NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title: Biological Opinion on the Issuance of Permit No. 14534 for Scientific Research on Marine Mammals in Pacific Ocean

Action Agency: Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service

Consultation Conducted By: Endangered Species Division, Office of Protected Resources, National Marine Fisheries Services

Consultation Tracking number: FPR-2010-169

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NOAA's National Marine Fisheries Service
Endangered Species Act Section 7 Consultation

Biological Opinion

Agency: Permits, Conservation and Education Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service

Activity Considered: The NMFS Office of Protected Resources - Permits, Conservation and Education Division's proposal to issue permit No. 14534 to Ned Cyr of NMFS Office of Science and Technology, for research on Pacific Marine Mammals in the U.S. Navy's Southern California (SOCAL) Range Complex, other US locations including offshore waters and international waters throughout the Pacific basin.

Consultation Conducted by: Endangered Species Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service

Approved by: [signature] for J.H. Lecky

Date: July 2, 2010

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq.*) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency 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 of such species. When a federal agency's action "may affect" listed species or critical habitat that has been designated for them, that agency is required to consult formally with either NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending upon the listed resources that may be affected. Federal agencies are exempt from this requirement if they have concluded that an action "may affect," but is "unlikely to adversely affect" listed species or designated critical habitat, and NMFS or USFWS conclude with that conclusion (50 CFR 402.14[b]).

For the actions described in this document, the action agency is NMFS' Office of Protected Resources – Permits, Conservation and Education Division. The consulting agency is NMFS' Office of Protected Resources – Endangered Species Division. pursuant to the Marine Mammal Protection Act (MMPA), NMFS' Office of Protected Resources – Permits, Conservation and Education Division proposes to issue a permit for direct "takes" of endangered sperm (*Physeter macrocephalus*), blue (*Balaenoptera musculus*) and fin whales (*Balaenoptera physalus*) within the U.S. Navy's existing Southern California (SOCAL) Range Complex, other US locations including offshore waters and international waters throughout the Pacific basin. This permit would also authorize "takes" of nontarget endangered humpback (*Megaptera novaeangliae*) and sei whales (*Balaenoptera borealis*) as well as threatened Guadalupe fur seals (*Macrocephalus townsendi*) pursuant to the MMPA and the Endangered Species Act (ESA). This ESA Section 7 consultation (Opinion) considers the effects of the proposed studies on endangered and threatened species and designated critical habitat.

Consultation History

On December 30, 2009, NMFS Permits, Conservation and Education Division requested consultation with NMFS Office of Protected Resources – Endangered Species Division on the proposal to issue Permit No. 14534 to Ned Cyr of NMFS Office of Science and Technology, for research on whales within Southern California offshore waters primarily in the U.S. Navy's Southern California Range Complex and the U.S. Navy Hawaii Range Complex. A draft Environmental Assessment was submitted with this request.

On February 1, 2010, NMFS Office of Protected Resources – Endangered Species Division initiated formal consultation on this proposed action.

On March 10, 2010 a revised application was submitted (75 FR 1131) and formal consultation was suspended. The revised application: (1) increased the number of Risso's (*Grampus griseus*), bottlenose (*Tursiops truncatus*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and northern elephant seals (*Mirounga angustirostris*) that may be harassed; (2) increased the number of requested ``tagless" playbacks for some cetacean species, such as blue (*Balaenoptera musculus*) and fin whales (*B. physalus*) and the social pelagic delphinids; (3) modified the proposed action area slightly northward to 35º N; and (4) clarified tagging and playback protocols and mitigation for when dependent calves are present.

On April 20, 2010, the public comment period ended for this revised application, and no changes to the proposed action were made. Consultation resumed at this time.

BIOLOGICAL OPINION

Description of the Proposed Action

NMFS proposes to issue a permit for research on marine mammals, pursuant to the MMPA, as amended (MMPA, 16 U.S.C. 1361). The permit would exempt the applicant from the MMPA's and ESA's prohibition against activities that may result in "takes" of endangered blue, fin, sperm, humpback and sei whales, as well as threatened Guadalupe fur seals. "Take" is defined by the ESA 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 NMFS 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. The proposed permit would last for five years.

The proposed permit would authorize a multi-stimulus behavioral response study (BRS) which would document the responses of several marine mammal species when exposed to underwater natural noises, novel synthetic noises and simulated mid-frequency (MF) sonar noises. Target animals are also proposed to be photographed, tagged and have sloughed skin samples collected.

The primary target species are nonlisted beaked whales. However, if beaked whales are not available, other marine mammals, including listed species, would be targeted. Phase I of this study is proposed to be conducted in summer 2010 in Southern California offshore waters primarily in the U.S. Navy's Southern California (SOCAL) Range Complex (Figure 1). Here, target species can be monitored using existing US Navy seafloor underwater tracking range hydrophones. These tracking ranges include the deepwater Southern California Anti Submarine Warfare Range (SOAR) that is located offshore to the west of San Clemente Island and the San Clemente Island Underwater Range located northeast of San Clemente Island. Later phases of this research are planned for the U.S. Navy Hawaii Range Complex (HRC) and other locations in the southern California Pacific Ocean in addition to the SOCAL Range Complex. These activities are not proposed to occur during any active U.S. Navy operations. **Table 1** identifies the number of disturbance events to which listed species are proposed to be exposed annually as authorized by the proposed permit. Animals are proposed to be taken via close approaches, tagging and noise playback experiments as described below.

Table 1. Proposed "Takes" to Listed Species from the Proposed Activities.

Species & Listing Unit or Stock	Lifestage and Sex	No. Animals per Year/ Total for Permit	Procedures
Sperm whale	All; Both Sexes	10 / 50	Harassment from acoustic sonar for prey mapping
Sperm whale	Non-neonate; Both Sexes	80 / 400	Harassment from acoustic, active playback/broadcast; acoustic, passive recording; observations, behavioral; photos
Sperm whale	All; Both Sexes	86 / 430	Harassment from acoustic, passive recording; observations, behavioral; photos
Sperm whale	Adult/ Juvenile; Both Sexes	20 / 100	Harassment from acoustic, active playback/broadcast; acoustic, passive recording; instrument, suction-cup tags; observations, behavioral; photos
Sperm whale	Adult/ Juvenile; Both Sexes	40 / 200	Harassment from acoustic, passive recording; Instrument, suction-cup tags; observations, behavioral; photos

Species & Listing Unit or Stock	Lifestage and Sex	No. Animals per Year/ Total for Permit	Procedures
Sperm whale	Adult/ Juvenile; Both Sexes	60 / 300	Harassment from collection, sloughed skin
Humpback Whale	All; Both Sexes	2/10	Harassment from acoustic active playback/broadcast, acoustic sonar for prey mapping
Blue whale	All; Both Sexes	228 / 1140	Harassment from acoustic, passive recording; observations, behavioral; photos
Blue whale	Adult/ Juvenile; Both Sexes	100 / 500	Harassment from collection of sloughed skin
Blue whale	Adult/ Juvenile; Both Sexes	20 / 100	Harassment from acoustic, active playback/broadcast; acoustic, passive recording; instrument, suction-cup tags; observations, behavioral; photos
Blue whale	Adult/ Juvenile; Both Sexes	80 / 400	Harassment from acoustic, passive recording; instrument, suction-cup tags; observations, behavioral; Photos
Blue whale	All; Both Sexes	4 / 20	Harassment from acoustic, active playback broadcast, acoustic sonar for prey mapping
Blue whale	Non-neonate; Both Sexes	20 / 100	Harassment from acoustic, active playback/broadcast; acoustic, passive recording; observations, behavioral; photos
Sei whale	All; Both Sexes	6 / 30	Harassment from acoustic active playback/broadcast, acoustic sonar for prey mapping
Fin whale	All; Both Sexes	342 / 1710	Harassment from acoustic, passive recording; observations, behavioral; Photos
Fin whale	Adult/ Juvenile; Both Sexes	20 / 100	Harassment from acoustic, active playback/broadcast; acoustic, passive recording; instrument, suction-cup tags; observations, behavioral; photos

Species & Listing Unit or Stock	Lifestage and Sex	No. Animals per Year/ Total for Permit	Procedures
Fin whale	Adult/ Juvenile; Both Sexes	80 / 400	Harassment from acoustic, passive recording; Instrument, suction-cup tags; observations, behavioral; Photos
Fin whale	Adult/ Juvenile; Both Sexes	100 / 500	Harassment from collection of sloughed skin
Fin whale	All; Both Sexes	6 / 30	Harassment from acoustic, active playback broadcast, acoustic sonar for prey mapping
Fin whale	Non-neonate; Both Sexes	40 / 200	Harassment from acoustic, active playback/broadcast; acoustic, passive recording; observations, behavioral; photos
Guadalupe fur seal	All, Both Sexes	5 / 25	Harassment from acoustic, active playback/broadcast; acoustic, passive recording; whale observations, behavioral; photos; collection of sloughed whale skin/mucous; acoustic sonar for prey mapping

<u>Vessels</u>
Three types of vessels are proposed to be used for tag attachment, whale observation and sound playbacks.

Tag Attachment Vessels

Tag attachment vessels are small maneuverable vessels for tag attachment. They are typically 3-5m Rigid Hulled Inflatable Boats (RHIBs).

Whale Observation Vessels

Whale observation vessels are larger vessels with adequate height capabilities for antenna placement and for visual mammal observations, silent propulsion and ability to deploy a hydrophone array, capabilities to deploy tag attachment vessels and cabin and bunk space for tagging team, visual monitors, and a crew of acoustic monitors. Marine mammal interactions with the whale observation vessels are not likely because observers on these research vessels are constantly and purposely on the lookout for these animals.

Playback Vessels

The playback vessel would be used to deploy the sound sources and transmit the experimental playback noises. It must have suitable deck, and laboratory space for the source equipment and for sound generation electronics. One critical component of the playback experiments involves the accurate assessment of range from the playback source to the focal animal. The researchers would use laser range-finding binoculars or measure the angle between a surfacing animal and the horizon to calculate range for animals visually sighted at the sea surface. This vessel would have a relatively quiet propulsion system to minimize potentially confounding vessel noise. Playback vessels will have observers onboard to site and avoid marine mammals.

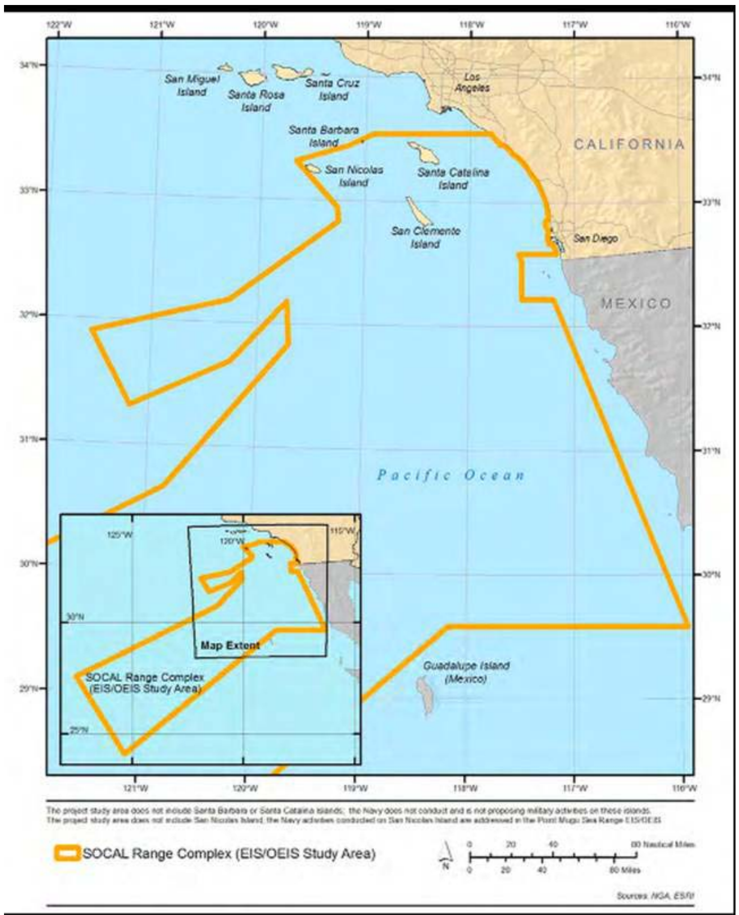

Figure 1. SOCAL Range Complex (DON, 2008)

<u>Passive Acoustic Monitoring and Focal Follows</u>

Real time passive acoustic monitoring is proposed to be undertaken partly by using existing US Navy hydrophones to locate and monitor target marine mammals in the action area. Passive acoustic monitoring equipment will also be deployed from vessels and are proposed to include towed linear arrays of hydrophones, single hydrophones, compact 4-hydrophone bearing arrays, and regular or broadband sono-buoys. Once animals have been detected, investigators may begin closely pursuing target animals. These close pursuits directed at single target animals are known as focal follows. Focal follows are defined as the close and targeted prolonged approach and pursuit of individual animals or groups of individuals.

Close Approaches

An "approach" is defined as a continuous sequence of maneuvers (including drifting) involving a vessel directed toward a cetacean or group of cetaceans closer than 100 yards. “Close approaches” are defined as “a continuous sequence of maneuvers involving a vessel, aircraft, or researcher's body in the water, including drifting, directed toward a cetacean or group of cetaceans for the purposes of conducting authorized research, [including approaches to <10-15 m to allow for tag attachment and/or photo-identification], which involves one or more instances of coming closer than 100 yards to the cetacean or group of cetaceans.” Close approaches are proposed to be made within <10 m to allow for photographs to be taken and for the attachment of tags. These close approaches are proposed to be done slowly, deliberately, and for as short a time as necessary to complete photographing and tagging activities.

Tagging and Sloughed Skin Collection

Target animals are proposed to be fitted with the latest version of digital archival recording tags (DTAG2s) to measure received sound exposure, animal vocalizations, behavior and physiology. They include sensors that record pressure, pitch, roll, heading, surfacing events, and ambient temperature. The DTAG2 is a high data rate recording tag and is designed to be attached to an animal for relatively short periods of time (~ 5-18 hr). The tags are attached in a non-invasive manner by the use of 4-60 mm diameter suction cups made from medical grade silicone. Suction cups are disinfected prior to attachment to avoid possible infection or disease transfer. The dimensions of the tags are approximately 11 cm x 4 cm x 2 cm for the tag itself, and 20 cm x 10 cm x 4 cm for the tag in its fairing housing (used to reduce drag). The tag is slightly positively buoyant to allow for retrieval after detachment from the target animal. The DTAG2s include a GPS sensor that tracks the location of the tagged whales so that vessels do not have to follow the animals continuously.

Bio-acoustic probe tags (BProbes) are also proposed to be attached to target animals. BProbes are electronic data-logging tags that record calibrated acoustic pressure, temperature, depth, acceleration, and body orientation of the tagged animal (see Goldbogen et al., 2006). The use of these probes will allow for 3-D tracking of target animals relative to the passing research boat. BProbes tags are approximately 33 cm long and 6 cm in diameter[1.] They are equipped with a flotation device and VHF transmitter to allow for recovery after detachment from the whale (Burgess et al., 1998). Attachment of the BProbes will be via suction cups similar to those proposed for the DTAG2s.

All tags are proposed to be attached by using a hand-held carbon fiber pole several meters in length from 3-5m vessels or by using a >12m cantilevered pole deployed from a medium sized RHIB.

Fragments of sloughed skin, which often remain attached to retrieved tag suction cups, would be collected and used for genetic analyses.

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[1] Scripps Institute Whale Acoustics Laboratory: http://cetus.ucsd.edu/technologies_AcousticTag.html

Playbacks

After the baseline behavior of target animals has been observed and recorded, playback experiments are proposed. These experiments would project a variety of natural (e.g. killer whale) and manmade (e.g. simulated military active mid-frequency sonar) noises. These playbacks are proposed to be conducted by using an underwater speaker deployed from a boat. Synthetic mid-frequency noises simulating sonar or pseudorandom sounds would be between 1.5 and 5 kHz and are proposed be 0.5-5 seconds in length, transmitted every 20-60 seconds. Simulated killer whale vocalizations may be transmitted over a larger bandwidth (1-20 kHz) for up to 30 minutes.

