National Marine Fisheries Service

Endangered Species Act Section 7 Consultation

Biological Opinion

Agency:	**Permits and Conservation Division of the Office of Protected Resources, National Marine Fisheries Service**
Activity Considered:	**Proposal to issue permit No. 16388 to Mark Baumgartner of Woods Hole Oceanographic Institution, who would conduct scientific research on baleen whales in the North Atlantic, North Pacific, and Arctic Oceans, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973**
Prepared by:	**Endangered Species Act Interagency Cooperation Division of the Office of Protected Resources, National Marine Fisheries Service**
Approved by:	
Date:	APR 15 2013

Section 7(a)(2) of the Endangered Species Act (ESA; 16 U.S.C. 1536(a)(2)) requires each Federal agency to insure 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 designated critical habitat, that agency is required to consult with the National Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service, depending on the species that may be affected.

In this instance, the Permits and Conservation Division of NMFS ("Permits Division," the action agency) consulted with the Endangered Species Act Interagency Cooperation Division of NMFS (the consulting agency) on the former's issuance of a scientific research permit (the action) to Mark Baumgartner of Woods Hole Oceanographic Institution (the applicant or researcher). This Biological Opinion ("Opinion") is the result of our consultation with the Permits Division regarding their issuance of scientific research permit No. 16388.

We, the Endangered Species Act Interagency Cooperation Division, prepared this Opinion in accordance with Section 7 of the ESA and its regulations (50 CFR Part 402). We based our Opinion on information provided in the research permit application, the draft permit, and the environmental assessment. We also reviewed published and unpublished scientific data, recovery plans, and other sources of information.

The format of this Opinion is as follows. After a brief history of the consultation, we describe the proposed action and the area in which it will occur (i.e., *Action Area*). In the *Status of the Species* section, we document which listed species occur in the action area. We identify which, if any, listed species are not likely to be adversely affected and can be eliminated from further consideration. For species that are likely to be adversely affected by the action, we provide the background information required to assess the action's impact on their continued survival. In the *Environmental Baseline* section, we review past and present activities that have affected these species, specifically in the action area. These summaries serve as the context for the *Effects of the Proposed Action* section, in which we consider the species' exposure and

responses to stressors caused by the action. In the *Risk Analyses* section, we determine whether activities that adversely affect listed individuals are likely to reduce their fitness and, in turn, diminish the viability of the population(s) and species they represent. In addition, we consider the *Cumulative Effects* of future state or private activities that are reasonably certain to occur in the action area. We integrate all information in a final synthesis and use this to arrive at our conclusion: whether the Federal agency has insured that their action is not likely to jeopardize listed species or destroy/adversely modify critical habitat. We end with the following sections: *Incidental Take Statement*, *Conservation Recommendations* and *Reinitiation Statement*.

CONSULTATION HISTORY

On June 26, 2007, the Permits Division issued scientific research Permit No. 1058-1733 to the Mark Baumgartner of Woods Hole Oceanographic Institution, to perform research on baleen whales in the North Atlantic, North Pacific and Antarctic Oceans. Section 7 consultation determined that this action was not likely to jeopardize ESA listed species or adversely modify their critical habitat. The permit was amended on November 16, 2009, to authorize the use of suction-cup and dermal attachment tags. On July 17, 2012, the Permits Division requested consultation on the new scientific research permit, No. 16388. We initiated consultation on July 17, 2012.

DESCRIPTION OF THE PROPOSED ACTION

The Permits Division proposes to authorize a 5 year, scientific research permit, pursuant to Section 10(a)(1)(A) of the ESA and the Marine Mammal Protection Act (MMPA, 16 U.S.C. 1361). Permit No. 16388 would authorize the passive acoustic recording, instrumentation, behavioral observation, photo identification, tracking, and incidental harassment of baleen whales species in the North Pacific (Table 1), North Atlantic (Table 2), Arctic (Table 3), and Canada (Table 4).

Table 1. Permitted activities and maximum annual takes, California to Alaska, under Permit No. 16388.

SPECIES	LIFESTAGE	SEX	EXPECTED TAKE	PROCEDURES
Whale, blue	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, blue	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, blue	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, blue	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, blue	All	Male and Female	800	Incidental harassment
Whale, fin	All	Male and Female	800	Incidental harassment

Whale, fin	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, fin	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, fin	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, fin	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, gray	All	Male and Female	800	Incidental harassment
Whale, gray	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, gray	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, gray	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, gray	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, humpback	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, humpback	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, humpback	All	Male and Female	800	Incidental harassment
Whale, humpback	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, humpback	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, right, North Pacific	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking

Whale, right, North Pacific	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, right, North Pacific	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, right, North Pacific	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, right, North Pacific	All	Male and Female	800	Incidental harassment
Whale, sei	All	Male and Female	800	Incidental harassment
Whale, sei	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, sei	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, sei	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, sei	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking

Table 2. Permitted activities and maximum annual takes, Florida to Maine, under Permit No. 16388.

SPECIES	LIFESTAGE	SEX	EXPECTED TAKE	PROCEDURES
Whale, blue	All	Male and Female	800	Incidental harassment
Whale, blue	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, blue	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, blue	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, blue	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking

Whale, fin	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, fin	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, fin	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, fin	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, fin	All	Male and Female	800	Incidental harassment
Whale, humpback	All	Male and Female	800	Incidental harassment
Whale, humpback	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, humpback	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, humpback	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, humpback	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, right, North Atlantic	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, right, North Atlantic	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, right, North Atlantic	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, right, North Atlantic	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, right, North Atlantic	All	Male and Female	800	Incidental harassment

Whale, sei	All	Male and Female	800	Incidental harassment
Whale, sei	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, sei	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, sei	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, sei	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking

Table 3. Permitted activities and maximum annual takes, Arctic Ocean, under Permit No. 16388.

SPECIES	LIFESTAGE	SEX	EXPECTED TAKE	PROCEDURES
Whale, bowhead	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	All	Male and Female	800	Incidental harassment
Whale, gray	All	Male and Female	800	Incidental harassment
Whale, gray	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, gray	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, gray	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking

Whale, gray	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking

Table 4. Permitted activities and maximum annual takes, Canada, under Permit No. 16388.

SPECIES	LIFESTAGE	SEX	EXPECTED TAKE	PROCEDURES
Whale, bowhead	Adult/ Juvenile	Male and Female	60	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	Calf	Male and Female	10	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	Adult	Female	20	Acoustic, passive recording; Instrument, suction-cup (e.g., VHF, TDR); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	Adult/ Juvenile	Male and Female	45	Acoustic, passive recording; Instrument, implantable (e.g., satellite tag); Observations, behavioral; Photo-id; Tracking
Whale, bowhead	All	Male and Female	800	Incidental harassment

Acoustic, passive recording

The researchers would deploy passive acoustic monitoring equipment from their vessel. The equipment would include one or more of the following instruments: towed linear arrays of hydrophones, single hydrophones, compact 4-hydrophone bearing arrays, and regular or broadband sono-buoys.

