the MMHSRP are able to reliably estimate the maximum number of individuals likely to be affected by the proposed action.

7.5.3 Knowledge of Resulting Stressors

Has the Federal agency structured the program to know or reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of activities?

Previous data collected by the MMHSRP and peer-reviewed scientific papers describe the responses of marine mammals to the emergency response procedures and conducting scientific research. We have described these responses in the Effects of the Action section of this biological opinion in narrative form (e.g., emergency responses) and in data summaries (e.g., Table 7). During emergency response procedures, the stressors caused by the activities are predictable (based on experience from previous responses) and expected to be minimal relative to that of the emergency. For example, during disentanglement, an individual may experience a temporary stress response to capture; however, without disentanglement, an individual is likely to drown or become emaciated. The stressors associated with research activities are also well-known (from previous experience with research activities) and include evasion, stress response, and the potential for infection. The results from this research allow the MMHSRP to develop and continually improve mitigation measures to minimize evasive behavior, stress response, and infection potential. Therefore, the Permits Division and the MMHSRP have structured the Permit and the Program to reliably estimate and address the stressors produced as a result of the action.

7.5.4 Minimization of Likely Adverse Effects

Has the Federal agency structured the program to minimize likely adverse effects of such activities on ESA-listed species and designated critical habitat?

During emergency response events, the MMHSRP performs the activities required to remove or reduce danger to an individual. In these endeavors, they strive to minimize additional adverse effects; though, as with the disentanglement example above, improving the overall fitness potential of an individual may occur at the cost of temporary stressors. As described above, every emergency response and research activity provides an opportunity to discover new ways to minimize the stressors, and resulting responses, of the MMHSRP procedures. Examples of mitigation measures that have been implemented include:

- Observing animals from a distance to determine if an emergency response is warranted
- Slow approach of animals requiring emergency response
- Minimization of evasive tagging and sampling techniques
- Sedation of animals prior to euthanasia to minimize suffering
- Minimal and qualified personnel involved in emergency responses and research techniques
- Captive animal trials of all medications, procedures, and instrumentations, when possible
- Conservative dosages of medications when first used on wild animals
- Required compliance with established terms conditions
- Continually revised capture, handling, and restraint procedures to minimize stress and

duration
- Review of all research protocols by Permits Division and MMHSRP
- Annual meetings to discuss activities, responses, and outcomes
- Publication of findings in annual reports, government reports, and peer-reviewed scientific journals

In this manner, the Permits Division and the MMHSRP have structured the program and permit to minimize likely adverse effects on threatened and endangered species.

7.5.5 Monitoring and Evaluation of Adverse Effects

Has the Federal agency structured the program to continuously monitor and evaluate likely adverse effects on ESA-listed species and designated critical habitat?

As described in the Permit, all direct and incidental takes must be recorded and reported to the Permits Division on an annual basis. The MMHSRP monitors the health and disposition of approached, captured, and tagged individuals. Responses to emergency and research procedures are summarized in annual reports and other publications. In this manner the Permits Division and the MMHSRP have structured the Permit and the Program to continuously monitor and evaluate the adverse effects of the proposed action.

7.5.6 Compliance

Has the Federal agency structured the program to encourage, monitor/evaluate, and enforce compliance?

The Permit clearly states the requirements for compliance and the consequences of noncompliance under the ESA and MMPA. The MMHSRP further encourages compliance by establishing a set of accepted protocols for approaching, capturing, handling, and treating marine mammals. The actual activities are monitored, recorded, and reported annually. The annual reports are reviewed by the Permits Division and by the MMHSRP. The Permits Division and MMHSRP requires strict adherence to the Permit terms and conditions, established procedures, and monitoring and reporting requirements. Violators are not allowed to participate further in MMHSRP activities. Every five years (permit duration), the permitted activities are reviewed in an ESA section 7 consultation. Therefore, the Permits Division and MMHSRP have structured the program to encourage, monitor, evaluate, and enforce compliance.

7.5.7 Adaptive Management

Has the Federal agency structured the program to allow them to change it or activities authorized under it, if deemed necessary, to minimize unanticipated impacts on listed species and critical habitat?

The Permit requires that any changes to the Permit (in personnel or activities) be approved by the Chief of the Permits Division. The MMHSRP conducts scientific research to identify the most effective and efficient procedures to use on marine mammals, to minimize the adverse effects caused during emergency responses. Once these activities are established as effective alternatives, the MMHSRP works with the marine mammal community to establish these activities as best management practices. In this manner the agencies have incorporated adaptive management into its action such that unanticipated impacts will be detected and changes can be made to minimize adverse effects.