The proposed playbacks may be broadcast either from a stationary source of sound or from vessels following the target animal. Investigators will attempt to keep vessels a minimum of 200m from target animals to reduce any disturbance they may cause.

Before starting each playback, the distance to the target animal will be estimated by using passive acoustic monitoring or visual observations. Noises will be emitted from an underwater speaker with a maximum source level of 220 dB in order to reduce the maximum received level at the target animal to 180 dB or less. This level is intended to be set well below noise levels that might cause injury. All reasonable precautions are to be taken to control the source level including a mandatory shut down of source transmissions if the target animal, or any other marine mammal, is observed to be within 200m of the sound source. Each playback sequence will start with a source level well below the maximum. The noise level will then be gradually increased while responses are monitored until either a response is observed or the maximum planned exposure is reached. After the playback has been completed, either the playback vessel or a different tracking vessel will follow the target whale and any post exposure responses will be observed and recorded.

The mid-frequency sound source proposed to be employed is constructed by the NATO Undersea Research Centre and consists of 3 ceramic free flooded ring transducers co-axially mounted on a central stainless steel air-filled cylinder. A fiberglass tow-body provides towing stability and allows for towing at speeds of up to 7 knots at depths of up to 180 m. This source operates relatively omnidirectionally with the capability to direct sound energy downwards towards the target animal which would reduce exposures to nontarget species. The source is capable of a maximum source level of 219 dB operating at 2 kHz, and operates in the 1.5-5 kHz frequency range for optimal performance.

Other sound sources are also proposed for playback experiments. The Lubell LL9642T Underwater Acoustic Transducer may be used for relatively low-level broad band playbacks of simulated killer whale calls. This instrument is designed for general scientific applications. It has a wide output frequency range of 250Hz-20 kHz and a sound pressure level of 183 dB at 1 kHz, and 193dB at 10kHz. The operating depth is up to ~15m.

Broad band playbacks of odontocete vocalizations are proposed to be conducted with a J-9 transducer transmitting between 40 Hz to 20 kHz. It will be focused at the 40-80 kHz range where most odontocetes hear and vocalize. The LL-1424HP underwater acoustic transducer will be used when higher source levels at smaller frequency bands are desired. The LL-1424HP has a useful frequency range of 200Hz-9 kHz and a maximum sound pressure level of 197 dB. It operates at depths from ~2 to 15 m.

The synthetic mid-frequency noises simulating sonar-like or pseudorandom sounds are proposed be 0.5-5 seconds in length transmitted every 20-60 seconds. Killer whale signals may be transmitted over a larger bandwidth (1-20 kHz) at a low duty cycle for up to 30 minutes. These noises will be ramped up from 160 dB to the maximum source level planned for transmitting. For animals that are vocalizing or clicking while diving, the maximum source level will depend on what level the target whale responds in a salient, identifiable manner. The playbacks would be stopped if any moderate to strong adverse behavioral responses are observed. Moderate reactions, as classified by Weinrich et al. (1992), are those where the animal modifies its behavior in a moderately forceful manner (e.g. trumpet blows, hard tail flicks etc.), but give no prolonged evidence of behavioral disturbance. Strong reactions are those where the animal modifies its behavior to a succession of forceful activities (e.g. continuous surges, tail slashes, numerous trumpet blows etc) (Weinrich et al., 1992).

Active Acoustics for Prey Mapping

The investigators also propose to use Simrad EY500 split-beam echosounders with sources operating at 38 kHz, 70 kHz, or 120 kHz to map target species' prey. The echosounders have a sound pressure level at 38 kHz of 183 dB. The maximum source is estimated to be 202 dB. The duration of pulses is typically less than 1 msec.

Mitigation Measures

The research project is designed to minimize the potential of any stress, pain or suffering. The following components reflect this design:

1. Small (3-5 m), relatively quiet boats will be used to minimize disturbance.

2. Each close approach will last a few minutes, and individuals will not be approached more than three times a day.

3. Close approaches are proposed to be done slowly, deliberately, and for as short a time as necessary to complete photographing and tagging activities.

4. If an animal shows a strong attempt to avoid the approaching tagging vessel, or shows a moderate or strong reaction (as classified by Weinrich et al., 1992), investigators will cease the approach and select a different subject.

    - **Moderate reaction** The animal modified its behavior in a more forceful manner (trumpet blows, hard tail flicks), but gave no prolonged evidence of behavioraldisturbance.

    - **Strong reaction** The animal modified its behavior to a succession of forceful activities continuous surges, tail slashes, numerous trumpet blows).

5. Investigators will cease their attempts after three unsuccessful close approaches to an animal for tag attachment and select a different subject for tagging.

6. Tags would be attached to the animal using suction-cups, which are temporary and non-invasive.

7. Suction cups made from medical grade silicone and are disinfected prior to attachment to avoid possible infection or disease transfer.

8. Tags are designed to dislodge easily via rapid movements if they were to irritate target animals.

9. Investigators will compare the movements and vocal behavior of whales exposed to playbacks to silent control baseline conditions. This comparison will be used to help establish the minimum exposures necessary to produce detectable reactions.

10. Playbacks are designed to avoid sound levels that could cause hearing damage. The maximum received level of 180 dB would be used for playback signals (after Southall et al., 2007).

11. Exposure of animals to playbacks would be limited to the shortest duration required to elicit identifiable behavioral reactions.

12. The playback subjects will be followed after exposure to monitor for their return to baseline behavior. The playback protocol will be modified if there is any evidence of longer term changes.

13. A margin of error for safety will be added to account for the possibility that the acoustic models used to predict received level at the animal are not always correct. This margin of error will be determined and validated by comparing estimated levels to received levels measured during the course of the playback experiments.

14. If there is any sign of prolonged responses that might pose a risk of injury (e.g., panicked flight toward shallow water), playbacks will be suspended and investigators will communicate with NMFS Office of Protected Resources to develop a protocol to ensure that future playbacks would limit exposure to levels below those likely to expose animals to any such risk.

Permit 14534 includes terms and conditions that limit the research activities, specifies the number and kinds of species that can be taken, and specifies the location and manner of taking. Some of these terms and conditions are as follows:

1. Researchers must suspend all permitted activities in the event serious injury or mortality[2] of protected species occurs. The Permit Holder must contact the Chief, NMFS Permits, Conservation and Education Division (hereinafter "Permits Division") by phone within two business days. The Permit Holder must also submit a written incident report as described in Condition E.2. 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 this permit.

2. If authorized take is exceeded, Researchers must cease all permitted activities and notify the Chief, NMFS Permits, Conservation and Education Division (hereinafter "Permits Division") by phone as soon as possible, but no later than within two business days. The Permit Holder must also submit a written incident report as described in Condition E.2. 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 this permit.

3. Researchers must exercise caution when approaching animals and must retreat from animals if behaviors indicate the approach may be life threatening.

4. Researchers must not attempt to tag any cetacean calf less than 1 year old or female accompanied by a calf less than 1 year old.

5. Researchers shall consider a marine mammal to have been taken if:

   (i) during a tag attachment attempt, the animal is approached within 100 m; the instrument (i.e., tag package) misses (does not make contact); the instrument contacts the animal but does not successfully attach; or the instrument attaches to the animal, regardless of duration of attachment.

   (ii). during close approach, for photo-identification, or focal follows, an animal is approached within 100 m, regardless of whether the animal exhibits behaviors indicative of harassment.

   (iii). the animal is exposed to a playback.

6. No individual animal may be taken more than 6 times in one day by any combination of tag attachment, focal follow, or photo-identification activities and more than 2 times in one day by intentional exposure to playbacks.

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2 This permit does not allow for unintentional serious injury and mortality caused by the presence or actions of researchers. This includes, but is not limited to; deaths of dependant 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.

7. A tag attachment attempt must be discontinued if an animal exhibits a strong adverse reaction to the activity or the vessel (*e.g.*, breaching, tail lobbing, underwater exhalation, or disassociation from the group).

8. A playback episode must be discontinued if an animal exhibits a strong adverse reaction to the playback activity or the vessel (*e.g.*, breaching, tail lobbing, underwater exhalation, or disassociation from the group).

Approach to the Assessment

NMFS approaches its section 7 analyses of agency actions through a series of steps. The first step identifies those aspects of proposed actions that are likely to have direct and indirect physical, chemical, and biotic effects on listed species or on the physical, chemical, and biotic environment of an action area. As part of this step, we identify the spatial extent of these direct and indirect effects, including changes in that spatial extent over time. The result of this step includes defining the *Action Area* for the consultation. The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure (these represent our *Response Analyses*).

The final steps of our analyses – establishing the risks those responses pose to listed resources – are different for listed species and designated critical habitat (these represent our *Risk Analyses*). Our jeopardy determinations must be based on an action's effects on the continued existence of threatened or endangered species as those "species" have been listed, which can include true biological species, subspecies, Evolutionarily Significant Units (ESUs) or Distinct Population Segments (DPSs) of species. The continued existence of these "species" depends on the fate of the populations that comprise them. Similarly, the continued existence of populations are determined by the fate of the individuals that comprise them – populations grow or decline as the individuals that comprise the population live, die, grow, mature, migrate, and reproduce (or fail to do so).

Our risk analyses reflect these relationships between listed species, the populations that comprise that species, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise.

We measure risks to listed individuals using the individuals' "fitness," or the individual's growth, survival, annual reproductive success, and lifetime reproductive success. In particular, we examine the scientific and commercial data available to determine if an individual's probable lethal, sub-lethal, or behavioral responses to an action's effect on the environment (which we identify during our response analyses) are likely to have consequences for the individual's fitness.

When individual, listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions are likely to reduce the abundance, reproduction, or growth rates (or increase the variance in these measures) of the populations those individuals represent (see Stearns, 1992). Reductions in at least one of these variables (or one of the variables we derive from them) is a *necessary* condition for reductions in a population's viability, which is itself a *necessary* condition for reductions in a species' viability. As a result, when listed plants or animals exposed to an action's effects are *not* expected 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 (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). As a result, if we conclude that listed plants or animals are *not* likely to experience reductions in their fitness, we would conclude our assessment.

Although reductions in fitness of individuals is a *necessary* condition for reductions in a population's viability, reducing the fitness of individuals in a population is not always *sufficient* to reduce the viability of the population(s) those individuals represent. Therefore, if we conclude that listed plants or animals are likely to experience reductions in their fitness, we determine whether those fitness reductions are likely to reduce the viability of the populations the individuals represent (measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, variance in these measures, or measures of extinction risk). In this step of our analyses, we use the population's base condition (established in the *Environmental Baseline* and *Status of listed Resources* sections of this Opinion) as our point of reference. If we conclude that reductions in individual fitness are not likely to reduce the viability of the populations those individuals represent, we would conclude our assessment.

Reducing the viability of a population is not always *sufficient* to reduce the viability of the species those populations comprise. Therefore, in the final step of our analyses, we determine if reductions in a population's viability are likely to reduce the viability of the species those populations comprise using changes in a species' reproduction, numbers, distribution, estimates of extinction risk, or probability of being conserved. In this step of our analyses, we use the species' status (established in the *Status of the Species* section of this Opinion) as our point of reference. Our final determinations are based on whether threatened or endangered species are likely to experience reductions in their viability and whether such reductions are likely to be appreciable.

To conduct these analyses, we rely on all of the evidence available to us. This evidence might consist of monitoring reports submitted by past and present permit holders, reports from NMFS Science Centers, reports prepared by State or Tribal natural resource agencies, reports from non-governmental organizations involved in marine conservation issues, the information provided by the Permits, Conservation and Education Division when it initiates formal consultation and the general scientific literature. We supplement this evidence with reports and other documents – environmental assessments, environmental impact statements, and monitoring reports – prepared by other federal and state agencies such as the Minerals Management Service, U.S. Coast Guard and U.S. Navy whose operations extend into the marine environment.

During the consultation, we conducted searches of peer reviewed scientific literature, master's theses, doctoral dissertations, government reports and commercial studies. These searches included the use of literature search engines such as *Science Direct, Ingenta Connect, JSTOR,* and *Google Scholar* as well as the use of NOAA and university libraries. These searches focused on identifying recent information on the biology, ecology, distribution, status, and trends of the threatened and endangered species considered in this opinion. We considered the results of these searches based on the quality of their study design, sample sizes and study results.

<u>Action Area</u>
The action area consists of Southern California offshore waters primarily in the U.S. Navy's SOCAL Range Complex (Figure 1). Later phases of this research are planned for the HRC and other locations in the southern California Pacific Ocean.

Exposure Analysis

Exposure analyses identify the co-occurrence of ESA-listed species within the action's effects in space and time, and identify the nature of that co-occurrence. They identify as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent.

The proposed permit would authorize a study of the responses of several marine mammal species when exposed to controlled underwater natural noises, novel synthetic noises and simulated MF sonar noises. Target animals are also proposed to be photographed, tagged and have sloughed skin samples collected. Whales, including listed species, would be targeted. Listed nontarget marine mammals may be exposed.

<u>Species and Critical Habitat that may be Adversely Affected</u>
NMFS has determined that the actions considered in this Opinion may affect the following listed resources provided protection under the endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.; ESA):

Mammals		
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered

Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Guadalupe fur seal	*Arctocephalus townsendi*	Threatened
Reptiles		
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley turtle	*Lepidochelys kempii*	Endangered
Leatherback turtle	*Dermochelys coriacea*	Endangered
Loggerhead turtle	*Caretta caretta*	Threatened
Fish		
Southern DPS Green sturgeon	*Acipenser medirostris*	Threatened
Chinook salmon	*Oncorhynchus tshawytscha*	
(California coastal ESU		
(Central Valley spring-run ESU		
(Lower Columbia River ESU)		Threatened
(Upper Columbia River spring-run ESU)		Endangered
(Puget Sound ESU)		Threatened
(Sacramento River winter-run ESU)		Endangered
(Snake River fall-run ESU)		Threatened
(Snake River spring/summer-run ESU)		Threatened
(Upper Willamette River ESU)		Threatened
Coho Salmon	*Oncorhynchus kisutch*	
(Central CA Coast ESU)		Endangered
(Southern OR/Northern CA Coast ESU)		Threatened
(Lower Columbia River ESU)		Threatened
(Oregon Coast ESU)		Threatened
Steelhead trout	*Oncorhynchus mykiss*	
(Puget Sound ESU)		
(Central California coast ESU)		Threatened
(Snake River Basin ESU)		Threatened
(Upper Columbia River ESU)		Endangered
(Southern California ESU)		Endangered
(Middle Columbia River ESU)		Threatened
(Lower Columbia River ESU)		Threatened
(Upper Willamette River ESU)		Threatened
(Northern California ESU)		Threatened
(South-Central California coast ESU)		Threatened
(California Central Valley ESU)		Threatened
Invertebrates		
Black abalone	*Haliotis cracherodii*	Endangered
White abalone	*Haliotis sorenseni*	Endangered

Species and Critical Habitat Not Likely to be Adversely Affected

Sea Turtles

Green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles may be present in the action area during the proposed activities. Studies of green and loggerhead sea turtles demonstrate that these species are sensitive to sounds at low frequencies with a maximum efficiency at about 250 to 700 Hz (Ridgeway et al., 1969; Lenhardt et al., 1983; Lenhardt et al., 1985; Bartol et al., 1999). Bartol and Ketten (2006) measured the auditory responses of green and Kemp's ridley -a congener of Olive Ridley- sea turtles and found their hearing to be in a similar range of 100 to 500 Hz with their most sensitive hearing between 100 – 200 Hz. While the hearing ability and sensitivity for leatherback and hawksbill sea turtles is largely unknown, these species share a similar auditory anatomy. It is therefore reasonable to assume that they have similar hearing ranges.

Because these activities are targeted specifically to marine mammals and because the sounds of the proposed playback and prey mapping activities are at frequencies much higher than the hearing ranges of sea turtles, it is extremely unlikely that noise from these proposed actions will affect sea turtles. In addition, the small sizes, slow operating speeds and maneuverability of the boats proposed to be used, any potential ship strikes to sea turtles are also extremely unlikely. The proposed activities are thus not likely to adversely affect marine turtles. These species are therefore not considered in this consultation.