Instrumentation

The researchers would launch a small boat from the larger research vessel. It would approach a whale to within a few meters. The researchers would use a hand-held, 9 m long pole to attach a suction-cup instrument to the whale; they would use a compressed-air launcher to inject the implantable instrument. They would place the instrument at least 1.5 m posterior to the blowholes; the tag would never be attached near or anterior to the blowholes or to the flippers or the flukes.

Suction cup

The suction-cup tag would include a time-depth recorder (Wildlife Computers), pitch and roll sensor (Star Oddi), a 36 kHz acoustic transmitter (Vemco), a VHF radio transmitter (Telonics), and syntactic foam floatation to allow recovery of the tag at the sea surface after detachment. The portion of the tag in contact with the whale (i.e., the suction cup) would be roughly 9.7 cm in diameter. The tag would be 10-12 cm high and weigh approximately 500 g in air. After 1-3 hours, a corrosive foil release would cause the suction cup to be flooded with seawater and detach from the whale.

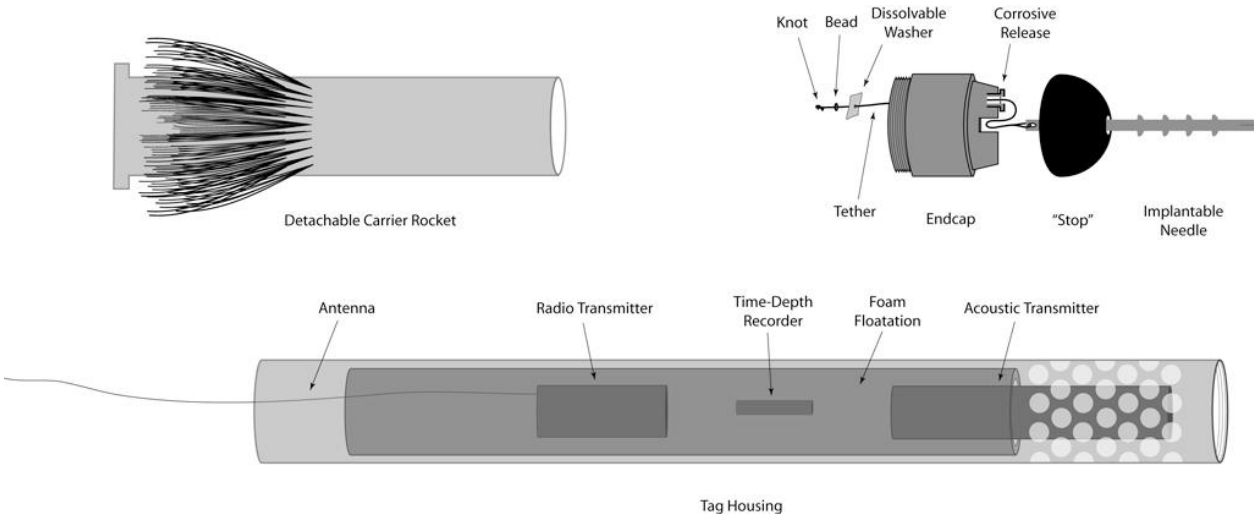
Implantable/dermal

The researchers would use one of two implantable dermal attachment instruments (Fig. 1). The first would consist of a 36 kHz acoustic transmitter (Vemco), a time-depth recorder (Lotek), a VHF radio transmitter (Telonics), and PVC foam floatation housed in a 42.5 cm long and 3.7 cm diameter polyethylene pipe (Figure 1). The pipe freely floods to allow accurate depth sensing by the time-depth recorder and effective acoustic transmission from the acoustic transmitter. The total tag weight is approximately 250 g in air. The tag is designed to be a contiguous projectile when launched, but after attachment, the tag housing

would disconnect from the needle such that it is free to float parallel to the whale's skin while still attached to the needle by the severable wire tether. After a specified period of time, the zinc foil release would corrode sufficiently to allow detachment of the tag from the needle. The needle would remain implanted in the whale while the tag floats to the surface and is recovered. It is anticipated that the needle would remain implanted for several days before being shed by the whale.

The second tag to be used via dermal attachment is a Wildlife Computers MK10-PATF (152×51×32 mm, 130 g in air; Figure 3). This tag allows archival storage of depth, temperature, light level, wet/dry state, and Fastloc GPS data, and it also has the capability to transmit Fastloc GPS data via an integrated ARGOS transmitter. To facilitate tracking and recovery, the ship would receive frequent (every 5 minutes) ARGOS transmissions from the tag via a wideband radio receiver and an antenna mounted high on the ship's mast (this should provide a line-of-sight reception range of roughly 10 km). The Fastloc GPS data would be combined with GPS satellite ephemeris data acquired by a conventional ship-mounted GPS receiver (Garmin) to compute accurate locations of the tagged whale. This tag would be used for deployments of 24+ hours, as the Fastloc GPS would allow safe nighttime tracking from a large oceanographic vessel.

Figure 1. Dermal attachment tag components, including tag housing, foam floatation, TDR, radio transmitter, acoustic transmitter, detachable carrier rocket with flu-flu fletching design, and endcap with needle, stop, and corrosive release mechanism. To assemble for launch, the carrier rocket is fitted into the end of the tag housing at the left, and the endcap is screwed into the tag housing at the right.



Observation, behavioral
Prior to any of the above actions, the researchers would observe undisturbed, natural behavior. They would also observe response behavior after tagging. Every effort would be made to minimize disturbance to the whale while the whale is within 100 yards of the vessel.

Photo-identification
The researchers would take photographs and video for photo-identification and behavioral photo-documentation.

Tracking
The researchers would use a hand-held directional hydrophone to track the whale. They would maintain a distance of greater than 100 m

Incidental harassment
Non-target animals could potentially be harassed by vessel approaches during tagging operations. Environmental sampling would be conducted in proximity to the tagged whale with a vertical profiler that contains a conductivity-temperature-depth instrument, fluorometer, optical plankton counter, and video plankton recorder.

The permit would exempt the applicant from ESA and MMPA prohibitions against take, 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. 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)]. This is similar to the U.S. Fish and Wildlife Service's regulatory definition of "harass" pursuant to the ESA (50 CFR 17.3). 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.