8.0 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered by this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

During this consultation, we searched for information on future state, tribal, local, or private actions reasonable certain to occur in the action area. We did not find any information other than what has already been described in the Environmental Baseline section, which we expect will continue into the future. Anthropogenic effects include commercial and recreational exploitation, vessel traffic, ocean noise, fisheries interactions, and those from habitat degradation due to pollution, discharged contaminants, and coastal development. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time.

9.0 Integration and Synthesis

The Permits Division proposes to extend for one year the Permit issued to the MMHSRP, which conducts emergency response and scientific research on marine mammals, including those listed as threatened or endangered under the ESA. The Permits Division also proposed to modify the Permit to include radiography activities and to allow take of species listed under the ESA since the original issuance of the Permit. These species include: ringed seal (Arctic DPS), bearded seal (Beringia DPS), Cook Inlet beluga whale, and Hawaiian Insular false killer whale.

As described in the biological opinion on the original permit, we measure risks to listed individuals using changes in the individuals' "fitness" or the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When we do not expect listed animals exposed to an action's effects to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (Anderson 2000, Mills and Beatty 1979, Brandon 1978, Stearns 1977, 1992). As a result, if we conclude that listed animals are *not* likely to experience reductions in their fitness, we would conclude our assessment. We summarize our analyses in Table 9.

Table 9. Summary of stressors, responses, and fitness costs associated with each activity.

Proposed activity	**Expected exposure**	**Stressors**	**Likely response**	**Fitness costs?**	**Population effects?**
Emergency response	165 marine mammals	"Predation", potential for pain, injury, or mortality	Avoidance, stress response	No	No
Aerial survey	21 small cetaceans 100 large whales 142 pinnipeds	Disturbance	Avoidance, submergence	No	No
Vessel survey		Disturbance	Avoidance, submergence	No	No
Close approach		"Predation"	Avoidance, submergence, stress response	No	No
Capture, handling, restraint		"Predation," potential for injury or mortality	Stress response	Possible, but not likely	No
Transport		None	NA	NA	NA
Tagging, instrumentation		Pain, potential for injury, potential for infection, increased drag, potential for entanglement	Temporary behavior changes	No	No
Marking		Disturbance, potential for injury, potential for infection	Avoidance	No	No
Biopsy sampling		Pain, potential for injury, potential for infection	Avoidance, submergence	No	No
Blood sampling		Pain, potential for injury, potential for infection	Increased blood production	No	No
Other sampling		Pain, potential for injury, potential for infection	Disrupted foraging	No	No
Ultrasound		None	NA	NA	NA
Drug administration		Potential for chemical reaction or overdose	Stress response, improved condition	Possible, but not likely	No
Euthanasia		Mortality	Mortality	Yes	No
Radiography		X-ray exposure	None	No	No
Acoustic sampling		Disturbance	Avoidance	No	No
Import/export	None	None	NA	NA	NA
Sample collection, analysis	None	None	NA	NA	NA

The emergency response actions of the MMHSRP entail responses to health emergencies involving marine mammals that were caused by other natural or anthropogenic phenomena, particularly responses to marine mammals that have stranded, have become entangled in fishing and other gear, or otherwise appear to be in distress. During responses to health emergencies, the MMHSRP would be authorized to expose endangered or threatened marine mammals to close approaches, aerial and vessel surveys, disentanglements, capture, restraint, handling, tagging, sample collections that include biopsy samples, anesthesia, sedation, x-ray, treatment, import/export of animals, transport, relocation, rehabilitation, and release on beaches and in coastal waters and waters of the EEZ of the United States, its territories, and possessions, and international waters. The proposed permit would also authorize the MMHSRP to euthanize and unlimited number of endangered and threatened marine mammals on beaches and in coastal waters and waters of the EEZ of the United States, its territories, and possessions.

In those circumstances, we assume the primary stressor facing the animal is that which caused its distress and we assume that if the MMHSRP did not respond to the animal's distress, the animal would die, suffer serious injury or impairment, or other health outcomes that would reduce its longevity or reproductive success. An individual is likely to experience no change or an increase in fitness as a result of the MMHSRP's response to the health emergency.

Based on the data available, we would expect few endangered or threatened marine mammals to be involved in stranding events and require emergency response actions from the MMHSRP, in the next year. If the data available are representative of patterns that might occur in the next year, the majority of stranding events would involve humpback whales, North Atlantic right whales, sei whales, Hawaiian monk seals, and Steller sea lions). It is possible that the activities will also involve the newly listed species of ringed seals, bearded seals, Cook Inlet beluga whales, and Hawaiian Insular false killer whales. We assume that these whales and pinnipeds may represent any age, gender, reproductive condition, or health condition.