Marine and Anadromous Fish

Listed Pacific salmon (*Oncorhynchus spp.*) and green sturgeon (*Acipenser medirostris*) may occur in the action area. However, because of the small sizes, slow operating speeds and maneuverability of the boats proposed to be used, the proposed vessel activities should not negatively impact any listed fish species from ship activities.

Proposed audio playback and prey survey activities are unlikely to affect listed fish species because the frequencies used in these activities are over an order of magnitude higher than the optimal hearing range for many anadromous fish (Hawkins & Johnstone, 1978). The proposed activities are therefore not likely to adversely affect listed fish species. These species are therefore not considered in this consultation.

Marine Invertebrates

Listed white and black abalone (*Haliotis spp.*) may occur in the action area. Because of the small sizes and the corresponding low draft and maneuverability of the boats proposed to be used, the proposed activities should not affect the benthic habitat where these species are found. The proposed audio playback and prey survey activities are also not likely to affect listed invertebrate species. These species are therefore not considered in this consultation.

Critical habitat

The proposed activities may occur within the critical habitat of the listed steelhead trout. The areas designated for this species includes multiple riverine and nearshore marine areas along the U.S. west coast[3]. The Primary Constituent Elements (PCEs) for Pacific salmon species include adequate spawning sites, food resources, water quality and quantity and riparian vegetation. The proposed activities involve audio playbacks and vessel based survey and monitoring activities. No effects are expected to spawning sites, food resources, water quality and quantity and riparian vegetation. These actions should therefore have no effect on any listed species' PCEs and therefore have no effect on the conservation value of any species' critical habitat. The proposed activities are not likely to destroy or adversely modify the critical habitat of any listed species. Critical habitat will therefore not be considered in this consultation.

<u>Species Likely to be Adversely Affected</u>

NMFS has determined that the actions considered in this Opinion are likely to adversely affect the following listed resources provided protection under the endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.; ESA):

Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Guadalupe fur seal	*Arctocephalus townsendi*	Threatened

The biology and ecology of these species are described in the *Species Descriptions* Section below, and will contribute to the effects analysis for this Opinion.

Species Descriptions

<u>Sperm Whale</u>

Species Description and Distribution

Sperm whales are a cosmopolitan species. In the North Pacific, they are widely distributed but are mostly found south of 40º N in winter (Rice, 1974; Gosho et al., 1984). Mature females and juveniles occupy temperate and tropical areas throughout the year and are joined by adult males in the winter (Reeves and Whitehead., 1997). Most males migrate north in summer to the waters of the Aleutian Islands, Gulf of Alaska, and the Bering Sea, with some animals remaining at northern latitudes throughout the year (Mellinger et al., 2004). Sperm whales are found year-round in waters off of California (Dohl et al., 1983; Barlow, 1995; Forney et al., 1995), and reach peak abundance there from April through June and from the end of August through mid-November (Rice, 1974). Sperm whales have been observed to occupy Washington and Oregon waters in all seasons except winter (Green et al., 1992). Sperm whales occupy Hawaiian waters

[3] See for details: http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm

throughout the year and are the most abundant large whale in these waters (Shallenberger et al., 1981; Lee, 1993; Mobley et al., 2000).

In the North Atlantic, the IWC recognizes one sperm whale population (Donovan, 1991). However, NMFS stock assessment reports describe a northern Gulf of Mexico stock and a western North Atlantic stock (Waring et al., 2008). In the western North Atlantic, concentrations of female and immature groups are found in the Caribbean Sea and south of New England along the eastern coast of the United States (Perry et al., 1999a). The northern distributional limit of female and juvenile groupings is likely around Georges Bank or the Nova Scotia shelf. Sperm whales primarily occur in waters off the east coast of the U.S. from New England south to North Carolina (Leatherwood et al., 1976; Schmidly, 1981). Seasonal aerial surveys confirm that sperm whales are present in the northern Gulf of Mexico in all seasons (Mullin et al., 1994; Hansen et al., 1996).

Life History Information

Female sperm whales become sexually mature at an average of 9 years of age (Kasuya, 1991). Male sperm whales become sexually mature between 9 to 20 years of age but are likely not large enough to successfully compete for females for another 10 years (Kasuya, 1991). The gestation period for sperm whales is about 15 months and calves are nursed for 4 to 6 years (Kasuya, 1991). Adult male sperm whales move north in summer to feed, while females and juveniles stay in tropical and temperate waters year round (Kasuya and Miyashita, 1988). Sperm whale "societies" are comprised of related and unrelated females and their offspring (Christal et al., 1998). Most females probably spend their entire life in the same family unit (Whitehead, 2002). Male sperm whales leave these groups (Rice, 1989) at an estimated age of six years (Richard et al., 1996) and return to breed when they reach their late twenties (Best, 1979). Adult male sperm whales are usually solitary, but may be found co-mingled in groups, with a mean group size of 20 to 30 (Whitehead, 2003). Genetic studies suggest that sperm whales of both genders commonly move across over ocean basins and that males, but not females, often breed in ocean basins that are different from the one in which they were born (Whitehead, 2003)

Sperm whales appear to be restricted to waters deeper than 300m (Berzin, 1971) and in nearshore areas where steep drops in bathymetry result in upwelling events that correlate with highly productive waters (Berzin and Rovnin, 1966). Sperm whales may utilize the entire water column to forage but appear to feed near the bottom and often ingest stones, sand, sponges, and other objects (Whitehead et al., 1992a; Whitehead et al., 1992b). They feed year round and a large portion of their diet is squid (Clarke, 1996).

Vocalization and Hearing

Vocalization and hearing in sperm whales is relatively well understood. Sperm whales produce broad-band clicks in the frequency range of 100 Hz to 20 kHz that can reach 200-236 dB (Weilgart and Whitehead, 1993; Goold and Jones, 1995; Weilgart and Whitehead, 1997; Møhl et al., 2003). Most of the energy in sperm whale clicks is concentrated at around 2-4 kHz and 10-16 kHz (Weilgart and Whitehead, 1993; Goold and Jones, 1995). These clicks are associated with feeding, echolocation (Weilgart and Whitehead, 1993; Goold and Jones, 1995; Weilgart and Whitehead, 1997) and during

social behavior and intragroup interactions (Weilgart and Whitehead, 1993). Sperm whale "squeals" are produced at frequencies of 100 Hz to 20 kHz (e.g., Weir et al., 2007).
The only direct measurement of hearing was from a young stranded individual which responded to sounds of 2.5-60 kHz (Carder and Ridgway, 1990). Sperm whales have also been observed to stop echolocating in the presence of underwater pulses made by echosounders and submarine sonar (Watkins and Schevill., 1975) suggesting that these noises are perceived by the animal.

Listing Status

Sperm whales have been listed as endangered since 1970 under the precursor to the endangered Species Act (ESA) (35 FR 18319; December 2, 1970) and have remained on the list of threatened and endangered species after the passage of the ESA in 1973. They are also protected by the MMPA of 1972.

Population Status and Trends

For MMPA stock assessment reports, sperm whales within the Pacific U.S. EEZ are divided into three discrete areas: California, Oregon and Washington waters, Hawaii waters and Alaskan waters. An estimated 1,407 sperm whales existed in California, Oregon, and Washington waters during summer/fall based on pooled 1993 and 1996 ship line transect surveys within 300 nmi of the coast (Barlow and Taylor, 2001) and 2,593 sperm whales were observed from a survey of the same area in 2001 (Barlow and Forney, 2007). A 2005 survey of this area resulted in an abundance estimate of 3,140 whales, which was corrected for diving animals not seen during surveys (Forney, 2007). The most recent estimate of abundance for this stock is the geometric mean of the 2001 and 2005 summer/autumn ship survey estimates or 2,853 sperm whales (Carretta et al., 2008).

Whitehead (2002) estimated that there are approximately 76,803 sperm whales in the eastern tropical Pacific, eastern North Pacific, Hawaii, and western North Pacific. Minimum population estimates in the eastern North Pacific are 1,719 individuals and 5,531 in the Hawaiian Islands (Carretta et al., 2007). The minimum population estimate is unknown in the North Pacific (Carretta et al., 2007). The tropical Pacific is home to approximately 26,053 sperm whales and the western North Pacific has a population of approximately 29,674 (Whitehead, 2002).

The total number of sperm whales in the western North Atlantic is unknown (Waring et al., 2008). The best available current abundance estimate for western North Atlantic sperm whales is 4,804 based on data from 2004 (Waring et al., 2008). The best available current abundance estimate for Northern Gulf of Mexico sperm whales is 1,665, based on data from 2003 and 2004. There are insufficient data to determine trends for these populations (Waring et al., 2008).

Humpback Whale

Species Description and Distribution

The Humpback Whale (*Megaptera novaeangliae)* is a baleen whale that occurs throughout the world's oceans. The species is listed as endangered throughout its range, and is generally found over continental shelves, shelf breaks, and around oceanic islands (Balcomb and Nichols, 1978; Whitehead, 1987). Humpback whales exhibit seasonal migrations between warmer temperate and tropical waters in winter and cooler waters of high prey productivity in summer, although the seasonal distributions of this species are not fully understood (Reeves et al., 2004). The Humpback Whale has the longest known migratory movements of any mammal, with one-way distances up to 8,461 km (Rasmussen et al., 2007). Populations of humpback whales are not rigid. For example, Pomilla and Rosenbaum (2005) observed an individual animal to migrate from the Indian Ocean to the South Atlantic Ocean.

NMFS currently recognizes four stocks of humpback whales in the North Pacific Ocean: two Eastern North Pacific stocks, one Central North Pacific stock, and one Western Pacific stock (Hill and DeMaster, 1998). In the North Pacific, the species is found off the Hawaiian Islands, from Mexico north to the Gulf of Alaska and Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and Sea of Okhotsk (Nemoto, 1957; Tomilin, 1957; Johnson and Wolman, 1984). Humpbacks that occur off Central America and Mexico in the winter and spring migrate to the coast of California north to British Columbia in summer and fall (Steiger et al., 1991). Although the Pacific coast of Central America is not considered a major wintering area for this species, humpback whales are reported off the west coast of Panama as well as Costa Rica (Steiger et al., 1991).

The Gulf of Maine stock is the only humpback whale population recognized in the North Atlantic. Here, humpback whales are found in six separate subpopulation feeding areas in the summer months: the eastern coast of the United States, the Gulf of St. Lawrence, Newfoundland, western Greenland, Iceland, Scotland, northern Norway, and in the Barents Sea (Katona and Beard, 1990; Sigurjónsson and Gunnlaugsson, 1990; Christensen et al., 1992; Palsbøll et al., 1997; Perry et al., 1999a). In the fall and winter, humpback whales from all feeding areas migrate to calving and mating grounds in the Caribbean, where mixing among subpopulations occurs (Katona and Beard, 1990; Palsbøll et al., 1997).

Life History Information

Humpback whale reproductive activities occur primarily in winter, and gestation takes about 11 months (Winn and Reichley., 1985), followed by a nursing period of up to 12 months (Baraff and Weinrich, 1993). Calving occurs in the shallow coastal waters of continental shelves and some oceanic islands (Perry et al., 1999a). The calving interval is likely two to three years (Clapham and Mayo, 1987), although some evidence exists of calving in consecutive years (Glockner-Ferrari and Ferrari, 1985; Clapham and Mayo, 1987; 1990; Weinrich et al., 1993). Mother/calf groups are found in relatively stable pairs (Ersts and Rosenbaum, 2003). Sexual maturity in humpback whales is reached between five and 11 years of age (Clapham, 1992; Gabriele et al., 2007). During the breeding season, humpback whales form small unstable groups (Clapham, 1996), and males sing long, complex songs directed toward females, other males or both. Males compete for mates and are polygamous (Clapham, 1996).

Although largely solitary, humpback whales often cooperate during feeding activities (Elena et al., 2002). They exhibit a wide range of foraging behaviors, and feed on a range of prey types including small schooling fishes, euphausiids, and other large zooplankton (Nemoto, 1957; Nemoto, 1959; Nemoto, 1970; Krieger and Wing., 1984; Krieger and Wing., 1986). Because most humpback prey are likely found above 300m (984 ft) depths, most dives are probably relatively shallow, with maximum diving depths are approximately 60-170m, with occasional deeper dives (Hamilton et al., 1997). Dives usually range between two and five minutes, but can last to around 20 minutes (Dolphin, 1987). Feeding groups are sometimes stable for long periods of times, and there is good evidence of some territoriality on both feeding (Clapham, 1996) and wintering grounds (Tyack, 1981).

Vocalization and Hearing

Male humpback whales produce complex sounds while in low-latitude breeding areas in a frequency range of 20-10 kHz with estimated source levels from 144-174 dB (Payne, 1970; Winn et al., 1970; Tyack, 1983; Silber, 1986; Richardson et al., 1995; Au, 2000; Frazer and Mercado, 2000; Au et al., 2006). While in northern feeding areas, both sexes vocalize in grunts (25 Hz to 1.9 kHz), pulses (25-89 Hz), and songs (ranging from 30 Hz to 8 kHz but dominant frequencies of 120 Hz to 4 kHz) (Payne and Payne, 1985; Thompson et al., 1986; Richardson et al., 1995; Au, 2000; Erbe, 2002).

Data from direct studies on humpback whale hearing are not available, but it is assumed that they can hear the same frequencies that they produce. Evidence indicates the species is able to hear at least low-frequencies based on the morphology of its auditory apparatus (Ketten, 1997) and vocalizations in the low-frequency range (Richardson et al., 1995). Houser et al. (2001) modeled the potential hearing abilities for the humpback whale based on the length of the basilar membrane and predicted sensitivity to frequencies from 700 Hz to 10 kHz, with maximum relative sensitivity between 2 and 5 kHz.

Listing Status

Humpback whales have been listed as endangered under the ESA since 1973; critical habitat has not been designated for this species. The International Whaling Commission (IWC) first protected humpback whales in the North Pacific in 1965, and this species is also protected by CITES and the MMPA. Humpback whales are listed as “vulnerable” under the IUCN Red List of threatened Species (IUCN, 2005).

Status and Trends

Estimates of the current size of humpback whale populations vary widely. Winn and Reichley (1985) suggest that the global population of humpback whales consisted of at least 150,000 whales in the early 1900s. However, based on mitochondrial DNA analysis, Roman and Palumbi (2003) estimated that pre-exploitation populations of humpback whales to be 240,000 in the North Atlantic alone. Rice (1978) estimated pre exploitation numbers of humpback whales in the North Pacific to be around 15,000. But these data are less reliable.

In the 1980s, North Pacific humpback whale population estimates ranged from 1,407 to 2,100 (Darling and Morowitz, 1986; Baker and Herman., 1987). By the mid-1990s, the population was estimated to have risen to around 6,000 (Calambokidis et al., 1997; Cerchio, 1998; Mobley et al., 1999). Between 2004 and 2006, a comprehensive assessment of the population of humpback whales in the North Pacific identified 7,971 unique individuals from photographic records (Calambokidis et al., 2008). Based on the results of that effort, Calambokidis (2008) estimated that the current population of humpback whales in the North Pacific Ocean consisted of about 18,300 adult whales. In the North Atlantic, Stevick et al., (2003) estimated that approximately 11,570 animals existed in 1993 with an estimated rate of increase of 0.0311 animals per year. Assuming that this rate of increase has remained constant over the years, the estimated 2009 population size for North Atlantic humpback whales would be around 18,886 individuals.

All of these estimates suggest that the global population of humpback whales numbers in the tens of thousands. These populations are of sizes that are likely large enough to withstand natural environmental and genetic stresses to fitness. However, their resilience to anthropogenic stressors is less clear.

Blue Whale

Species Description and Distribution

The blue whale (*Balaenoptera musculus*) is the largest living animal. They are a cosmopolitan species and exist primarily in the open ocean from tropical to polar waters worldwide. Though widely distributed, the blue whale is listed as endangered throughout its range. Blue whales are highly mobile but their migratory patterns are not well known (Perry et al., 1999a; Reeves et al., 2004). However, the distribution of blue whales is assumed to be determined primarily by food requirements, with seasonal migration toward the poles in spring to feed on zooplankton during the summer months. Most blue whales migrate toward the warmer waters of the subtropics in the fall to reproduce while some individuals do not migrate (Yochem and Leatherwood, 1985; Clark and Charif, 1998).