Mitigation Measures

- The researchers would minimize disturbance to the whale during tagging attempts.
- Prior to approaching a whale, they would monitor the behavior of the candidate whale.
- They would not approach animals that are in any way agitated (e.g., breaching, tail lobbing) or engaged in social activity with other whales .
- They would conduct close in a controlled manner at safe speeds so as not to alarm the whale and so that the approach can be aborted at any time.
- They would abandon tagging attempts on animals that continually evade the vessel.
- They would abandon tagging attempts of animals that exhibit moderate to strong reactions to close approaches (e.g., forceful roll, tail slash, tail lob, breach).
- They would use only suction-cup tags to study the diving and foraging behavior of females accompanied by calves or calves over 6 months of age.
- They would limit the use of the dermal attachment to sub-adults (> 1 year) and adults that are unaccompanied by a calf, as determined by size (i.e., small animals and those accompanied by an adult would not be considered for the dermal attachment).
- They would not tag any calf with evidence of fetal folds.
- During tagging attempts, if any close boat approach results in separation of a mother and her calf by more than 50 m for longer than a few minutes, they would abandon tagging attempts on the pair.
- The researchers would use suction cup tags unless
    - Whales regularly evade approach within 10 m for pole deployment of suction-cup tags,
    - The skin condition of target animals make attachment via suction cup unlikely,
    - Rough seas preclude the use of a long pole for attachment, but still allow for effective deployment with a projectile tag, and
    - The study design calls for attachment durations (24-72 hours) that exceed the typical capabilities of suction cups (6-12 hours).
- The researchers would use the following measures if deploying the implantable tags
    - Needles would be washed in warm soapy water, rinsed with tap water, inserted into an autoclave bag, and sterilized with a tabletop steam sterilizer (autoclave).
    - An indicator would be used to insure the effectiveness of each sterilization procedure.
    - After sterilization, the needle would remain in its autoclave bag until immediately prior to loading in the ARTS launcher.
    - The needle is not touched during the loading process (it is handled by the delrin stop), and it is subsequently protected from incidental contact and sea spray while inside the barrel of the launcher.

- If launched and recovered (i.e., a missed shot or premature shedding), anchors would never be re-used without washing and steam sterilization.
- Replacing a needle would be easily achieved in the field by unscrewing the end cap with the used anchor and replacing it with an end cap attached to a sterile anchor.

PERMIT TERMS AND CONDITIONS

The Permits Division requires the following conditions to minimize harassment to marine mammals:

1. No individual animal may be taken more than 3 times in one day.
2. When approaching females with calves, the researchers must:
   a. Immediately terminate efforts if there is any evidence that the activity may be interfering with pair-bonding or other vital functions;
   b. Avoid positioning the research vessel between the mother and calf;
   c. Approach gradually to minimize or avoid any startle response; and
   d. Avoid approaching while the calf is actively nursing
3. To avoid taking Southern Resident killer whales, researchers must maintain a distance of at least 183 m and may not intercept a whale or position the vessel in its path
4. To avoid taking Steller sea lions, the researchers must:
   a. Maintain a distance of at least 92 m of a Steller sea lion in the water or hauled out on land.
   b. Maintain a vessel distance of at least 5.5 km of a Steller sea lion rookery site listed in 50 CFR 223.202.

APPROACH TO THE ASSESSMENT

The National Marine Fisheries Service approaches its Section 7 analyses 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 effects (i.e., the *Action Area*).

The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time. We then perform our *Effects Analyses*. The first of these are our *Exposure Analyses*, in which 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. We evaluate which aspects of the proposed actions could be considered stressors on listed species (i.e., *Potential Stressors*). We then examine available scientific and commercial data to determine whether and how listed individuals are likely to respond to each stressor (i.e., *Response Analyses*).

The final steps of our analyses include assessing the risks those responses pose to listed species and the impacts to their designated critical habitat (i.e., *Risk Analyses*). Our jeopardy determinations must be based on an action's impact on the continued existence of threatened or endangered species as those "species" have been listed, which can include true biological species, subspecies, as well as distinct populations segments (DPSs) and evolutionarily significant units (ESUs) of vertebrate species. The continued existence of species depends on the fate of the populations that comprise them. Similarly, the continued existence of populations is 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 the species, and the individuals that comprise those populations. They begin by identifying the probable risks that actions pose to listed individuals. 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.

We measure risks to listed individuals in terms of "fitness," i.e., their 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 identified during our response analyses) are likely to have consequences for its 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 (Stearns 1992; Mills & Beatty 1979; Anderson 2000). 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. Alternatively, 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. 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 are 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 must next consider whether those fitness reductions are likely to reduce the viability of the population(s) 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 the Species* 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 natural resource agencies in states and other countries; reports from domestic and foreign non-governmental organizations involved in marine conservation issues; the information provided by the Permits Division when it initiates formal consultation; and published scientific literature. To find this information, we review peer reviewed scientific literature, master's theses, doctoral dissertations, government reports, and commercial studies. We use literature search engines such as *Science Direct, BioOne, JSTOR,* and *Google Scholar* as well as the use of NOAA and university libraries. We focus on identifying recent information on the biology, ecology, distribution, status, and trends of the threatened and endangered species considered in this opinion.

We evaluate all evidence based on the quality of the study design, sample sizes, and study results. When data are equivocal, or in the face of substantial uncertainty, our decisions are designed to avoid the risks of incorrectly concluding that an action would not have an adverse effect on listed species when, in fact, such adverse effects are likely. In those cases, in keeping with the direction from the U.S. Congress to provide the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], we generally make determinations, which provide the most conservative outcome for listed species.

ACTION AREA

The action area includes waters of the northwest Atlantic from Maine to Florida; Canadian waters of the Gulf of Maine, Labrador Sea, Davis Strait, Baffin Bay, and Hudson Bay; waters off the U.S. North Pacific (California to Washington); and the Arctic Ocean including Bering, Chukchi and Beaufort Seas.

STATUS OF THE SPECIES

The following endangered and threatened species may occur in the action area:

Common Name	Scientific Name	Listing Status
Marine Mammals		
North Atlantic right whale	*Eubalaena glacialis*	Endangered
North Pacific right whale	*Eubalaena japonica*	Endangered
Bowhead whale	*Balaena mysticetus*	Endangered
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
Cook Inlet beluga whale	*Delphinapterus leucas*	Endangered
Southern Resident killer whale	*Orcinus orca*	Endangered
Steller sea lion	*Eumetopias jubatus*	
Western DPS		Endangered
Sea Turtles		
Leatherback turtle	*Dermochelys coriacea*	Endangered
Marine and anadromous fish		
Sockeye salmon	*Oncorhynchus nerka*	
Snake River DPS		Endangered
Chinook salmon	*Oncorhynchus tschawytscha*	
Snake River Fall Run		Threatened
Snake River Summer/Spring Run		Threatened
Puget Sound		Threatened
Lower Columbia River		Threatened
Upper Columbia River Spring Run		Endangered
Upper Willamette River		Threatened
Steelhead trout	*Oncorhynchus mykiss*	
Snake River Basin		Threatened
Lower Columbia River		Threatened
Middle Columbia River		Threatened
Upper Willamette River		Threatened

Species and Critical Habitat Not Likely to Be Affected by the Action

The purpose of this action is to photograph and observe humpback whales, discussed in a later section. Non-target species may be affected by general risks associated with operating watercraft (i.e., vessel noise, visual disturbance, and collision with the vessel).