The MMHSRP would also conduct prospective health assessment research activities on stranded animals and free-ranging animals that occur in areas with known health concerns or in areas of previous health concerns. Marine mammals that are captured for these health assessments may have visible health problems (for example, skin lesions), they may have been exposed to known toxins, or they may have been exposed to other physical, chemical, or biotic stressors that are known to produce adverse health outcomes in marine mammals.

The proposed permit would authorize representatives of the MMHSRP to behaviorally harass cetaceans during close approaches, aerial and vessel surveys. In the next year, the proposed permit would also authorize representatives of the MMHSRP to tag and collect samples (including biopsy samples and respiratory gases). Because such approaches and sampling are opportunistic, we do not know how many endangered or threatened marine mammals might actually be subjected to one or more of the procedures associated with the prospective health assessments. Although the MMHSRP and the proposed permit have not identified particular endangered or threatened species that might be exposed to one or more of the procedures associated with prospective health assessments, based on the data available, humpback whales and North Atlantic right whales seem most likely to be exposed to those investigations over the next year. The MMHSRP does not seem likely to conduct investigations on blue whales, bowhead whales, or North Pacific right whales over the next year of the proposed permit, although such investigations are possible.

Threatened and endangered cetaceans are likely to respond to response to close approach, capture, sampling, and drug administration with temporary behavior changes that are not likely to result in fitness reductions. Similarly, pinnipeds are likely to respond to close approach, capture, sampling, and treatment with temporary behavior changes that are not likely to result in fitness reductions. The MMHSRP would try to avoid Steller sea lion (western population) critical habitat; however, if an emergency response required aerial or vessels surveys in critical habitat, the MMHSRP would take great care to avoid causing a stampede by keeping maximum altitude or distance, using slow approaches, and minimizing the duration of such activities. Euthanasia of marine mammals is likely to result in the death of moribund individuals, to reduce their suffering; because these individuals exhibit irreversibly poor condition (i.e., effective fitness approaches zero), their loss is not likely to reduce the viability of a population. Therefore, we conclude that the activities proposed by the MMHSRP are not likely to reduce the fitness of any individual, reduce the viability of any population, or reduce the conservation value of any designated critical habitat.

10.0 Conclusion

After reviewing the current status of the ringed seal (Arctic DPS), bearded seal (Beringia DPS), Cook Inlet beluga whale, Hawaiian Insular false killer whale, Guadalupe fur seal, Steller sea lion (western population), Hawaiian monk seal, blue whale, bowhead whale, fin whale, humpback whale, killer whale (southern resident population), right whale (North Atlantic), right whale (North Pacific), sei whale, and sperm whale, the environmental baseline for the action area, the effects of the proposed research programs, and the cumulative effects, it is our biological opinion that the Permit Division's issuance of the amended and extended ESA and MMPA permit to the MMHSRP and the MMHSRP's implementation of emergency response and research activities are not likely to jeopardize the continued existence of the ringed seal (Arctic DPS), bearded seal (Beringia DPS), Cook Inlet beluga whale, Hawaiian Insular false killer whale, Guadalupe fur seal, Steller sea lion (western population), Hawaiian monk seal, blue whale, bowhead whale, fin whale, humpback whale, killer whale (southern resident population), right whale (North Atlantic), right whale (North Pacific), sei whale, and sperm whale. After reviewing the current status of Steller sea lion (western population) critical habitat and the effects of the proposed activities, it is our biological opinion that the Permit Division's issuance of the amended and extended ESA and MMPA permit to the MMHSRP and the MMHSRP's implementation of emergency response and research activities are not likely to adversely modify or destroy Steller sea lion (western population) critical habitat.

The Permit Division's issuance and the MMHSRP's implmentation of the amended and extended ESA and MMPA permit is not likely to adversely affect any threatened and endangered sea turtle species. Their actions are not likely to adversely affect the designated critical habitat of the North Atlantic right whale, North Pacific right whale, Cook Inlet beluga whale, or southern resident killer whale.

11.0 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

However, as discussed in the accompanying biological opinion, any "take" associated with the proposed permit is part of the intended purpose of the activities that would be authorized by the permit and, therefore, is not incidental take. Therefore, we do not anticipate the proposed action will incidentally take any threatened or endangered species.

12.0 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Permits Division and MMHSRP are conducting the proposed activities to respond to marine mammal health and stranding emergencies and performing scientific research to identify more productive and effective means of doing so. We do not have any conservation recommendations at this time.

13.0 Reintiation Notice

This concludes formal consultation and conference on the actions. As described in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of take is exceeded, any operations causing such take must cease pending reinitiation.

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