Blue whales are typically found swimming alone or in groups of two or three. However, larger foraging aggregations, including aggregations mixed with other whales, are regularly reported (Corkeron et al., 1999; Shirihai, 2002). In the North Pacific, Nishiwaki (1966) noted the occurrence of blue whales In waters off of the Aleutian Islands and in the Gulf of Alaska. However, there have been no recent blue whale sightings in Alaskan waters despite several extensive surveys (Leatherwood et al., 1982; Stewart et al., 1987; Forney and R. L. Brownell, 1996; Carretta et al., 2008). Blue whales have been recorded off Oahu and the Midway Islands (Northrop et al., 1971; Thompson and Friedl., 1982; Barlow et al., 1997a).

In the North Atlantic, blue whales are typically found in the open ocean from the Arctic to mid-latitude waters with only occasional occurrences in the U.S. EEZ (Yochem and Leatherwood, 1985; Wenzel et al., 1988). Yochem and Leatherwood (1985) noted that blue whales' winter range may extend south to the Gulf of Mexico, and they have been observed in much of the North Atlantic (Yochem and Leatherwood, 1985; Clark et al., 1995). In the western North Atlantic, blue whales are most often observed in the waters off of eastern Canada in the Gulf of St. Lawrence (Sears, 1987).

Life History Information

Blue whale reproduction occurs mostly in winter (Yochem and Leatherwood, 1985). Gestation takes between 10 and 12 months (NMFS, 1998b), and nursing continues for six to seven months. The calving interval is probably two to three years and sexual maturity in is reached at about five years of age (Yochem and Leatherwood, 1985).

Important feeding areas for the blue whale include the edges of continental shelves (Yochem and Leatherwood, 1985; Reilly and Thayer, 1990). The food of blue whales consists of large euphausiid crustaceans (Kawamura, 1980; Yochem and Leatherwood, 1985). Although fish and copepods are observed to have been consumed by blue whales, they are not believed to be a major food source for this species (see Kawamura, 1980).

Data indicate that some summer feeding takes place at low latitudes in highly productive waters caused by upwelling events (Reilly and Thayer, 1990). Although it is reasonable to assume that blue whales compete with other baleen whales for prey (Nemoto, 1970), there is little evidence to suggest that this is the case (Clapham and Brownell, 1996). The migratory nature of most blue whales may help them avoid competition with other whales (Clapham and Brownell, 1996).

Vocalization and Hearing

Blue whales produce prolonged low-frequency vocalizations that range from 12.5-400 Hz, with dominant frequencies from 16-25 Hz, and songs that span frequencies from 16-60 Hz (see McDonald et al., 1995). Berchok et al. (2006) examined vocalizations of St. Lawrence blue whales and found mean peak frequencies ranging from 17.0-78.7 Hz. Reported source levels are 180-188 dB re 1μPa, but may reach 195 dB (Aburto et al., 1997; Ketten, 1998; McDonald et al., 2001; Clark and Ellison, 2004).
As with other baleen whale vocalizations, blue whale vocalization are hypothesized to be used in maintaining spacing between individuals, recognition, socialization, navigation, contextual information transmission, and location of prey resources; (Payne and Webb, 1971; Thompson et al., 1992; Edds-Walton, 1997). 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 (Richardson et al., 1995; Ketten, 1997).

Listing Status

Blue whales have been listed as endangered under the ESA since 1973; critical habitat has not been designated for this species. The blue whale is also protected by CITES and the MMPA. The North Atlantic stock of blue whales is listed as “vulnerable” under the IUCN Red List of threatened Species (IUCN, 2005b).

Status and Trends

Recent information on blue whale population abundance and trends in the North Atlantic is unavailable and there is uncertainty about estimates of blue whale abundance in the

North Pacific Ocean. An ocean-wide population estimate for the-Pacific is not available, but the population has been estimated to be as high as 3,300 (Wade and Gerrodette., 1993) and as low as 1,400 (Barlow et al., 1997a; Barlow et al., 1997b). The feeding stock of blue whales in California is estimated at 1,940 (Forney et al., 2000). However, these data are insufficient to estimate population trends. Although the population in the North Pacific is expected to have grown since being given protected status in 1966, estimates from line transect surveys declined between 1991-2005 (Carretta et al., 2007). However, this estimate may be subject to inter-annual variability in the fraction of the population that utilizes California waters during the summer and in autumn.

There is uncertainty concerning the size of the blue whale population in the North Atlantic. Sigurjonsson (1995) estimated the population to be between 1,000 to 2,000 individuals. Sears et al. (1990) identified 308 individual blue whales in the Gulf of St. Lawrence, which provides a minimum estimate for their population in the North Atlantic. Approximately 400 whales have been identified in the Gulf of St Lawrence (Ramp et al., 2006).

Estimates for the Southern Hemisphere population of blue whales range from 5,000 to 6,000 with an average rate of increase of four to five percent per year (Yochem and Leatherwood, 1985). Butterworth *et al.* (1995) estimated the Antarctic population to be 710 individuals. More recently, Branch *et al.* (2004) estimated the blue whale population in the Southern Ocean to be between 860 and 2,900 animals.

<u>Sei Whale</u>

Species Description and Distribution

The sei whale (*Balaenoptera borealis*) occurs in all oceans of the world except the Arctic and is listed as endangered throughout its range. The migratory pattern of this species is thought to encompass long distances from high-latitude feeding areas in summer to low-latitude breeding areas in winter, however the location of winter areas is largely unknown (Perry et al., 1999b). Sei whales are associated with deeper waters and areas along the edges of continental shelves (Hain et al., 1985). However, individuals may move into more shallow inshore waters (Waring et al., 2008).

In the North Pacific Ocean, sei whales have been reported primarily south of the Aleutian Islands, in Shelikof Strait and waters surrounding Kodiak Island, in the Gulf of Alaska, and inside waters of southeast Alaska (Nasu, 1974). In the western North Atlantic, a major portion of the sei whale population occurs from northern waters, potentially including the Scotia Shelf, and south as far as North Carolina (Mitchell and Chapman, 1977; Waring et al., 2008). In the Southern Hemisphere, the distribution of sei whales during austral summer is thought to be between 40^{o}S and 50^{o}S based on historic catch data; the winter distribution of this species generally unknown (Gambell, 1985; Perry et al., 1999a). Movements of sei whales in the Southern Hemisphere are thought to be generally similar to those of blue and fin whales, except within a smaller range of latitudes (Gambell, 1985; Perry et al., 1999a).

The sei whale population in the western North Atlantic is assumed to consist of two stocks: the Nova Scotia, Iceland-Denmark Strait, and Northeast Atlantic stocks (Donovan, 1991; Perry et al., 1999a). However, the identification of sei whale population structure is difficult (Donovan, 1991; Perry et al., 1999a). The IWC only recognizes one stock of sei whales in the North Pacific (Donovan, 1991).

Life History Information

Rice (1977) notes that mating activities for sei whales occur primarily in winter. Gestation is about 12.7 months, calves are weaned at 6 to 9 months of age, and the calving interval is about 3 years (Rice 1977). Sei whales become sexually mature at about age 10 (Rice 1977). The species appears to lack a well-defined social structure, and individuals are usually found alone or in small groups of up to six whales (Perry et al., 1999a). Larger groupings have been observed in feeding areas (Gambell, 1985).

Sei whales are primarily planktivorous, feeding mainly on euphausiids and copepods, although the species is also known to consume fish (Waring et al., 2008). In the Northern Hemisphere, sei whales are known to consume small schooling fish and squid (Nemoto and Kawamura, 1977; Mizroch et al., 1984; Gambell, 1985; Calkins, 1986). Rice (1977) suggested that the diverse diet of sei whales may allow them greater opportunity to take advantage of variable prey resources, but may also increase their potential for competition with commercial fisheries.

Listing Status

Sei whales have been listed as endangered since 1970 under the precursor to the Endangered Species Act (ESA) (35 FR 18319; December 2, 1970) and then remained on the list of threatened and endangered species after the passage of the ESA in 1973. They are also protected by the Convention on International Trade in Endangered Species of wild flora and fauna and the MMPA.

Vocalization and Hearing

Data on sei whale vocal behavior is limited, but includes observations of broadband sounds in the 100-600 Hz range and calls in the 200-600 Hz range (McDonald et al., 2005). Differences may exist in vocalizations between ocean basins (Rankin and Barlow, 2007). Data from direct studies on sei whale hearing are not available, but it is assumed that they can hear the same frequencies that they produce.

Status and Trends

Ohsumi and Wada (1974) estimated that the pre-whaling numbers of sei whales in the North Pacific numbered 58,000-62,000 individuals. Tillman (1977) revised this number to 42,000 with an estimated population abundance in 1974 of 7,260-12,620. There are insufficient data to determine trends of the sei whale population in either the Atlantic or the Pacific Ocean (Carretta et al., 2007; Waring et al., 2008).

There have been no direct estimates of sei whale populations for the eastern Pacific Ocean or the Pacific Ocean as a whole. During ship and aerial surveys between 1991 and 2005, there were five confirmed sightings of sei whales in California, Oregon, and

Washington waters (Hill and Barlow, 1992; Carretta and Forney, 1993; Mangels and Gerrodette, 1994; Barlow, 2003; Forney, 2007). The minimum population estimate based on line transect surveys of out to 300 nmi between 2001 and 2005 is around 28 whales (Carretta et al., 2007), and the best abundance estimate is 49 (Barlow and Forney, 2007; Forney, 2007).

No sei whale sightings were made during twelve aerial surveys around the main Hawaiian Islands from 1993 to 1998 (Mobley et al., 2000). Barlow (2003) estimated a summer/fall number of 77 whales from a 2002 line-transect survey of the entire Hawaiian Islands EEZ. This is currently the best available abundance estimate for the Hawaiian stock (Carretta et al., 2007). No data are available on current population trend and the effects of possible unauthorized harvesting make this estimate uncertain (Yablokov, 1994 as cited in Carretta et al., 2007).

The most current population estimate for the North Atlantic is over 4,000 sei whales (Braham, 1991). Based on an aerial survey conducted in August 2006, NMFS estimated the current abundance of the Nova Scotia stock at 207 individuals, with a minimum population estimate of 128 (Waring et al., 2008). However, the total number of sei whales in the U.S. Atlantic EEZ remains unknown (Waring et al., 2008).

Fin Whale

Species Description and Distribution

Fin whales (*Balaenoptera physalus*) are widely distributed throughout the world's oceans. They are the second largest baleen whale by length, and are long-bodied and slender, with a prominent dorsal fin set about two-thirds of the way back on the body. They are dark gray dorsally and white ventrally, but the pigmentation pattern is often complex. Distinctive features of pigmentation, along with dorsal fin shapes and body scars, are useful for photo-identification (Agler et al., 1993).

Fin whales are less concentrated in nearshore environments and appear to favor deep waters (Clark et al., 1995). They appear to avoid both highly polar and highly tropical waters (Sergeant, 1977). Fin Whale migration patterns are less predictable than for similar species and not all individuals migrate every year (COSEWIC, 2005). Most Fin whales in the Northern Hemisphere migrate seasonally from the Arctic in summer to lower latitudes in winter to breed. However , the locations of these breeding grounds are uncertain (Perry et al., 1999a). Other groups of individuals may remain year-round in a particular area.

In the North Pacific in summer, fin whales are found in the Chukchi Sea, the Sea of Okhotsk, waters of the Aleutian Islands and the Gulf of Alaska south to California (Gambell, 1985). Rice (1974) suggested that Northern Pacific fin whales may winter off of southern California. However, further research is needed to confirm this (Forney et al., 2000). Fin whales have been observed feeding in Hawaiian waters during mid-May (Shallenberger et al., 1981; Balcomb, 1987). In the North Atlantic Ocean in summer, fin whales occur in foraging areas from the coast of North America to the Arctic, around Greenland, Iceland, northern Norway, Jan Meyers, Spitzbergen, and the Barents Sea.

In the western Atlantic, they winter from the edge of sea ice south to the Gulf of Mexico and the West Indies (Gambell, 1985). In the eastern Atlantic, they winter from southern Norway, the Bay of Biscay, and Spain with some whales migrating into the Mediterranean Sea (Gambell, 1985).

Life History Information

The calving interval for fin whales is around two to three years (Agler et al., 1993). Fin whales become sexually mature between five and 15 years of age (Gambell, 1985; COSEWIC, 2005). Calving and mating activities occur in late fall and winter (Mackintosh and Wheeler, 1929; Nishiwaki, 1952; Tomilin, 1957) although off season births do occur off the eastern United States (Hain et al., 1992). Gestation lasts about 12 months and nursing occurs for 6 to 11 months (Perry et al., 1999a). Agler (1993) reported that the gross annual reproductive rate of fin whales in the Gulf of Maine was about eight percent during the 1980s.

Fin whales are most common in both oceanic and coastal temperate to polar regions and are less common near the equator. They have been observed singly, in pairs, and in larger groupings of three to 100 animals (Balcomb, 1987). The amount of time fin whales spend diving varies from a tens of seconds to over an hour (Watkins et al., 1981; Gambell, 1985; Hain et al., 1992; Croll et al., 2001). Hain et al. (1992) found that individuals or pairs represented about 75% of sightings in waters off the U.S. Atlantic Coast. Individuals or groups of less than five represented about 90% of these observations and the mean group size was 2.9 (Hain et al., 1992). They have also been reported grouped with other balaenopterid whale species (Corkeron et al., 1999; Shirihai, 2002).

Fin whales feed on euphausiids and large copepods in addition to schooling fish (Nemoto, 1970; Kawamura, 1982; Watkins et al., 1984). Their diet varies seasonally and geographically (Watkins et al., 1984; Shirihai, 2002). Competition may occur with other baleen whales or other consumers of these prey types (Nemoto, 1970; Kawamura, 1980), although Payne et al.(1990) concluded that fin whales are less stressed by fluctuations in prey availability than are humpback whales due to their greater ability to exploit patchy prey aggregations.

Vocalization and Hearing

Fin whales produce a variety of low-frequency sounds in the 10-200 Hz range (Watkins, 1981a; Watkins et al., 1987; Edds, 1988; Thompson et al., 1992). Typical vocalizations are long, patterned pulses of short duration in the 18-35 Hz range (Patterson and Hamilton, 1964; Croll et al., 2002). Richardson et al. (1995) reported the most common sound as a 1 s vocalization of about 20 Hz, occurring in short series during spring, summer, and fall, and in repeated stereotyped patterns in winter. 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 (Watkins, 1981a; Edds, 1988; Cummings and Thompson, 1994). Source levels for fin whale vocalizations are 140-200 dB re 1μPa/m (see Erbe, 2002; see also Clark and Ellison, 2004).

Low-frequency fin whale vocalizations travel over long distances and may aid in long-distance communication (Payne and Webb, 1971; Edds-Walton, 1997). During the breeding season, fin whales produce pulses in a regular repeating pattern, which have been proposed to be mating displays (Croll et al., 2002). These vocal bouts last for a day or longer (Tyack, 1999). Direct studies of fin whale hearing have not been conducted, but it is assumed that they can hear the same frequencies that they produce.

Listing Status

Fin whales have been listed as endangered under the ESA since 1973; critical habitat has not been designated for this species. The IWC began management of commercial whaling for fin whales in 1969 and they were fully protected from commercial whaling in 1976 (Allen, 1980). The species is also protected by CITES and the MMPA. Fin whales are listed as endangered on the IUCN Red List of threatened Species (IUCN, 2005c).

Status and Trends

NMFS recognizes three stocks of fin whales: North Atlantic, North Pacific, and Antarctic. In the North Pacific, NMFS recognizes three populations: Alaska, Hawaii and California/Oregon/Washington (Barlow et al., 1997; Hill and DeMaster, 1998). Moore et al. (2000) conducted surveys for whales in the central Bering Sea in 1999 and estimated the fin whale population to be approximately 4,951 animals. 3,279 Fin Whales were estimated to be off California, Oregon, and Washington based on ship surveys in summer/autumn of 1996 and 2001 (Barlow and Taylor, 2001). A 2005 ship survey of the same area resulted in an abundance estimate of 3,281 Fin Whales (Forney, 2007). The geometric mean of line transect estimates from summer/autumn ship surveys conducted in 2001 and 2005 in California, Oregon, and Washington waters out to 300 nmi is 3,454 animals (Barlow and Taylor, 2001; Forney, 2007). Based on the available information, it is feasible that the North Pacific population as a whole has failed to increase significantly over the past 30 years.