The researchers' vessel would maintain safe operating speeds and abide by safe boat-operating guidelines. In addition to the captain or boat driver, there would be observers aboard to watch out for marine animals. The researchers would not intentionally approach non-target species in their vessel. They would avoid all non-target whales, sea turtles, and anadromous fish. Vessel collision is thus discountable, i.e., extremely unlikely to occur, and not likely to adversely affect the above listed non-target whales, sea turtles, and fish. The noise and visual disturbance caused by the whale observation vessel or tagging vessel would be similar

to that of other vessels in the area. The presence of one additional vessel in the action area (which has considerable vessel traffic) is unlikely to have a significant impact on listed species. Therefore, non-target whales, leatherback sea turtles, and fish species are unlikely to be adversely affected by the operation of watercraft for the purposes of this action.

The researchers would maintain a distance of at least 183 meters from all Southern Resident killer whales. They may not intercept a whale or position the vessel in its path. They would not approach sperm whales or Cook Inlet beluga whales (or their critical habitat).

In 1993, critical habitat was designated for all major Steller sea lion rookeries, major haulouts, and associated terrestrial, air, and aquatic zones in Alaska (50 CFR 223.202). The designated critical habitat prohibits: vessel approach within 5.5 km of rookeries, terrestrial approach within 0.8 km of rookeries, and terrestrial approach of the eastern shore of Marmot Island.

The researchers would maintain a distance of at least 92 m from Steller sea lions in the water or hauled out on land. In their vessel, they would maintain a distance of at least 5.5 km from designated rookery sites. On land, they would maintain a distance of at least 0.8 km of designated rookery sites and 2.4 km of Marmot Island. The researchers' activities would not occur in Steller sea lion critical habitat. They would not affect individuals, rookeries, or food abundance. Therefore, their actions are not likely to destroy or adversely modify Steller sea lion critical habitat.

In conclusion, the following non-target species and their critical habitats are not likely to be adversely affected by the actions of the researchers, and therefore, are not considered further in this opinion: anadromous fish, sperm whale, Southern Resident killer whale, Cook Inlet beluga whale, Steller sea lion (Western DPS), and leatherback turtle.

Species Likely to be Adversely Affected by the Action:

Humpback Whale

Species Description and Distribution

The humpback whale is a cosmopolitan species that occurs in the Pacific, Atlantic, Indian, and Southern Oceans. Most populations migrate between breeding areas in tropical waters, usually near continental coastlines or island groups, and productive colder waters in temperate and high latitudes (Reilly et al. 2008).

Listing Status

The humpback whale was listed as endangered under the ESA in 1973. It is considered depleted by the MMPA. In 2008, the IUCN Red List of Threatened Species downgraded the species from Vulnerable to Least Concern, reflecting its low risk of extinction; however, the Arabian Sea and Oceania populations remain listed as Endangered (Reilly et al. 2008). It is also protected by the International Whaling Commission (IWC) and the Convention on International Trade in Endangered Species of wild flora and fauna (CITES). Critical habitat has not been designated for the species.

Population Designations, Abundance and Trends

Prior to commercial whaling, hundreds of thousands of humpback whales existed worldwide (Roman & Palumbi 2003; Winn & Reichley. 1985). Global abundance declined to the low thousands by 1968, the last year of substantial catches (Reilly et al. 2008). Since then, the total population size has grown to over 60,000 individuals and continues to increase (Reilly et al. 2008). Humpback whales are broadly divided into four broad geographic regions based on tagging and genetic data (Baker et al. 1990; Palsboll et al. 1995): North Pacific, North Atlantic, Arabian Sea, and Southern Hemisphere.

<u>North Pacific.</u> In the winter, humpback whales breed and calf in the coastal waters of Southeast Asia, Hawaii, Mexico, and Central America. In the summer, they move to foraging areas in the Bering Sea, the

Gulf of Alaska, and the temperate eastern Pacific (Calambokidis 2010). All breeding areas and most foraging areas are genetically differentiated, as indicated by maternally inherited genetic markers (i.e., mitochondrial haplotypes; Baker 2008). In addition, most breeding and foraging areas exhibit significantly different haplotype frequencies, indicating that there is not a simple one-to-one relationship among feeding and breeding areas (Baker 2008). An estimated 15,000 humpback whales resided in the North Pacific in 1905 (Rice 1978). Commercial whaling depleted the population to the low thousands by 1965 (Perry et al. 1999). Current estimates indicate approximately 20,000 humpback whales in the North Pacific, with an annual growth rate of 4.9 percent (Calambokidis 2010).

North Atlantic. In the summer, North Atlantic humpback whales range from the Gulf of Maine in the west and Ireland in the east. The northern extent of their range includes the Barents Sea, Greenland Sea, and Davis Strait. In the winter, the majority migrate to breeding grounds in the West Indies, though a small number migrate to the Cape Verde Islands (Reilly et al. 2008). Limited genetic exchange among summer feeding areas but mixing in the winter breeding areas is indicative of a single panmictic (i.e., interbreeding) population in the North Atlantic (Palsboll et al. 1997). Whaling nearly extirpated humpback whales from the eastern North Atlantic by 1910 and the Canadian Atlantic by 1920 (Stevick et al. 2003). Protection against whaling began in 1955, and the population has since rebounded. As of 1993, there was an estimated 11,570 humpback whales in the North Atlantic, growing at a rate of three percent annually (Stevick et al. 2003).

Southern Hemisphere. Humpback whales are abundant throughout the Antarctic during the summer; they occur south to the ice edge but not within the pack ice zone (Reilly et al. 2008). In the winter, Southern Hemisphere whales migrate to coastal areas within the South Pacific, South Atlantic, and Indian Oceans. There is genetic differentiation within and among all southern ocean basins (Baker et al. 1998; Rosenbaum et al. 2009). Over 200,000 humpback whales were killed in the Southern Hemisphere during the early 20th century. The area now supports more than 36,000 humpback whales and is growing at a minimum annual rate of 4.6 percent (Reilly et al. 2008)

Arabian Sea. A small, genetically and demographically distinct population of humpback whales resides year-round in the Arabian Sea (Mikhalev 1997; Reilly et al. 2008). Though historical estimates are not available, 242 whales were killed in 1965 and 1966 (Reilly et al. 2008). The minimum population size, based on photo-identification data, is 56 whales (Mikhalev 1997); the maximum estimate is 400 (Reilly et al. 2008).