There is no evidence of a population trend from recent line-transect abundance surveys conducted in 1996, 2001, and 2005 in these waters. In Hawaii, the best available estimate is 174 animals (Carretta et al., 2007). This number is based on a 2002 shipboard line-transect survey of the entire Hawaiian Islands EEZ (Barlow, 2003). No data are currently available on the population trend of this population (Carretta et al., 2007).

The best abundance estimate available for the western North Atlantic fin whale stock is 2,269 (Waring et al., 2008). However, because of the incomplete coverage of the survey as well as the lack of data regarding movement patterns and population structure, this estimate should be considered a conservative one. Hain et al. (1992) estimated that there were approximately 5,000 fin whales in the western North Atlantic Ocean based on a 1978-1982 survey. Data are limited on the population status of this stock and thus insufficient to determine population trends (Carretta et al., 2007).

<u>Guadalupe Fur Seal</u>

Species Description and Distribution

Guadalupe fur seals are medium sized, sexually dimorphic and tend to be solitary (Belcher and T.E. Lee, 2002; Reeves et al., 2002). They are distinguished from other seals by their large, long fore-flippers, and their behavior of floating vertically with their heads down in the water and their hind flippers exposed to allow for heat exchange (Reeves et al., 2002). Their diet apparently consists of cephalopods, bony fish, and crustaceans (Belcher and T.E. Lee, 2002).

Guadalupe fur seals' historic range included the Gulf of Farallons, California to the Revillagigedo Islands, Mexico (Belcher and T.E. Lee, 2002; Rick et al., 2009). Currently, they breed mainly on Guadalupe Island, Mexico, some 200 km off of the Pacific Coast of Baja California (Aurioles et al., 2009). A smaller breeding colony, discovered in 1997, appears to have been established at Isla Benito del Este, Baja California, Mexico (Belcher and T.E. Lee, 2002).

There are reports of individuals being sighted in the California Channel Islands, Farallon Islands, Monterey Bay, and other areas of coastal California and Mexico (Belcher and T.E. Lee, 2002; Carretta et al., 2002; Reeves et al., 2002). A single female gave birth to a pup on the Channel Islands in 1997 (Aurioles et al., 2009).

Life History Information

Guadalupe fur seals are a polygamous species that exhibit strong breeding site fidelity (Belcher and T.E. Lee, 2002). Males establish territories and may breed with as many as 12 females during a single breeding season (Reeves et al., 2002). Territorial males spend the majority of their time in the breeding colony fasting and resting and stay with the colony from 35 to 122 days (Reeves et al., 1992; Belcher and T.E. Lee, 2002). Guadalupe fur seals prefer to colonize on rocky haul outs near water and in caves for relief from heat during the summer breeding season. Breeding occurs shortly after females give birth (June to July), after which time, females forage for two to six day periods between nursing their pups during the nine month lactation period (Reeves et al., 2002).

Lander *et al*. (2000) observed that the mean dive depth was between ~14m and 15.7 m, with a majority of time was spent at less than 4 m. The majority of dives occur at night (Croll et al., 1999). Little is known about Guadalupe fur seal behavior during non-breeding season. They appear to spend long periods foraging at shallow depths during this time, but little information is known on their distribution at sea (Belcher and T.E. Lee, 2002).

Vocalization and Hearing

There is no published information on the hearing range of the Guadalupe fur seal. However, it is reasonable to assume that their hearing is similar to that of other fur seal species. The underwater hearing range of the northern fur seal ranges from 0.5 Hz to 40 kHz with optimal hearing between 4 and 28 kHz (Moore and Schusterman, 1987).

Listing Status

Guadalupe fur seals were listed as threatened under the ESA on December 16, 1985 (50 FR 51252). The population is considered a single stock from a single breeding colony at Isla Guadalupe, Mexico. Critical habitat has not been designated for this species.

Status and Trends

Guadalupe fur seals were hunted to near extinction by the late 1800s (Townsend, 1931). They were believed to be extinct until two adult males were captured on Guadalupe Island in 1928 (Townsend, 1931). The population size prior to commercial exploitation is unknown, but estimates range from 20,000 to 100,000 animals (Hubbs, 1956; Fleischer, 1987). The most recent estimate is 7,400 animals in 1993 with a population growth rate of 13.7% per year (Carretta et al., 2007).

Environmental Baseline

By regulation, environmental baselines for biological opinions include the past and present impacts of all state, federal 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 that are contemporaneous with the consultation in process (50 CFR §402.02).

The *Environmental Baseline* for this Opinion includes the effects of many activities on the survival and recovery of ESA listed species in the action area; it focuses primarily on past and present impacts to these species. A number of human activities have contributed to the current status of listed marine species in the action area. Some of those activities, (e.g. commercial whaling and intentional shooting) no longer regularly occur. However, the effects from these activities may still persist. Other human activities are ongoing and appear to be directly or indirectly affecting these species. Additionally, unrelated factors may be acting together to affect listed species. For example, vessel effects combined with the stresses of reduced prey availability or increased contaminant loads may reduce foraging success and lead to chronic energy imbalances and poorer reproductive success; or all three factors may work to lower an animal's ability to suppress disease (Williams et al., 2002; NMFS, 2008).

Taken together, the components of the environmental baseline for the action area include sources of natural mortality as well as influences from natural oceanographic and climatic features in the action area. Circulation and productivity patterns influence prey distribution and habitat quality for listed species. The effects of climatic variability on these species in the action area and the availability of prey remain largely undetermined. However, it is likely that any changes in weather and oceanographic conditions resulting in effects on prey populations would have consequences for marine mammals.

The baseline also includes human activities resulting in disturbance, injury or mortality of individuals. Historically, commercial harvest marine mammals significantly affected these species. Although these activities are not conducted now as in the past, effects from these activities still persist today. Current anthropogenic activities and effects on individuals in the action area are thought to include habitat degradation (e.g., due to contaminants, risk of oil spills, underwater sound sources, changes in prey availability), interactions with fishing gear and with vessels and scientific research. Conservation and management efforts are ongoing and have a positive effect on the status of listed marine mammals within the action area.

The following discussion summarizes the natural and human phenomena in the action area that may affect the likelihood that these species will survive and recover in the wild. These include natural mortality; oceanographic and climate conditions; commercial harvest and live capture; habitat degradation; environmental contaminants and the risk of oil spills; noise; changes in prey availability; interactions with fishing gear and vessels and scientific research and conservation efforts.

Natural Sources of Stress and Mortality

Sperm Whales

Although it is unclear how they affect sperm whale populations, predation on calves from killer whales (Arnbom et al., 1987) and possibly large sharks (Best et al., 1984) has been documented. Recently, bone necrosis has been observed in sperm whales, possibly caused by the formation of nitrogen bubbles following deep dives and subsequent ascents (Moore and Early, 2004) which could potentially contribute to mortality. However, the effects of necrosis on the fitness of individuals or populations are unknown.

Humpback Whales

The causes of natural mortality in humpback whales are largely unknown although parasites may play a significant role (Lambertsen, 1986). Humpback whales are known to be parasitized by the nematode, *Crassicauda boopis,* which is a significant cause of death in the closely related fin whale (Lambertsen, 1986). Killer whale attacks have also been documented on humpback whales (Dolphin, 1987), but it is unclear what impacts this has on population trends for this species. Lethal strandings attributed to harmful algal blooms have also been documented (Geraci et al., 1989) and lethal entrapment in ice has also been observed (Mitchell, 1979).

Blue Whales

Little is known about natural mortality of blue whales. In the North Atlantic, ice entrapment is known to injure and kill some blue whales (Beamish, 1979; Sergeant, 1982) and individuals have been observed to bear scars thought to be from contact with ice (Sears et al., 1987). Killer whales have been observed to attack blue whales (Tarpy, 1979), and blue whales in the Gulf of California bear scars that are consistent with killer whale attacks (Sears et al., 1990). However, it is uncertain how these attacks can impact populations (Reeves, 1998).

Sei Whales

Important natural mortality factors are largely unknown in sei whales. However, diseases have been observed in this species. The sei whale is often heavily infected with endoparasitic helminth worms (Rice, 1977). In addition, in the 1980’s, roughly seven percent of sei whales off California were observed to have an unknown disease that causes them to shed their baleen plates which impairs their feeding ability (Mizroch et al., 1984). However, it is unknown how these diseases affect sei whale populations.

Fin Whales

Sources and rates of natural mortality are largely unknown in fin whales. Ice entrapment is known to injure and kill some whales in the Atlantic (Sergeant et al., 1970). Disease presumably plays a role in natural mortality as well (Lambertsen, 1986). Urinary tract diseases caused by parasites has been suggested to be the primary cause of natural mortality in North Atlantic fin whales (Lambertsen, 1986). Killer whale attacks may result in serious injury or death in young or sick fin whales (Perry et al., 1999a). Rates of natural mortality in fin whales generally are thought to range between four and six percent (Aguilar and Lockyer, 1987).

Guadalupe Fur Seals

Although currently protected from commercial harvest, natural genetic factors are seen as a significant threat to the continued survival of this species. Relatively low genetic diversity as a result of overharvesting has resulted in remaining individuals being more susceptible to disease and inbreeding effects (Bernardi et al., 1998; Weber et al., 2004). Sharks are known to prey upon Guadalupe fur seals but the effects to the population is unknown (Gallo-Reynosa, 1992).

Oceanographic Features and Climatic Variability

Climatic variability and change may be affecting listed species through change in habitat and prey availability. However, these effects are not well understood. Possible effects of climatic variability for marine species include the alteration of community composition and structure, changes to migration patterns or community structure, changes to species abundance, increased susceptibility to disease and contaminants, alterations to prey composition and altered timing of breeding (MacLeod et al., 2005; Robinson et al., 2005; Kintisch, 2006; Learmonth et al., 2006; McMahon and Hays, 2006). Naturally occurring climatic patterns, such as the Pacific Decadal Oscillation and the El Niño and La Niña events, are identified as major causes of changing marine productivity worldwide and may also therefore influence listed species' prey abundance (Mantua et al., 1997; Francis et al., 1998; Beamish et al., 1999; Hare et al., 1999; Benson and Trites, 2002). Gaps in information and the complexity of climatic interactions complicate the ability to predict the effects of climate change and variability may have to these species (Kintisch, 2006; Simmonds and Isaac, 2007).

<u>Anthropogenic Stressors</u>

Commercial Harvest

Although commercial harvesting no longer targets any listed species in the proposed action area, prior exploitation may have altered the population structure and social cohesion of the species such that effects on abundance and recruitment can continue for years after harvesting has ceased.

Sperm Whales

Sperm whales were subject to commercial whaling in all parts the world. Whitehead (2002) suggested that the pre-exploitation worldwide population of sperm whales was approximately 1,100,000. This number had been reduced to approximately 360,000 by the 1990's (Whitehead, 2002; Taylor, 2008). The IWC gave sperm whales complete protection from commercial whaling in 1986 (IWC, 1982). Japan still takes a small number of sperm whales each year under an exemption for scientific research and Norway and Iceland have formally objected to the IWC ban on commercial whaling and therefore may resume whaling of sperm whales under IWC rules.

In the North Pacific, sperm whale hunting began in the early 1800s (Best, 1983). After the introduction of modern whaling technology, the peak annual catches by modern whaling before the war were less than 2,000, but soon climbed to over 16,000 by 1968 (Ohsumi, 1980). Between 1910 and 1976, approximately 269,000 sperm whales were taken in the North Pacific (Ohsumi, 1980). However, deliberate misreporting of Japanese catch data has been suggested (Kasuya, 1998). Under reporting by Soviet whalers is also known to have occurred (Yablokov, 1994). An estimated 180,000 animals are now believed to have been killed by Soviet whalers between 1949 and 1971 (Brownell et al., 1998) before the IWC implemented it's international observer policy to curtail misreporting of whale catch data. This figure is approximately 60% higher than official reports (Brownell et al., 1998).

No reliable records exist for the number of sperm whales killed in the North Atlantic before the 1900s, but estimates are in the hundreds of thousands (see NMFS, 2006). Better records exist for catches after the advent of modern whaling. An extrapolation of all catch data in the North Atlantic after 1905 resulted in an estimated figure of 38,235 whales killed since 1905 (IWC, 1981).

Humpback Whales

Commercial whaling heavily depleted worldwide humpback whale numbers, but most populations have increased since whaling was banned in 1966 (Reilly, 2008). For Humpback whales in the Pacific Ocean, whaling operations took nearly 30,000 whales from 1900 to 1965 with an unknown number harvested prior to 1900 (Perry et al., 1999a). In 1965, the IWC banned the commercial hunting of Humpback Whales in the Pacific.

In the western North Atlantic, 522 humpback whales were harvested off Greenland from 1886 to 1976 (Kapel, 1979) and 1,397 animals were harvested off of eastern Canada from 1903 to 1970 (Mitchell, 1974). At least 1,579 humpback whales were killed in the eastern North Atlantic and Arctic from 1868 to 1955, with other un-documented harvestings also occurring (Perry et al., 1999a). This stock was given protected status in the North Atlantic in 1955, with an allowance for subsistence harvesting (Brown, 1976). Reported subsistence harvests of this stock have been of one or two animals in most years since 1986 (IWC, 2007).

In the Southern Hemisphere, some 208,359 humpback whales were recorded to have been killed between 1904-2002 (Yablokov et al., 1998; Clapham and Baker, 2002). Soviet whalers killed more than 48,000 humpback whales after World War II with nearly 13,000 animals harvested in the 1959-1960 season alone (Clapham and Baker, 2002). The population of whales that inhabited the coastal waters of New Zealand collapsed in 1960 (Clapham and Baker, 2002). Although rare, some animals have been recently observed in these waters (Clapham and Baker, 2002).

Blue Whales

While the pre-whaling worldwide abundance of blue whales may have been as high as 200,000 individuals (Maser et al., 1981; U.S. Department of Commerce, 1983), current estimates range from 3,300 (Wade and Gerrodette., 1993) to as low as 1,400 (Barlow et al., 1997). The IUCN estimated an approximate 50% decline in blue whales worldwide over the last 75 years when commercial whaling was widely practiced (Reeves et al., 2003). Rice (1974) suggested that the pre-1924 North Pacific blue whale population size was around 6,000. Approximately 9,500 whales of this population were reported killed between 1910 and 1965 (Ohsumi and Wada., 1972). An estimated 360,644 southern hemisphere blue whales have been killed by whalers from 1904 to 2000 (Yablokov et al., 1998; Clapham and Baker, 2002). In addition, an unknown number of blue whales were taken illegally by the Soviet Union after gaining protection from commercial whaling in 1966 (Yablokov et al., 1998). At least 11,000 blue whales were killed in the North Atlantic in the 19th to mid-20th centuries (Sigurjónsson and Gunnlaugsson, 1990).

Sei Whales

The stocks of sei whales have been heavily depleted before gaining protection from commercial harvest in the 1970s and 1980s (Reeves et al., 2003). After the blue and fin whales became scarce due to overharvesting, sei whales were heavily exploited (Reeves et al., 2003). The IUCN estimated an approximate 50% decline in sei whales worldwide over the last 75 years when commercial whaling was widely practiced (Reeves et al., 2003). Most of this decline occurred in the Southern Hemisphere (Reeves et al., 2003). In the North Pacific, 72,215 sei whales were reported to have been killed by commercial whalers between 1910 and 1975 (Horwood, 1987). There were 14,295 sei whales reported to have been killed in the North Atlantic between 1885 and 1984 (Horwood, 1987). A total of 152,233 sei whales were killed in the Southern Hemisphere between 1910 and 1979 (Horwood, 1987). The extent to which stocks have recovered since then is unknown. Relatively little recent research has been conducted on this species (Reeves et al., 2003).

Fin Whales

Coinciding with the advent of modern whaling practices, the IUCN estimated an approximate 50% decline in fin whales worldwide over the last 75 years, with most of this decline occurring in the Southern Hemisphere (Reeves et al., 2003). Prior to commercial harvest, there may have been up to 45,000 Fin Whales in the North Pacific. By the early 1970s, commercial whaling may have reduced this population to between 13,620 and 18,630 (Ohsumi and Wada, 1974). Commercial whaling for fin whales ended in the North Pacific in 1976. There were 703,693 fin whales killed in the Antarctic from 1904 to 1975 (IWC, 1990).

In the North Atlantic, there may have been as many as 30,000 to 50,000 fin whales before commercial exploitation (Sergeant, 1977). However, Roman and Palumbi (2003) estimated that, based on genetic analysis, the historical population size for North Atlantic fin whales may have been as high as 360,000. Over 48,000 fin whales were caught between 1860 and 1970 in the Atlantic (Braham, 1991). Fin whales are still hunted in Greenland and subject to catch limits under the IWC's Aboriginal Subsistence Whaling

Scheme. From 1996 to 2007, subsistence catches are reported to be 126 animals from the North Atlantic (IWC, 2007). The best current abundance estimate available for the western North Atlantic fin whale stock is 2,269 (Waring et al., 2008).

Guadalupe Fur Seals

Guadalupe fur seals were hunted to near extinction by the 1890s (Townsend, 1931). The species was believed to be extinct until two adult males were captured on Guadalupe Island in 1928 (Townsend, 1931). The population size prior to commercial exploitation is unknown, but estimates range from 20,000 to 100,000 animals (Hubbs, 1956; Fleischer, 1987).

US Navy Activities

SOCAL

The U.S. Navy has been conducting training and other activities in SOCAL for over 70 years. Current activities include anti-submarine warfare exercises, anti-air warfare exercises, anti-surface warfare exercises, and amphibious warfare exercises, coordinated training events and research, development and evaluation activities. The U.S. Navy estimates that it currently conducts about 8 major training exercises, seven integrated exercises, and numerous unit-level training and maintenance exercises in the Southern California Range Complex each year (U.S. Navy, 2008a).

Although the U.S. Navy did not estimate the number of times different listed species might be exposed to mid-frequency active sonar during these training activities, NMFS estimated about 14,000 instances in which endangered or threatened marine mammals would be exposed to Navy training activities during the cold season and another 3,600 exposure events during the warm season. The largest number of exposure events (about 70 percent or about 9,900 exposure events during the cold season and about 1,891 exposure events during the warm season) would involve blue whales, with 2,100 exposure events involving sperm whales (about 15 percent of the exposure events), and 1,900 exposure events involving fin whales (about 13.7 percent of the exposures).

Of this total number of exposure events involving mid-frequency active sonar, the U.S. Navy estimated that yearly totals for behavioral harassment events would be 480 for blue whales, 135 for fin whales, 120 for sperm whales, and 772 for Guadalupe fur seals. Because blue whales are not likely to hear mid-frequency active sonar, it is assumed that blue whales would be more likely to be harassed by vessel traffic rather than the active sonar itself.

The U.S. Navy also estimated that three blue whales would have been behaviorally harassed each year as a result of underwater detonations associated with training activities in the SOCAL and another two blue whales would have experienced temporary losses in hearing sensitivity as a result of being exposed to those detonations. Two fin whales and an additional fin whale would also have experienced temporary losses in hearing sensitivity as a result of being exposed to these detonations. Two sperm whales would have been behaviorally harassed each year and an additional two sperm whales would have experienced temporary losses in hearing sensitivity as a result of being exposed to these detonations. Two Guadalupe fur seals would have been behaviorally harassed and an additional two seals would have experienced temporary losses in hearing sensitivity as a result of being exposed to these detonations.

HRC

Since 1971[4], the U.S. Navy has conducted the biennial Rim of the Pacific (RIMPAC) exercises. These exercises have historically lasted for approximately one month and have involved forces from various nations on the Pacific Rim including Australia, Canada, Chile, Japan, and the Republic of Korea. We have limited information on the timing and nature of RIMPAC Exercises prior to 2002 and we have no information on their potential effects on endangered and threatened marine animals in the HRC prior to 2006, when we started to consult with the U.S. Navy on the exercises.

Between June and July 2006, the U.S. Navy conducted RIMPAC exercises in the HRC. Based on the U.S. Navy's 7 December 2006 After Action Report, over the 15 calendar days of the 2006 RIMPAC (U.S. Navy, 2006), mid-frequency sonars were employed for a total of 472 hours. Active and passive sonobuoys were also deployed for 115 hours during these exercises but not all sonobuoys were transmitting noise.

During the 2006 RIMPAC exercises, U.S. Navy observers reported marine mammals on 29 occasions. On 12 of those 29 occasions, mid-frequency sonar was shut down for a total of eight hours. On two other occasions, marine mammals were observed more than 1,000 yards from a vessel while mid-frequency sonar was active.

The After Action Report for the 2006 RIMPAC concluded that (a) there was no evidence of any behavioral effects on marine mammals throughout the exercise; and (b) there were no reported standing events or observations of behavioral disturbance of marine mammals linked to sonar use during the exercise. The observations contained in the report do not identify or estimate the number of endangered or threatened species that might have been exposed to mid-frequency active sonar during the exercise. The Navy did not evaluate the efficacy of the mitigation measures nor did they evaluate the efficacy of the monitoring program associated with the exercises.

Between June and July 2008, the U.S. Navy conducted another set of RIMPAC exercises in the HRC, with the at-sea portions that involved mid-frequency active sonar occurring between July 7 and 31 2008. Based on the U.S. Navy's 30 November 2008 After-Action Report, over the 25 calendar days of the 2008 RIMPAC (U.S. Navy, 2008d), mid-frequency active sonars and sonobuoys were employed for a total of 547 hours. Of this total, active sonar was employed between the shoreline and the 200-meter bathymetric contour for about 6 hours.

Participants in the 2008 RIMPAC exercises reported 29 sightings of marine mammal groups totaling about 200 animals; dolphins represented 72 percent of these sightings.

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4 Previous biological opinions on the 2006 Rim of the Pacific Exercises and the Undersea Warfare Exercises reported that Rim of the Pacific Exercises had occurred in the Hawaii Range Complex since 1968. U.S. Navy historians have since verified that these exercises began in 1971.

Six whale groups were sighted during the exercise, all in waters more than 100 nm west of the Island of Hawaii. An aerial survey over a portion of the area in which the 2008 RIMPAC exercises occurred reported 24 sightings of marine mammal groups involving eight species of small odontocetes, Hawaiian monk seals, or unidentified dolphins or sea turtles. A shipboard survey that also occurred in a portion of the area in which the 2008 RIMPAC exercises occurred reported 9 sightings of marine mammal groups consisting of either bottlenose dolphins, rough-toothed dolphins, or Hawaiian spinner dolphins. None of the observers reported unusual behavior or adverse behavioral responses to active sonar exposures or vessel traffic associated with the exercises.

The U.S. Navy has also conducted Undersea Warfare Exercises in the HRC for several years, but the components of these exercises can vary widely. For example, an Undersea Warfare Exercise conducted in the HRC from 13 to 15 November 2007, involved two ships equipped and entailed a total of 77 hours of mid-frequency active sonar from all sources (U.S. Navy, 2008d). An Undersea Warfare Exercise conducted in the HRC from 25 to 27 March 2008, involved a total of 169 hours of mid-frequency active sonar from all sources (U.S. Navy, 2008c). An Undersea Warfare Exercise conducted in the HRC from 27 to 31 May 2008, involved four ships, and entailed a total of 204 hours of mid-frequency active sonar from all sources (hull-mounted sonars, dipping sonars, and sonobuoys; U.S. (U.S. Navy, 2008b).

Monitoring surveys associated with the November 2007 Undersea Warfare Exercises reported 26 sightings of five species during exercise, including green sea turtles and Hawaiian monk seals. None of the marine animals observed from survey vessels or aircraft were reported to have exhibited unusual behavior or changes in behavior during the surveys. Monitoring surveys associated. Monitoring surveys associated with the March 2008 Undersea Warfare Exercises reported 47 sightings of five species during exercise, including humpback whales (40 sightings of 68 individuals) and an unidentified sea turtle. None of the marine animals observed from survey vessels or aircraft were reported to have exhibited unusual behavior or changes in behavior during the surveys.

Pollution

Pesticides and Contaminants

Exposure to pollution and contaminants has the potential to cause adverse health effects in marine species. In the eastern Pacific, marine ecosystems receive pollutants from a variety of local, regional, and international sources and their levels and sources are therefore difficult to identify and monitor (Grant and Ross, 2002). Marine pollutants come from multiple municipal, industrial and household as well as from atmospheric transport (Iwata, 1993; 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).

Hydrocarbons

Exposure to hydrocarbons released into the environment via oil spills and other discharges pose risks to marine species. Marine mammals 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). Acute exposure of marine mammals to petroleum products causes changes in behavior and may directly injure animals (Geraci, 1990). Cetaceans have a thickened epidermis that greatly reduces the likelihood of petroleum toxicity from skin contact with oils (Geraci, 1990), but 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.

Marine Debris

Types of marine debris include plastics, glass, metal, polystyrene foam, rubber, and derelict fishing gear from human marine activities or transported into the marine environment from land. The sources of this debris include littering, dumping and industrial loss and discharge from land. Marine debris can damage important marine habitat, such as rookeries and haulout sites of pinnipeds by making them inhospitable to the species that rely on them. Marine animals can also become entangled in marine debris, or ingest it, which may lead to injury or death.

The bottom-feeding habits of sperm whales suggest that they could ingest marine debris (Lambertsen, 1997). One of 32 sperm whales examined for pathology in Iceland had a lethal disease thought to have been caused by the complete obstruction of the gut with plastic marine debris (Lambertsen, 1997). Given the limited knowledge about the impacts of marine debris on baleen whales, it is difficult to determine the extent of the threats that marine debris poses to these species.

Noise

Noise generated by human activity has the potential to affect listed species. This includes sound generated by commercial and recreational vessels, aircraft, commercial sonar, military activities, seismic exploration, in-water construction activities and other human activities. These activities all occur within the action area to varying degrees throughout the year. Marine mammals generate and rely on sound to navigate, hunt and communicate with other individuals. As a result, anthropogenic noise can interfere with these important activities. The effects of noise on marine mammals can range from behavioral effects to physical damage (Richardson et al., 1995).

Commercial shipping traffic is a major source of low frequency anthropogenic noise in (NRC, 2003). Although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships that includes significant levels above 2kHz, 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 for oil and gas deposits and for 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. In the United States, all seismic projects for oil and gas exploration and most research activities involving the use of airguns with the potential to take marine mammals are covered by incidental harassment authorizations under the MMPA.

Fishing Activities

Entrapment and entanglement in fishing gear is a frequently documented source of human-caused mortality in marine mammals (see Dietrich et al., 2007). Guadalupe fur seals have been found stranded with fish hooks and other evidence of fishing gear interaction along the California coast (Hanni et al., 1997). These entanglements also make animals more vulnerable to additional dangers (e.g., predation and ship strikes) by restricting agility and swimming speed. There is concern that many marine mammals that die from entanglement in commercial fishing gear tend to sink rather than strand ashore thus making it difficult to accurately determine the extent of such mortalities.

Marine mammals probably consume at least as much fish as is harvested by humans (Kenney et al., 1985). Therefore, competition with humans for prey is a potential concern for whales. The sperm whale's principle prey is large squid (Clarke et al., 1980; Clarke and Macleod., 1980; Clarke, 1996), but they will also eat large sharks, skates, and fishes (Clarke, 1977; Clarke, 1980; Rice, 1989). Reductions in fish populations, whether natural or human-caused, may affect listed whale populations and their recovery.

Sei whales consume a diverse set of prey which may allow them a greater opportunity to take advantage of variable resources (Waring et al., 2008). However, this attribute may also increase their potential for competition with commercial fisheries (Rice, 1977). Similarly, humpback and fin whales are known to feed on several species of fish that are harvested by humans and fishery-caused reductions in prey resources could also have an influence on these species (Waring et al., 2008). However, the extent of competition between humans and whales is not known.

Krill species are their principle prey of blue whales and are not commercially exploited on a large scale in the Northern Hemisphere. However, reduced zooplankton abundance due to habitat degradation is a potential indirect threat to these species.

Ship Strikes and Other Vessel Interactions

Ships have the potential to affect marine mammals through strikes and from noise and visual disturbance by their physical presence. Responses to vessel interactions include disturbance 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 listed species (Hoyt, 2001).

Ship strikes are considered a serious and widespread threat to marine mammals. 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 marine mammals is to be expected. For whales, studies show that the probability of fatal injuries from ship strikes increases as vessels operate at speeds above 14 knots (Laist et al., 2001).

However, ships moving at relatively slow speeds may be a threat as well. On Oct. 19, 2009 a ship mapping the seafloor off CA for NOAA reported a "a shudder underneath the[ir] ship" (NMFS unpublished data). A whale was spotted soon thereafter and was observed to be bleeding profusely. A dead 20m long blue whale was found washed up on Ft. Bragg beach in northern CA soon thereafter and was the apparent victim of a ship strike (Unpublished report from Fugro Pelacos, Inc. to NMFS). The vessel that struck the whale was only traveling at approximately 5.5 knots (NMFS unpublished data).

Twenty-one confirmed mortalities of large whales resulted from 42 confirmed ship strikes in the North Atlantic between the years of 2000-2004 alone (Cole et al., 2006). Fin whales are the most frequently struck whale, although right whales, humpback whales and sperm whales are also commonly struck (Laist et al., 2001). In some locations, one-third of all fin whale and right whale strandings appear to involve ship strikes (Laist et al., 2001).

Scientific Research

Marine mammals in the action area have been the subject of scientific research activities, as authorized by NMFS permits. Research in the action area has included biopsy sampling, close vessel and aircraft approaches, the collection of sloughed skin, tagging, active acoustic experiments and anatomical data gathering using ultrasound devices. No mortalities are authorized for any animal of any age. There are 32 permits authorizing research on one or more of the marine species listed to be taken by the proposed action. Fourteen of these permits are for research in the Atlantic and 18 are for research in the Pacific with one for both the Pacific and Atlantic Oceans. The following is a list of some currently authorized scientific research permits that have been issued for tagging or introducing sound into the marine environment that have similarities to those in the proposed action:

- Permit no. 981-1707 (Peter Tyack, Woods Hole Oceanographic Institute) involves research into the biology, foraging ecology, communication, and behavior of a variety of cetacean species in the North Atlantic and Mediterranean Sea, including endangered whales, with a focus on their responses to anthropogenic sounds in the marine environment. It recently ended in May 2009.

- Permit no. 731-1774 (Robin Baird, Cascadia Research) involves research on all cetacean species in the Pacific Ocean to study diving and nighttime behavior, population assessment, and social organization and inter-specific interactions of cetaceans. Research includes tagging and tracking using suction-cup attached tags. This permit extends through August 2010.

- Permit no. 1121-1900 (Brandon Southall, NOAA Science and Technology) authorized a behavioral response study of deep diving odontocetes in the Bahamas (AUTEC Range). This permit extends through January 2011.

- Permit no. 87-1851 (Daniel Costa, University of California at Santa Cruz) includes research on California sea lions (*Zalophus californianus*) in California to investigate foraging and diving behavior, energetics, food habits, and at sea distribution. This permit extends through January 2012.

- File number 14241 (Tyack, Woods Hole Oceanographic Institute) involves collecting data on vocal behavior critical for estimating how well passive acoustic monitoring can detect and estimate abundance for different cetacean species, by determining what characteristics of exposure to specific sounds evoke what responses in marine mammals near the Mediterranean Sea. This 5-year research effort is scheduled to commence July 2009 and extend through July 2014.

No authorized studies on these animals in are reported to have caused mortalities. Appendix A lists the permit holders, permit numbers, expiration dates and other information for all permits on these species.

<u>Conservation and Management Efforts</u>
Several conservation and management efforts have been undertaken for listed marine mammals in the action area. Recovery plans under the ESA help guide the protection and conservation of listed species and final plans are in place for the humpback whale (NMFS, 1991) and the blue whale (NMFS, 1998b). Recovery plans are in development for the sperm whale (NMFS, 2006) and the Fin Whale (NMFS, 1998a). NMFS implements conservation and management activities for these species through its Regional Offices and Fishery Science Centers in cooperation with states, conservation groups, the public, and other federal agencies.