Threats

Three human activities are known to threaten humpback whales: directed harvest, fisheries interactions, and vessel collisions. Historically, whaling represented the greatest threat to every population of humpback whales. It was ultimately responsible for the global decline in humpback whales prior to their listing as an endangered species. Hundreds of thousands of whales were removed from the world's oceans prior to bans on commercial whaling in the mid-20th century (Reilly et al. 2008). Humpback whales are often killed or injured during interactions with commercial fishing gear. They are vulnerable to ship strikes, which are often fatal. Their natural predators my include orcas, false killer whales, and sharks.

Life History Information

Humpback whale reproductive activities occur primarily in winter. Gestation takes about 11 months (Winn & Reichley. 1985), followed by a nursing period of up to one year (Baraff & Weinrich 1993). Calving occurs in the shallow coastal waters of continental shelves and some oceanic islands (Perry et al. 1999). The calving interval is likely two to three years (Clapham & Mayo 1987), although some evidence exists of calving in consecutive years (Clapham & Mayo 1987; 1990; Glockner-Ferrari & Ferrari 1985; Weinrich et al. 1993). Mother/calf groups are found in relatively stable pairs (Ersts & 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). Males sing long, complex songs, compete for mates, and are polygamous (Clapham 1996).

Humpback whales migrate long distances from breeding areas to foraging areas. Although largely solitary, humpback whales often cooperate during feeding activities (Elena et al. 2002). 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). Humpbacks exhibit a wide range of foraging behaviors and feed on a range of prey types, including: small schooling fishes, euphausiids, and other large zooplankton (Krieger & Wing. 1984; Krieger & Wing. 1986; Nemoto 1957; Nemoto 1959; Nemoto 1970). Because most humpback prey are likely found above 300 m depths, most dives are probably relatively shallow, with typical diving depths of approximately 60-170 m (Hamilton et al. 1997). Dives usually range between two and five minutes but can last to around 20 minutes (Dolphin 1987).

Blue Whale

Distribution

Blue whales are found along the coastal shelves of North America and South America (Rice 1974; Donovan 1984; Clarke 1980) in the North Pacific Ocean. In the North Pacific Ocean, blue whales occur in summer foraging areas in the Chukchi Sea, the Sea of Okhotsk, around the Aleutian Islands, and the Gulf of Alaska; in the eastern Pacific, they occur south to California; in the western Pacific, they occur south to Japan. Blue whales in the eastern Pacific winter from California south; in the western Pacific, they winter from the Sea of Japan, the East China and Yellow Seas, and the Philippine Sea (Gambell 1985).

Population Structure

At least three subspecies of blue whales have been identified based on body size and geographic distribution (*B. musculus intermedia*, which occurs in the higher latitudes of the Southern Oceans, *B. m. musculus*, which occurs in the Northern Hemisphere, and *B. m. brevicauda* which occurs in the mid-latitude waters of the southern Indian Ocean and north of the Antarctic convergence), but this consultation will treat them as a single entity. Readers who are interested in these subspecies will find more information in Gilpatrick *et al.* (1997), Kato *et al.* (1995), Omura *et al.* (1970) and Ichihara (1966).

In addition to these subspecies, the International Whaling Commission's Scientific Committee has formally recognized one blue whale population in the North Pacific (Donovan 1991), although there is increasing evidence that there may be more than one blue whale population in the Pacific Ocean (Gilpatrick *et al.* 1997, Barlow *et al.* 1995, Mizroch *et al.* 1984a, Ohsumi and Wada 1974). For example, studies of the blue whales that winter off Baja California and in the Gulf of California suggest that these whales are morphologically distinct from blue whales of the western and central North Pacific (Gilpatrick *et al.* 1997), although these differences might result from differences in the productivity of their foraging areas more than genetic differences (the southern whales forage off California; Sears *et al.*1987; Barlow *et al.*1997; Calambokidis *et al.* 1990).

A population or "stock" of endangered blue whales occurs in waters surrounding the Hawaiian archipelago (from the main Hawaiian Islands west to at least Midway Island), although blue whales are rarely reported from Hawaiian waters. The only reliable report of this species in the central North Pacific was a sighting made from a scientific research vessel about 400 km northeast of Hawai'i in January 1964 (nmfs 1998). However, acoustic monitoring has recorded blue whales off Oahu and the Midway Islands much more recently (Barlow *et al.* 1994, McDonald and Fox 1999, Northrop *et al.* 1971; Thompson and Friedl 1982).

The recordings made off Oahu showed bimodal peaks throughout the year, suggesting that the animals were migrating into the area during summer and winter (Thompson and Friedl 1982; McDonald and Fox 1999). Twelve aerial surveys were flown within 25 nm^2 of the main Hawaiian Islands from 1993-1998 and no blue whales were sighted. Nevertheless, blue whale vocalizations that have been recorded in these waters suggest that the occurrence of blue whales in these waters may be higher than blue whale sightings. There are no reports of blue whales stranding in Hawaiian waters.

The International Whaling Commission also groups all of the blue whales in the North Atlantic Ocean into one “stock” and groups blue whales in the Southern Hemisphere into six “stocks” (Donovan 1991), which are presumed to follow the feeding distribution of the whales.

Threats to the Species

Natural threats. Natural causes of mortality in blue whales are largely unknown, but probably include predation and disease (not necessarily in their order of importance). Blue whales are known to become infected with the nematode *Carricauda boopis* (Baylis 1920), which are believed to have caused fin whales to die as a result of renal failure (Lambertsen 1986; see additional discussion under *Fin whales*). Killer whales and sharks are also known to attack, injure, and kill very young or sick fin and humpback whale and probably hunt blue whales as well (Perry *et al.* 1999).

Anthropogenic threats. Two human activities are known to threaten blue whales: whaling and shipping. Historically, whaling represented the greatest threat to every population of blue whales and was ultimately responsible for listing blue whales as an endangered species. As early as the mid-seventeenth century, the Japanese were capturing blue, fin, and other large whales using a fairly primitive open-water netting technique (Tønnessen and Johnsen 1982, Cherfas 1989). In 1864, explosive harpoons and steam-powered catcher boats were introduced in Norway, allowing the large-scale exploitation of previously unobtainable whale species. Before fin whales became the focus of whaling operations, populations of blue whales had already become commercially extinct (IWC 1995).