In the Pacific, several conservation measures have been implemented to help reduce entanglements and other threats to marine mammals. These include placing observers aboard driftnet fishing vessels and those engaged in seismic activities. These observers record and monitor any takes of protected species. In addition, the Pacific Offshore Cetacean Reduction Plan has been implemented and, among other measures, requires the use of acoustic pingers to help repel marine mammals from fishing operations.

NMFS, in cooperation with the U.S. Coast Guard and the National Ocean Service's Channel Islands National Marine Sanctuary, has helped implement the broadcasting of speed advisories to vessels in the Santa Barbara Channel when blue whales are present. This effort is intended to lessen the possibility of ship strikes to blue whales, but will benefit other whale species as well.

Various efforts are underway with other Agencies and non federal entities to monitor and record the status of whale populations. The Structure Levels of Abundance and Status of Humpbacks (SPLASH) project is an international effort to understand the population structure of humpback whales in the North Pacific. In the North Atlantic, a similar effort called More North Atlantic Humpbacks (MoNAH) project seeks to population size of North Atlantic humpback whales that visit West Indian calving grounds. In addition, the status of other protected whale species is monitored by surveys conducted every three years.

Effects of the Proposed Action

Pursuant to Section 7(a)(2) of the ESA, federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Direct adverse effects of the permitted activities on listed species that are within the action area would include disruption of feeding, breeding, resting and other behaviors. Some displacement may result from these activities. The duration of the behavioral disruptions and displacements are expected to vary by species and type of disturbance.

In this section, we describe the potential physical, chemical, or biotic stressors associated with the proposed action, the probability of individuals of listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses of those individuals (given probable exposures) based on the available evidence. As described in the *Approach to the Assessment* section, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the listed species those populations represent. The purpose of this assessment is to determine if it is reasonable to expect the proposed studies to have effects on listed species that could appreciably reduce their likelihood of surviving and recovering in the wild.

For this consultation, we are particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences. The proposed permit would authorize non-lethal "takes" by harassment of listed species during activities. The ESA does not define harassment nor has NMFS defined the term pursuant to the ESA through regulation. However, the MMPA of 1972, as amended, defines harassment as any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal population in the wild or has the potential to disturb a marine mammal or marine mammal population in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [16 U.S.C. 1362(18)(A)]. The latter portion of this definition (that is, "...causing disruption of behavioral patterns including...migration, breathing, nursing, breeding, feeding, or sheltering") is almost identical to the U.S. Fish and Wildlife Service's regulatory definition of "harass"[5] pursuant to the ESA. For this Opinion, we define harassment similarly as an intentional or unintentional human act or omission that creates the probability of injury to an individual animal by disrupting one or more behavioral patterns that are essential to the animal's life history or its contribution to the population the animal represents.

Potential Stressors

The assessment for this consultation identified several possible stressors associated with the activities to be authorized under proposed permit: (1) potential boat strikes, (2) noise and visual disturbances while engaged in active acoustics, close approaches, photography, tracking, focal follows, passive recording, tagging and skin collection activities (3) effects from tagging, and (4) effects from recorded playback activities. The following section describes these stressors in greater detail, describes the probability of interactions then describes the probable responses of listed species based on the evidence available.

Response Analyses

As discussed in the *Approach to the Assessment* section of this Opinion, response analyses determine how listed resources are likely to respond after being exposed to an action's effects on the environment or directly on listed animals themselves. For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal, physiological or behavioral responses that might reduce the fitness of individuals. The proposed activities have the potential to produce disturbances that may affect listed marine mammals.

The responses by animals to human disturbance are similar to their responses to potential predators (Harrington and Veitch, 1992; Lima, 1998; Gill and Sutherland, 2001; Frid and Dill, 2002; Frid, 2003; Beale and Monaghan, 2004; Romero, 2004). These responses include interruptions of essential behavior and physiological processes such as feeding, mating, nursing, resting, digestion etc. This can result in stress, injury and increased

5 An intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3)

susceptibility to disease and predation (Frid and Dill, 2002; Romero, 2004; Walker et al., 2006).

Risks to listed individuals are measured in terms of changes to an individual's "fitness." Fitness is defined as the individual's growth, survival, annual reproductive success and lifetime reproductive success. When listed plants or animals exposed to an action's effects are not expected 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 (Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). As a result, if the assessment indicates that listed plants or animals are not likely to experience reductions in their fitness, we conclude our assessment. If possible reductions in individuals' fitness are likely to occur, the assessment considers the risk posed to populations to which those individuals belong, and then to the species those populations represent.

The proposed actions may expose listed species to disturbance from boat based survey and tagging activities. Playback experiments actions also have the potential to disturb listed species. These activities have the potential to harass, wound, injure, or kill listed individuals. In addition, these animals may undergo changes in behavior in response to disturbances from the proposed activities. Table 2 identifies the combined proposed takes to listed species.

All of the proposed activities require that investigators closely approach listed whales by boat. This creates the possibility of vessels striking an animal. In addition, tagging requires direct physical contact with target individuals. These activities have the potential to wound, injure, or kill listed whales. Indirect effects are also expected to listed animals that are exposed to boat, sonar and playback experiments. These animals may undergo changes in behavior in response to disturbances from these proposed activities.

Table 2. Combined Proposed "Takes" to Listed Species from the Proposed Activities over the Duration of the Proposed Permit (Five Years).

SPECIES	Number of Takes Allowed under the Proposed Permit	
	Annual	Total over Five Years
Sperm Whale	296	1480
Humpback Whale	2	10
Blue Whale	452	2260
Sei Whale	6	30
Fin Whale	588	2940
Guadalupe Fur Seal	5	25

<u>Noise and Visual Disturbance and Boat Strikes</u>

The proposed close approaches, photography, tracking, focal follows, passive recording, tagging activities and skin collections can cause noise and visual disturbance to listed species and give rise to the possibility for ship strikes. Animals of both sexes and of all age groups are proposed to be tracked, and approaches of as close as three meters may be made after visual contact is established. The proposed tracking activities also involve the use of sonar which also has the potential to disturb listed species from the noises emitted. During focal follows whales are proposed to be video-recorded and photographed. These focal follows would be conducted at distances of as less than 10m from the target animals.

Marine mammals exhibit a variety of responses to noise and visual disturbances from boat based human activities such as the proposed close approaches. These include short-term changes in swimming and feeding behaviors, as well as diving and staying submerged for longer periods of time (Watkins et al., 1981; Malme et al., 1984; Richardson et al., 1985; Baker and Herman., 1987; Brown et al., 1991; Clapham and Mattila, 1993; Jahoda et al., 1997; Patenaude et al., 2002; Best et al., 2005). Pinnipeds such as Guadalupe fur seals react to such disturbances by exhibiting an escape response (Richardson et al., 1995). These responses create additional energy expenditures that result in animals incurring an energy debt that must be compensated for by increased foraging. This can further interrupt normal behavior. Individually and collectively, these disturbances can adversely affect already imperiled individuals and populations.

Expected Responses to Noise and Visual Disturbance and Potential Boat Strikes

Marine mammals often display great tolerance to boat traffic (Richardson et al., 1995). Although some startle reactions have been observed in sperm whales upon close approaches (Whitehead et al., 1990), reactions to boat activities are usually minor when small vessels operate non-aggressively such as is proposed for the activities considered here (Papastavrou et al., 1989). Similarly, a study involving the close approaches of research vessels to humpback whales showed that responses were minimal when approaches were slow (Clapham and Mattila, 1993). These behavioral changes, if they even occurred, were short lived (Clapham and Mattila, 1993). Watkins (1986) found that several species of baleen whales simply ignored weak vessel noises altogether. Because any reactions to close approaches are expected to be minor and temporary, and because investigators will employ mitigation measures such as ceasing tagging attempts after three unsuccessful close approaches and conducting such approaches slowly, deliberately, and for as short a time as necessary, any reduction to fitness to any animal is unlikely to occur as a result of these activities.

While Guadalupe fur seals may exhibit an escape response in response to these disturbances, the severity of these reactions is variable (Calkins and Pitcher, 1982). A major concern for pinnipeds responding to vessel disturbance is trampling and pup abandonment from evacuating rookeries and haulouts (see Johnson, 1977). These severity of these reactions is variable and can range from complete evacuation of haulout areas to no reaction at all (Calkins and Pitcher, 1982). The proposed activities are oceanic in nature and will not affect animals in haulouts or in rookeries so these responses are unlikely. Any disturbances that would result from the proposed activities would be to swimming Guadalupe fur seals and should be brief and not have long-term consequences to any animal.

Noise and visual disturbances to listed marine mammals that would result from the proposed activities are expected to be minor and short lived. Actions will be terminated if target animals are observed to display unusual behavior, aggravation or distress. In addition, no mortality or physical injury to any animal is expected as a result of these proposed activities. Therefore, based on the proposed mitigation measures and the fact that these species are not likely to significantly alter their behavior or physiology as a result of these disturbances, no reduction in the fitness of any listed animal is expected from noise or visual disturbance from the proposed activities.

The proposed echosounders for prey mapping are of the type routinely used for fisheries surveys by NMFS and other agencies and investigators. These sonar systems are used widely on recreational and commercial vessels. They use high operating frequencies, low power, narrow beam patterns, and short pulse lengths (NRC, 2003). Frequencies for the model proposed to be used range between 38 and 120 kHz, and are well above the expected upper limit of hearing of baleen whales (see Southall et al., 2007).

While it is possible that sperm whales could hear these noises, there is no evidence that short pulses at this frequency adversely affect this species. In fact, sperm whales have been observed to show no reaction when exposed to transponders that produced 7 msec pings at 36 kHz at a level of 180 dB (Watkins and Tyack, 1991). These noise pulses were much longer than those expected for the proposed echosounders. In addition, the areas that would be affected would likely be very small due the high attenuation of the low power and high frequency sounds used. Therefore, any risks that the proposed use of this sonar may pose to listed species are discountable.

There is a potential for boat strikes to listed species resulting from the proposed activities. However, because of the small size, maneuverability and slow operating speeds of the RHIBs proposed to be employed in these activities, boat strikes are extremely unlikely. The whale observation and playback vessels are not likely to interact with marine mammals because observers are constantly and purposely on the lookout for them. As a result, no reduction in the fitness of any individual listed animal is expected as a result of these proposed activities.

Tag Attachment

Up to 300 sperm whales, 500 blue whales and 500 fin whales are proposed to be tagged over the duration of the permit. All tags are proposed to be attached by using a hand-held carbon fiber pole several meters in length from 3-5m vessels or by using a >12m cantilevered pole deployed from a medium sized RHIB. These activities have the potential to injure listed species as well as harass them via the process of approaching and tagging as well as from the effects that the tags themselves have on the target animals while attached.

Target animals are proposed to be fitted with DTAG2s to measure received sound exposure, animal vocalizations, behavior and physiology. The tags are designed to be attached to an animal for relatively short periods of time. The tags are attached via suction cups made from medical grade silicone. Suction cups are disinfected prior to attachment to avoid possible infection or disease transfer. The dimensions of the tags are approximately 20 cm x 10 cm x 4 cm for the tag in its fairing housing.

Bio-Probes (BProbes) are also proposed to be attached to target animals. The BProbes record calibrated acoustic pressure, temperature, depth, acceleration, and body orientation of the tagged animals. These tags are approximately 33 cm long and 6 cm in diameter. They are equipped with a flotation device and VHF transmitter to allow for recovery after detachment from the whale. Attachment of the BProbes will be via suction cups similar to those proposed for the DTAG2.

Tags similar to the proposed DTAG2s and BProbes have been used successfully in numerous past studies on both toothed and baleen whales and other marine mammals (see Burgess et al., 1998; Johnson et al., 2004; Tyack et al., 2006; Watwood et al., 2006). The investigators note that in their experience with these types of tags on large whales, the behavior of tagged animals has not been observed to be significantly affected.

Expected Responses to Tag Attachment

Suction-cup tags have been deployed multiple times in the past on blue, humpback, fin and sperm whales as well as other species for the attachment of various instruments. The suction-cup attachment method is non invasive and the duration of the attachment is limited. The tagging protocol involves careful observation of potential behavioral reactions to the approach of the tagging vessel and to the actual tag attachment. Attempts to tag will be terminated if the animal shows any adverse reactions or after the third failed attachment attempt. Observations will be made and recorded of the target animal's behavior during approaches and tag attachment, as well as after the tags have detached.

Few studies have investigated the effects of tagging on cetaceans and the available data are often limited to visual assessments of behavior (Walker and Boveng, 1995). To further complicate matters, reactions to tagging are difficult to differentiate from reactions to the close vessel approaches necessary to ensure proper tag placement. Evidence available on the short-term effects of tagging whales indicates that responses vary from little or no observable change in behavior to momentary changes such as skin twitching, startle reactions, altered swimming, diving, rolling, head lifts, high back arching and tail swishing (Goodyear, 1981; Watkins, 1981b; Watkins et al., 1984; Goodyear, 1989; Goodyear, 1993; Mate et al., 1997; Mate et al., 1998; Hooker et al., 2001). Rarely, aerial displays like breaching are also noted (Goodyear, 1989). Behavioral responses are usually short-term (Mate et al., 2007), and possibly dependant on the animal's behavioral state at the time of tagging (Hooker et al., 2001). Observed reactions to tagging include disturbances in foraging and diving behavior soon after the tag attachment (see Jochens et al., 2006).

Davis et al. (2007) tagged sperm whales with barbed attachments and observed reactions of tail strokes and shallow dives but researchers noted no unusual behaviors or aggression to the tagging vessel. Sperm whales tagged with suction cups (similar to those proposed) exhibited a high rate of breaching (Palka and Johnson., 2007). Jochens et al. (2003) analyzed the behavior of suction cup sperm whales during foraging dives. The behavior during the first dive differed significantly from subsequent dives and the researchers attributed the difference to the tag operation.

Although there is evidence of minor short-term effects on tagged whales, no research has been done to assess long-term impacts of these activities. However, Goodyear (1989) observed that humpback whales did not appear to exhibit altered behavior monitored several days after being suction-cup tagged. In addition, Mate et al. (2007) observed that tagged whales re-sighted up to three years later did not appear to be affected or to behave differently than untagged whales.

Although these tags would create drag, the proportion of this tag to a whale's size and weight is such that any drag effects would be insignificant. Tags are not expected to significantly alter the long-term behavior of any animal. In addition, investigators must exercise caution when approaching animals and immediately terminate activities if the animals appear to be adversely affected by the activities.

The proposed tagging activities are not likely to result in injuries to any listed animal. Tag attachment is expected to only change a whale's short-term behavior and these disruptions are not expected to lead to the reduction in fitness of any individual animal. Any effects of the proposed tagging activities are therefore discountable.

Playback Experiments

Five hundred sperm whales, 200 blue whales and 300 fin whales are proposed to be directly taken by targeted playback exposures. Other listed animals may also be exposed to playback sounds. The synthetic MF noises simulating sonar or pseudorandom sounds would be between 1.5 and 5 kHz and are proposed to be 0.5-5 seconds in length, transmitted every 20-60 seconds. Simulated sonar playbacks are expected to affect listed marine mammals because these noises are within their assumed hearing ranges. Simulated killer whale vocalizations may be transmitted over a larger bandwidth (1-20 kHz) for up to 30 minutes. Simulated killer whale vocalization playback noises are also expected to affect listed marine mammals.

Anthropogenic sounds can disturb or harm marine mammals in several ways. For example, whales have been observed to abandon feeding and mating grounds (Bryant et al., 1984; Morton and Symonds, 2002; Weller et al., 2002), deviate from migration routes (Richardson *et al.* 1995), and change vocalizations because of manmade noise (Miller et al., 2000). Sonar exposures have been directly correlated with mass stranding events (Cox et al., 2006). Acoustic exposures can also result in induced hearing loss in marine mammals (Finneran et al., 2002). In addition to direct physiological effects, noise exposures can impair marine mammals' hearing abilities through "masking" or result in other adverse behavioral responses. Although the proposed experiments would be targeted specifically to whales, Guadalupe fur seals occur in the action area and could be exposed.

Expected Responses to Playback Experiments

Auditory Injury

Playbacks are designed to avoid sound levels that could cause hearing damage. The maximum received level of 180 dB would be used for playback signals which should avoid any potential for injury to marine mammals (after Southall et al., 2007). Exposures of target animals to playbacks would be limited to the shortest duration required to elicit identifiable behavioral reactions. The playback subjects will be followed after exposure to monitor for their return to baseline behavior and playback protocols will be modified if there is any evidence of longer term changes. A margin of error for safety will be added to account for the possibility that the acoustic models used to predict received level at the animal are not always correct. This margin of error will be determined and validated by comparing estimated levels to received levels measured during the course of the playback experiments.

If there is any sign of prolonged responses that might pose a risk of injury, playbacks will be suspended. No animal will be taken more than two times in one day by intentional exposure to playbacks. A playback episode must be discontinued if an animal exhibits a strong adverse reaction to the playback activity or the vessels. Given the control over the single sound source, the precautions taken by the researchers and mitigation procedures in the permit, injuries from the proposed playback experiments are not expected. These risks are discountable.

Behavioral and Stress Responses

The responses of marine mammals to anthropogenic noise and killer whale playback experiments are variable. For target and nontarget listed whales and Guadalupe fur seals, responses to playback experiments could incur a physiological cost by disrupting normal behavior and result in additional energy expenditure. Sperm whale clicking and behavior has been observed to be disrupted by sonar noise. Sperm whales have been observed to frequently stop echolocations in the presence of these noises (Watkins and Schevill, 1975). Watkins and Schevill (1975) showed that sperm whales interrupted click production in response to pinger sounds (6 to 13 kHz). Sperm whales have also been observed to react to military sonar by dispersing from social aggregations, moving away from the sound source, remaining relatively silent and becoming difficult to approach (Watkins et al., 1987).

Other studies identify instances in which sperm whales did not appear to respond to anthropogenic sounds (Madsen and Mohl, 2000). Andre et al. (1997) exposed sperm whales to a variety of sounds to determine what sounds may be used to scare whales out of the path of vessels and observed sperm whales to have startle reactions to 10 kHz pulses at 180 dB source levels, but not to the other sources played to them. Another study indicated that sperm whales continued to call when exposed to pulses from a distant seismic vessel at levels of up to 146 dB (Madsen et al., 2002). Similarly, the distribution or behavior of sperm whales was not observed to change at various distances from an active seismic program (McCall Howard, 1999). The results from these studies suggest that some sperm whales tolerate seismic surveys and that any behavioral responses that do occur are temporary.

The possible responses of listed baleen whales to anthropogenic noises similar to those being proposed for playback experiments are less well known. Blue whales have been observed to continue vocalizing at the same rate as before exposure to airgun pulses, suggesting that behavior was undisturbed by the sound (McDonald et al., 1993). However, meta-analysis of combined study data from all years by Stone (2003) indicated that baleen whales altered their course more often, and were headed away from the vessel more frequently during periods of acoustic and seismic activities.

Humpback whales responded to sonar in the 3.1–3.6 kHz range by swimming away from the sound source or by increasing their speed (Maybaum, 1993). However, the frequency and duration of their dives and the rate of underwater vocalizations did not change. In a controlled exposure experiment involving low frequency active sonar sound, humpback whales responded with longer songs when the playback noises were louder (Fristrup et al., 2003).

There are numerous studies on the responses of pinnipeds to playback experiments noises. These responses include diving to avoid detection and are stronger when pinnipeds are exposed to playback calls from killer whales (Deeke et al., 2002; Deeke, 2006). This occurs presumably because the sounds are unfamiliar, or are perceived as a threat (Deeke et al., 2002).

The behavioral responses to anthropogenic noise are variable. Although marine mammals elicit a variety of responses to anthropogenic noises at the frequencies and levels proposed for this action, these responses are short lived and do not appear to affect the long-term health of any individual animal. In addition, the proposed mitigation measures listed above further ensure that any response by marine mammals to these noises will be minor. Any behavioral responses to the proposed activities are not expected to adversely affect the fitness of any individual listed species. These effects are therefore discountable.

Acoustic Masking

Marine mammals use acoustic signals for a variety of purposes, which differ among species, but include communication, navigation, foraging, and reproduction (Erbe and Farmer, 2000; Tyack, 2000). Auditory masking occurs when the interfering noise is louder than, and of a similar frequency to, the auditory signal produced or received by the affected animal. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals or entire populations.

For whales, the potential impacts that masking may have on individual survival and the energetic costs of changing behavior to reduce masking are poorly understood. A long-term study of odontocetes suggests that these animals may change their vocal behavior once background noises reach a threshold level (Foote et al., 2004). For baleen whales, the frequencies of the noises from the proposed sonar systems are well above the expected upper limit of hearing of baleen whales (see Southall et al., 2007), but these species are subject to masking effects from the lower frequency noises produced by the playback experiments and from the boats used in the proposed activities (Clark et al., 2009; Dunlop et al., 2010).

Most masking studies on pinnipeds have measured captive animals' ability to detect signals at a single frequency in the presence of broadband background masking noise (Southall et al., 2000). These studies demonstrated that acoustic masking was correlated with behavior changes such as producing more calls, longer calls, or shifting the frequency of the calls.

While acoustic masking in listed marine mammals is possible from the proposed activities, the low sound levels and short durations of these noises should reduce the possibility of these events and reduce their severity should they occur. Any interruptions in behavior due to acoustic masking are expected to be temporary and minor and not to have significant impacts on the fitness of any listed animal. The effects of acoustic masking to listed species from these proposed activities are therefore discountable.

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 in this Opinion. Future Federal actions, including research authorized under ESA Section 10(a)1(A), 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. After reviewing available information, NMFS is not aware of effects from any additional future non-federal activities in the action area that would not require federal authorization or funding and are reasonably certain to occur during the foreseeable future.

NMFS expects the natural phenomena in the action area (e.g., oceanographic features, storms, and natural mortality) will continue to influence listed whales as described in the *Environmental Baseline*. We also expect current anthropogenic effects will also continue, including the introduction of sound sources into marine mammal habitat, changes in prey availability, vessel traffic and scientific research. Potential future effects from climate change on marine mammals in the action area are not definitively known. However, climatic variability has the potential to affect these species in the future, including indirectly by affecting prey availability.

As the size of human communities increase, there is an accompanying increase in habitat alterations resulting from an increase in housing, roads, commercial facilities and other infrastructure. This results in increased discharge of sediments and pollution into the marine environment. These activities are expected to continue to degrade the habitat of marine mammals as well as that of the prey on which they depend.

Integration and Synthesis of Effects

The following text integrates and synthesizes the *Status of the Species*, the *Environmental Baseline* and the *Effects of the Action* sections of this Opinion. This information, in addition to the known cumulative effects, is used to assess the risk the proposed activities pose to listed species.

As explained in the *Approach to the Assessment* section, risks to listed individuals are measured using changes to an individual's "fitness." When listed plants or animals exposed to an action's effects are not expected 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 (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000).

When individual, listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions can reduce the abundance, reproduction, or growth rates of the populations that those individuals represent (see Stearns, 1992). If we determine that reductions in individual plants' or animals' fitness reduce a population's viability, we consider all available information to determine whether these reductions are likely to reduce the viability of any species as a whole.

The proposed issuance by PR1 of scientific research Permit No. 14534 would authorize direct "takes" of sperm whales, humpback whales, blue whales, sei whales, fin whales and Guadalupe fur seals primarily in the U.S. Navy's SOCAL Range Complex, Southern California offshore waters and in the U.S. Navy Hawaii Range Complex. The proposed activities under this permit include active acoustics, passive acoustic monitoring, close approaches, tagging and the collection of sloughed skin. The permit would be valid for five years and allow for total "takes" of 1480 North Atlantic sperm whales, 10 humpback whales, 2260 blue whales, 30 sei whales, 2940 fin whales and 25 Guadalupe fur seals.

<u>Current and Historic Stressors</u>
The current and historic stressors to these species are detailed in the *Environmental Baseline* section of this Opinion. These stressors include natural mortality, depletion of populations due to overharvesting, depletion of prey, pollution, noise, fishing interactions, ship strikes, vessel interactions and scientific research. Of these factors, overharvesting has greatly contributed to the decline of these species.

Sperm whale populations have been depleted heavily due to commercial whaling worldwide. Commercial whaling has also depleted worldwide humpback whale numbers, but populations have increased since whaling was banned in 1966 (Reilly, 2008). The IUCN estimated an approximate 50% decline in blue, fin and sei whales worldwide over the last 75 years when commercial whaling was widely practiced (Reeves et al., 2003). Guadalupe fur seals were hunted to near extinction by the late 1800s (Townsend, 1931). They were believed to be extinct until two adult males were captured on Guadalupe Island in 1928 (Townsend, 1931).

Possible Stressors from the Proposed Activities

The assessment for this consultation identified several possible stressors associated with the activities to be authorized under proposed permit: (1) potential boat strikes, (2) noise and visual disturbances generated by research boats and human presence while engaged in close approaches, photography, tracking, focal follows, passive recording, tagging activities and skin collection activities (3) effects from tagging, and (4) effects from recorded playback activities. For this consultation, we are particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences.

Expected Responses to Stressors from the Proposed Activities

As explained in the *Response Analyses* section of this Opinion, because of their small size and maneuverability, boat strikes are extremely unlikely and therefore discountable. Noise and visual disturbances that would result from the proposed activities are expected to be brief and not to have any long-term consequences to individual listed animals or the populations or species that they comprise. Proposed tagging procedures will be non-invasive and will incorporate several mitigation procedures to limit harassment. Any behavioral responses to tagging activities are expected to be minor and temporary and any effects from these activities are therefore discountable. Any behavioral responses to listed species resulting from playback experiments are also expected to be minor and temporary and therefore also discountable.

Conclusion

After reviewing the current status of species; the environmental baseline for the action area; the anticipated effects of the proposed activities; and the cumulative effects, it is the NMFS' Opinion that the activities authorized by the proposed issuance of scientific research permit No. 14534, as proposed, are not likely to jeopardize the continued existence of endangered sperm, humpback, sei, fin or blue whales, or threatened Guadalupe fur seals under NMFS' authority. Critical habitat that occurs within the action area is not expected to be affected by the proposed activities.

Incidental Take Statement

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA 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 NMFS 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. 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 Sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. However, as discussed in the accompanying Opinion, only the species permitted in the proposed research activities will be significantly harassed as part of the intended purpose of the proposed action. Therefore, the NMFS does not expect the proposed action will incidentally take additional threatened or endangered species.

Conservation Recommendations

Section 7(a) (1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA 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.

We recommend the following conservation recommendations, which would provide information for future consultations involving the issuance of marine mammal permits that may affect endangered whales as well as reduce harassment related to authorized activities:

1. *Cumulative Impact Analysis*. The Permits Division should work with the Marine Mammal Commission, International Whaling Commission, and the marine mammal research community to identify a research program with sufficient scope and depth to determine cumulative impacts of existing levels of research on whales. This includes the cumulative sub-lethal and behavioral impacts of research permits on listed species.

2. *Estimation of Actual Levels of "Take."* For future permits authorizing activities similar to those contained in the proposed permit, the Permits Division should continue to review all annual and final reports submitted by investigators that have conducted such research as well as any data and results that can be obtained from the permit holders. This should be used to estimate the amount of harassment that occurs given the level of research effort, and how the harassment affects the life history of individual animals. The results of the study should be provided to the endangered Species Division for use in the consultations on future research activities.

3. *Assessment of Permit Conditions*. The Permits Division should periodically assess the effectiveness of its permit conditions, including those for notification and coordination of research.

4. *Data Sharing*. For any permit holders planning to be in the same geographic area during the same year, the Permits Division should encourage investigators to coordinate their efforts by sharing research vessels and the data they collect as a way of reducing duplication of effort and the level of harassment threatened and endangered species experience as a result of field investigations.

In order for NMFS' endangered Species Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, listed species or their habitats, the Permits Division should notify the endangered Species Division of any conservation recommendations they implement in their final action.

Reinitiation Notice

This concludes formal consultation on the proposal to issue scientific research permit No. 14534. As provided 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) 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; (2) 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 (3) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, NMFS' Permits, Conservation and Education Division must immediately request reinitiation of section 7 consultation.

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Appendix A. Active NMFS Scientific Research Permits Authorizing Take of Target Species.

Permit No.	Holder	Expiration Date	Ocean Basin	Species Authorized
655-1652-01*	Kraus	1/31/2010	Atlantic Ocean	North Atlantic right whales
633-1763-01	Center for Coastal Studies	5/1/2010	Atlantic Ocean	North Atlantic right whales
1036-1744	DiGiovanni	5/1/2010	Atlantic Ocean	North Atlantic right, sei, blue, fin, and humpback whales
594-1759	Georgia DNR	5/1/2010	Atlantic Ocean	North Atlantic right whales
1121-1900	NOAA S & T	1/1/2011	Atlantic Ocean	humpback, fin and blue whales
948-1692	Pabst	5/31/2011	Atlantic Ocean	humpback, fin, sperm, and North Atlantic right whales
633-1778-01	Center for Coastal Studies	6/30/2011	Atlantic Ocean	humpback, fin, sei, blue, and sperm whales
1058-1733	Baumgartner	5/31/2012	Atlantic Ocean	humpback, fin and sei whales
775-1875	NMFS, NEFSC	1/15/2013	Atlantic Ocean	sperm, blue, sei, fin, humpback and North Atlantic right whales
605-1904	Whale Center of New England	2/15/2013	Atlantic Ocean	humpback, fin, and sei whales
1128-1922	Mercado	1/15/2014	Atlantic Ocean	Humpback whales
779-1633-01*	NMFS, SEFSC	**until new permit is issued	Atlantic Ocean	blue, fin, sei, humpback, sperm and North Atlantic right whales
369-1757	Mate	5/31/2010	Atlantic & Pacific Oceans	In both oceans: humpback, fin, sperm and blue whales
1071-1770-02	The Dolphin Institute	6/30/2010	Pacific Ocean	humpback, sperm, fin and blue whales
731-1774-05	Baird	8/31/2010	Pacific Ocean	sei, fin, blue, humpback, and sperm whales
540-1811-02	Calambokidis	4/14/2011	Pacific Ocean	blue, humpback, fin, sei, and sperm whales
781-1824	NMFS, NWFSC	4/14/2011	Pacific Ocean	blue, fin, humpback, and sperm whales
727-1915	Scripps Institute of Oceanography	2/1/2013	Pacific Ocean	blue, fin, sei, humpback, and sperm whales

Permit No.	**Holder**	**Expiration Date**	**Ocean Basin**	**Species Authorized**
1127-1921	Hawaii Marine Mammal Consortium	6/30/2013	Pacific Ocean	humpback, blue, fin, sei and sperm whales
782-1719-09*	NMFS, NMML	6/30/2010	Pacific Ocean	humpback, blue, fin, sei, and sperm whales
774-1714-10*	NMFS, SWFSC	6/30/2010	Pacific Ocean	sei, blue, fin, sperm, and humpback whales
473-1700-02*	Jan Straley	6/30/2010	Pacific Ocean	humpback, fin and sperm whales
1120-1898	Eye of the Whale	7/31/2012	Pacific Ocean	humpback whales
1049-1718*	Kate Wynne	6/30/2010	Pacific Ocean	humpback, fin, sperm and sei whales
1039-1699*	Ann Zoidis	6/30/2010	Pacific Ocean	humpback whales
10018	Rachel Cartwright	6/30/2013	Pacific Ocean	humpback whales
716-1705-01*	Fred Sharpe	6/30/2010	Pacific Ocean	humpback whales
1128-1922	Mercado	1/15/2014	Atlantic Ocean (Puerto Rico)	Humpback whales
909-1726	Englehaupt	6/30/2010	Atlantic Ocean	sperm whales
10074	Michael Etnier	11/01/2012	Pacific Ocean	seal, Guadalupe fur
13583	NMFS, NMML	01/01/2014	Pacific Ocean	seal, Guadalupe fur
14301	University of Alaska	12/31/2014	Pacific Ocean	seal, Guadalupe fur

*Permits operating under a one-year extension in which no additional takes were authorized between 2009 and the expiration date in 2010.
**The SEFSC has been granted an extension of their current permit while the new application is processed.