From 1910 to 1965, whalers killed about 9,500 blue whales in the North Pacific Ocean (NMFS 1998). Although the International Whaling Commission banned commercial whaling in the North Pacific in 1966, Soviet whaling fleets continued to hunt blue whales in the North Pacific for several years after the ban. Surveys conducted in these former-whaling areas in the 1980s and 1990s failed to find any blue whales (Forney and Brownell 1996). By 1967, Soviet scientists wrote that blue whales in the North Pacific Ocean (including the eastern Bering Sea and Prince William Sound) had been so overharvested by Soviet whaling fleets that some scientists concluded that any additional harvests were certain to cause the species to become extinct in the North Pacific (Latishev 2007). As its legacy, whaling has reduced blue whales to a fraction of their historic population size and, as a result, makes it easier for other human activities to push blue whales closer to extinction. Otherwise, whaling currently does not threaten blue whale populations.

In the Eastern North Pacific, ship strikes were implicated in the deaths of five blue whales, from 2004-2008 (Caretta *et al*. 2011). Four of these deaths occurred in 2007, the highest number recorded for any year. During 2004-2008, there were an additional eight injuries of unidentified large whales attributed to ship strikes. Several blue whales have been photographed in California with large gashes in their dorsal surface that appear to be from ship strikes (J. Calambokidis, pers. comm.). Blue whale mortality and injuries attributed to ship strikes in California waters averaged 1.0 per year for 2004-2008. Additional mortality from ship strikes probably goes unreported because the whales do not strand or, if they do, they do not always have obvious signs of trauma. Studies have shown that blue whales respond to approaching ships in a variety of ways, depending on the behavior of the animals at the time of approach, and speed and direction of the approaching vessel. While feeding, blue whales react less rapidly and with less obvious avoidance behavior than whales that are not feeding (Sears *et al.* 1983). Within the St. Lawrence Estuary, blue whales are believed to be affected by large amounts of recreational and commercial vessel traffic. Blue whales in the St. Lawrence appeared more likely to react to these vessels when boats made fast, erratic approaches or sudden changes in direction or speed (Edds and Macfarlane 1987, Macfarlane 1981). No confirmed ship strikes of blue whales have been recoreded in the North Atlantic and Gulf of Mexico between 2006 and 2010 (Henry et al. 2012).

Status

Blue whales were listed as endangered under the ESA in 1973. Blue whales are listed as endangered on the IUCN Red List of Threatened Animals (Baillie and Groombridge 1996). They are also protected by the Convention on International Trade in Endangered Species of wild flora and fauna and the MMPA. Critical habitat has not been designated for blue whales.

It is difficult to assess the current status of blue whales because (1) there is no general agreement on the size of the blue whale population prior to whaling and (2) estimates of the current size of the different blue whale populations vary widely. We may never know the size of the blue whale population prior to whaling, although some authors have concluded that their population numbers about 200,000 animals before whaling. Similarly, estimates of the global abundance of blue whales are uncertain. Since the cessation of whaling, the global population of blue whales has been estimated to range from 11,200 to 13,000 animals (Maser *et al.* 1981; U. S. Department of Commerce 1983). These estimates, however, are more than 20 years old.

A lot of uncertainty surrounds estimates of blue whale abundance in the North Pacific Ocean. Barlow (1994) estimated the North Pacific population of blue whales to number between 1,400 to 1,900. Barlow and Calambokidis (1995) estimated the abundance of blue whales off California at 2,200 individuals. Wade and Gerrodette (1993) and Barlow *et al.* (1997) estimated there were a minimum of 3,300 blue whales in the North Pacific Ocean in the 1990s. Most recently, Calambokidis et al. (2010) estimated that the eastern North Pacific stock size is increasing at approximately 3% per year.

The size of the blue whale population in the north Atlantic is also uncertain. The population has been estimated to number from a few hundred individuals (Allen 1970; Mitchell 1974) to 1,000 to 2,000 individuals (Sigurjónsson 1995). Gambell (1976) estimated that there were between 1,100 and 1,500 blue whales in the North Atlantic before whaling began and Braham (1991) estimated there were between 100 and 555 blue whales in the North Atlantic during the late 1980s and early 1990s. Sears *et al.* (1987) identified over 300 individual blue whales in the Gulf of St. Lawrence, which provides a minimum estimate for their population in the North Atlantic, and some speculate that there may be between 400 and 600 blue whales in the western North Atlantic (Mitchell 1974, Waring et al. 2011). Sigurjónsson and Gunnlaugson (1990) concluded that the blue whale population had been increasing since the late 1950s and argued that the blue whale population off western and southwestern Iceland had increased at an annual rate of about 5 percent between 1969 and 1988, although the level of confidence we can place in these estimates is low.

Estimates of the number of blue whales in the Southern Hemisphere range from 5,000 to 6,000 (review by Yochem and Leatherwood 1985) with an average rate of increase that has been estimated at between 4 and 5 percent per year. Butterworth *et al.* (1993), however, estimated the Antarctic population at 710 individuals. More recently, Stern (2001) estimated the blue whale population in the Southern Ocean at between 400 and 1,400 animals (c.v. 0.4). The pygmy blue whale population has been estimated at 6,000 individuals (Yochem and Leatherwood 1985).

The information available on the status and trend of blue whales do not allow us to reach any conclusions about the extinction risks facing blue whales as a species, or particular populations of blue whales. With the limited data available on blue whales, we do not know whether these whales exist at population sizes large enough to avoid demographic phenomena that are known to increase the extinction probability of species that exist as “small” populations (that is, “small” populations experience phenomena such as demographic stochasticity, inbreeding depression and Allee effects, among others, that cause their population size to become a threat in and of itself) or if blue whales are threatened more by exogenous threats such as anthropogenic activities (primarily whaling, entanglement, and ship strikes) or natural phenomena (such as disease, predation, or changes in the distribution and abundance of their prey in response to changing climate).

Diving and Social Behavior

Generally, blue whales make 5-20 shallow dives at 12-20 second intervals followed by a deep dive of 3-30 minutes (Mackintosh 1965; Leatherwood *et al.* 1976; Maser *et al.* 1981; Yochem and Leatherwood 1985; Strong 1990; Croll *et al.* 1999). Croll *et al.* (1999) found that the dive depths of blue whales foraging off the coast of California during the day averaged 132 m (433 ft) with a maximum recorded depth of 204 m (672 ft) and a mean dive duration of 7.2 minutes. Nighttime dives are generally less than 50 m (165 ft) in depth (Croll *et al.* 1999).

Blue whales are usually found swimming alone or in groups of two or three (Ruud 1956, Slijper 1962, Nemoto 1964, Mackintosh 1965, Pike and MacAskie 1969, Aguayo 1974). However, larger foraging aggregations and aggregations mixed with other species like fin whales are regularly reported (Schoenherr 1991, Fiedler *et al.* 1998). Little is known of the mating behavior of blue whales.

Vocalizations and Hearing

The vocalizations that have been identified for blue whales include a variety of sounds described as low frequency moans or long pulses (Cummings and Thompson 1971, 1977; Edds 1982, Thompson and Friedl 1982; Edds-Walton 1997). Blue whales produce a variety of low frequency sounds in the 10-100 Hz band (Cummings and Thompson 1971, Edds 1982, Thompson and Friedl 1982, McDonald *et al.* 1995, Clark and Fristrup 1997, Rivers 1997). The most typical signals are very long, patterned sequences of tonal infrasonic sounds in the 15-40 Hz range. The sounds last several tens of seconds. Estimated source levels are as high as 180-190 dB (Cummings and Thompson 1971). Ketten (1997) reports the frequencies of maximum energy between 12 and 18 Hz. In temperate waters, intense bouts of long patterned sounds are very common from fall through spring, but these also occur to a lesser extent during the summer in high latitude feeding areas. Short sequences of rapid calls in the 30-90 Hz band are associated with animals in social groups. The seasonality and structure of long patterned sounds suggest that these sounds are male displays for attracting females, competing with other males, or both. The context for the 30-90 Hz calls suggests that they are communicative but not related to a reproductive function. Vocalizations attributed to blue whales have been recorded in presumed foraging areas, along migration routes, and during the presumed breeding season (Beamish and Mitchell 1971; Cummings and Thompson 1971, 1977, 1994; Cummings and Fish 1972; Thompson *et al.* 1996; Rivers 1997; Tyack and Clark 1997; Clark *et al.* 1998).

Blue whale moans within the low frequency range of 12.5-200 Hz, with pulse duration up to 36 seconds, have been recorded off Chile (Cummings and Thompson 1971). A short, 390 Hz pulse also is produced during the moan. One estimate of the overall source level was as high as 188 dB, with most energy in the 1/3-octave bands centered at 20, 25, and 31.5 Hz, and also included secondary components estimates near 50 and 63 Hz (Cummings and Thompson 1971).

As with other vocalizations produced by baleen whales, the function of blue whale vocalizations is unknown, although there are numerous hypotheses (which include: maintenance of inter-individual distance, species and individual recognition, contextual information transmission, maintenance of social organization, location of topographic features, and location of prey resources; see the review by Thompson *et al.* 1992 for more information on these hypotheses). Responses to conspecific sounds have been demonstrated in a number of mysticetes, and there is no reason to believe that blue whales do not communicate similarly (Edds-Walton 1997). The low-frequency sounds produced by blue whales can, in theory, travel long distances, and it is possible that such long-distance communication occurs (Payne and Webb 1971, Edds-Walton 1997). The long-range sounds may also be used for echolocation in orientation or navigation (Tyack 1999).

Cetaceans have an auditory anatomy that follows the basic mammalian pattern, with some modifications to adapt to the demands of hearing in the sea. The typical mammalian ear is divided into the outer ear, middle ear, and inner ear. The outer ear is separated from the inner ear by the tympanic membrane, or eardrum. In terrestrial mammals, the outer ear, eardrum, and middle ear function to transmit airborne sound to the inner ear, where the sound is detected in a fluid. Since cetaceans already live in a fluid medium, they do not require this matching, and thus do not have an air-filled external ear canal. The inner ear is where sound energy is converted into neural signals that are transmitted to the central nervous system via the auditory nerve. Acoustic energy causes the basilar membrane in the cochlea to vibrate. Sensory cells at different positions along the basilar membrane are excited by different frequencies of sound (Tyack 1999). Baleen whales have inner ears that appear to be specialized for low-frequency hearing. In a study of the morphology of the mysticete auditory apparatus, Ketten (1997) hypothesized that large mysticetes have acute infrasonic hearing.

Fin Whale

Distribution

Fin whales are distributed widely in every ocean except the Arctic Ocean. In the North Pacific Ocean, fin whales occur in summer foraging areas in the Chukchi Sea, the Sea of Okhotsk, around the Aleutian Islands, and the Gulf of Alaska; in the eastern Pacific, they occur south to California; in the western Pacific, they occur south to Japan. Fin whales in the eastern Pacific winter from California south; in the western Pacific, they winter from the Sea of Japan, the East China and Yellow Seas, and the Philippine Sea (Gambell 1985).

In the North Atlantic Ocean, fin whales occur in summer 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. 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).

In the Southern Hemisphere, fin whales are distributed broadly south of 50° S in the summer and migrate into the Atlantic, Indian, and Pacific Oceans in the winter, along the coast of South America (as far north as Peru and Brazil), Africa, and the islands in Oceania north of Australia and New Zealand (Gambell 1985).

Fin whales are common off the Atlantic coast of the United States in waters immediately off the coast seaward to the continental shelf (about the 1,000-fathom contour). In this region, they tend to occur north of Cape Hatteras, where they accounted for about 46 percent of the large whales observed in surveys conducted between 1978 and 1982. During the summer months, fin whales in this region tend to congregate in feeding areas between 41°20'N and 51°00'N, from shore seaward to the 1,000-fathom contour.

In the Atlantic Ocean, Clark (1995) reported a general southward pattern of fin whale migration in the fall from the Labrador and Newfoundland region, south past Bermuda, and into the West Indies. The overall distribution may be based on prey availability, and fin whales are found throughout the action area for this consultation in most months of the year. This species preys opportunistically on both invertebrates and fish (Watkins *et al.* 1984). They feed by filtering large volumes of water for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments.

Population Structure

Fin whales have two recognized subspecies: *Balaoptera physalus physalus* (Linnaeus 1758) occurs in the North Atlantic Ocean while *B. p. quoyi* (Fischer 1829) occurs in the Southern Ocean. Globally, fin whales are sub-divided into three major groups: Atlantic, Pacific, and Antarctic. Within these major areas, different organizations use different population structure.

In the North Atlantic Ocean, the International Whaling Commission recognizes seven management units or "stocks" of fin whales: (1) Nova Scotia, (2) Newfoundland-Labrador, (3) West Greenland, (4) East Greenland-Iceland, (5) North Norway, (6) West Norway-Faroe Islands, and (7) British Isles-Spain-Portugal. In addition, the population of fin whales that resides in the Ligurian Sea, in the northwestern Mediterranean Sea, is believed to be genetically distinct from other fin whales populations (as used in this Opinion, "populations" are isolated demographically, meaning, they are driven more by internal dynamics — birth and death processes — than by the geographic redistribution of individuals through immigration or emigration. Some usages of the term "stock" are synonymous with this definition of "population" while other usages of "stock" are not).

In the North Pacific Ocean, the International Whaling Commission recognizes two "stocks": (1) East China Sea and (2) rest of the North Pacific (Donovan, 1991). However, Mizroch *et al.* (1984) concluded that there were five possible "stocks" of fin whales within the North Pacific based on histological analyses and tagging experiments: (1) East and West Pacific that intermingle around the Aleutian Islands; (2) East China Sea; (3) British Columbia; (4) Southern-Central California to Gulf of Alaska; and (5) Gulf of California. Based on genetic analyses, Berube *et al.* (1998) concluded that fin whales in the Sea of Cortez represent an

isolated population that has very little genetic exchange with other populations in the North Pacific Ocean (although the geographic distribution of this population and other populations can overlap seasonally). They also concluded that fin whales in the Gulf of St. Lawrence and Gulf of Maine are distinct from fin whales found off Spain and in the Mediterranean Sea.

Regardless of how different authors structure the fin whale population, mark-recapture studies have demonstrated that individual fin whales migrate between management units (Mitchell 1974; Gunnlaugsson and Sigurjónsson 1989), which suggests that these management units are not geographically isolated populations.

Mizroch *et al.* (1984) identified five fin whale "feeding aggregations" in the Pacific Ocean: (1) eastern and western groups that move along the Aleutians (Berzin and Rovnin 1966; Nasu 1974); (2) an East China Sea group; (3) a group that moves north and south along the west coast of North America between California and the Gulf of Alaska (Rice 1974); and (4) a group centered in the Sea of Cortez (Gulf of California).

Hatch (2004) reported that fin whale vocalizations among five regions of the eastern North Pacific were heterogeneous: the Gulf of Alaska, the northeast North Pacific (Washington and British Columbia), the southeast North Pacific (California and northern Baja California), the Gulf of California, and the eastern tropical Pacific.

Sighting data show no evidence of migration between the Sea of Cortez and adjacent areas in the Pacific, but seasonal changes in abundance in the Sea of Cortez suggests that these fin whales might not be isolated (Tershy *et al.* 1993). Nevertheless, Bérubé *et al.* (2002) concluded that the Sea of Cortez fin whale population is genetically distinct from the oceanic population and has lower genetic diversity, which suggests that these fin whales might represent an isolated population.

In its final recovery plan for fin whales, NMFS recognized three populations in U.S. Pacific waters: Alaska (Northeast Pacific), California/Oregon/Washington, and Hawai'i (Barlow *et al.* 1997; Hill *et al.* 1997).

Threats to the Species

Natural threats. Natural sources and rates of mortality are largely unknown, but Aguilar and Lockyer (1987) suggest annual natural mortality rates may range from 0.04 to 0.06. Although these results are based on studies of fin whales in the northeast Atlantic, there are no comparable estimates for fin whales in the Pacific Ocean. The occurrence of the nematode *Crassicauda boopis* appears to increase the potential for kidney failure in fin whales and may be preventing some fin whale stocks from recovering from whaling (Lambertsen 1992, as cited in Perry *et al.* 1999). Killer whale or shark attacks may injure or kill very young or sick whales (Perry *et al.* 1999, Tomilin 1967).

Anthropogenic threats. Three human activities are known to threaten fin whales: whaling, commercial fishing, and shipping. Historically, whaling represented the greatest threat to every population of fin whales and was ultimately responsible for listing fin whales as an endangered species. As early as the mid-seventeenth century, the Japanese were capturing fin, blue (*Balaenoptera musculus*), and other large whales using a fairly primitive open-water netting technique (Tønnessen and Johnsen 1982, Cherfas 1989). In 1864, explosive harpoons and steam-powered catcher boats were introduced in Norway, allowing the large-scale exploitation of previously unobtainable whale species. After blue whales were depleted in most areas, fin whales became the focus of whaling operations and more than 700,000 fin whales were landed in the Southern Hemisphere alone between 1904 and 1979 (IWC 1995).

As its legacy, whaling has reduced fin whales to a fraction of their historic population size and, as a result, makes it easier for other human activities to push fin whales closer to extinction. Otherwise, whaling currently does not threaten every fin whale population, although it may threaten specific populations.

From 1904 to 1975, the International Whaling Commission estimates that 703,693 fin whales were captured and killed in Antarctic whaling operations (IWC 1990). Whaling in the Southern Oceans originally targeted humpback whales, but by 1913, those whales had became rare so whalers shifted their focus to fin and blue whales (Mizroch *et al.* 1984b). From 1911 to 1924, whalers killed 2,000–5,000 fin

whales each year. After the introduction of factory whaling ships in 1925, the number of whales killed each year increased substantially: from 1931 to 1972, whalers killed about 511,574 fin whales (Kawamura 1994). In 1937 alone, whalers are reported to have killed more than 28,000 fin whales. From 1953 to 1961, the number of fin whales killed each year averaged around 25,000. In 1962, whalers appeared to shift their focus to sei whale as fin whales became scarce. By 1974, whalers killed fewer than 1,000 fin whales.

Recently released Soviet whaling records indicate a discrepancy between reported and actual fin whale catch numbers by whalers from the former USSR in southern waters between 1947 and 1980 (Zemsky *et al.* 1995). The former USSR previously reported 52,931 whales caught; however, the data that was released recently suggests that only 41,984 were killed.

In the Antarctic Ocean, fin whales are hunted by Japanese whalers for its scientific whaling program under an Antarctic Special Permit. Japan started killing fin whales in its 2005–2006 program season and increased its target from 10 to 50 fin whales for the next twelve seasons beginning with the 2007/2008 season. Japan took zero fin whales in the 2007/2008 season and one in the 2008/2009 season (NMFS 2010a); however, in 2009 and the 2009/2010 seasons Japan killed a total of one fin whale in Antarctica (IWC 2010).

In the Atlantic Ocean fin whales are also hunted in subsistence fisheries off West Greenland and Iceland. In 2004, 5 males and 6 females were killed and landed; 2 other fin whales were struck and lost in the same year off West Greenland. In 2003 2 males and 4 females were landed and 2 other fin whales were struck and lost off West Greenland (IWC 2005). Between 2003 and 2007, the IWC set a catch limit of up to 19 fin whales in the West Greenland subsistence fishery (IWC 2005), however, the IWC's Scientific Committee recommended limiting the number of fin whale killed in this fishery to 1 to 4 individuals until accurate population estimates are produced. Seven fin whales were killed, 2 struck and lost and 1 reported killed as an infraction in 2009 and the 2009/2010 seasons combined (IWC 2010). Another 125 fin whales with 2 reported as infractions were killed off Iceland in 2009 and the 2009/2010 seasons combined (IWC 2010).

Despite anecdotal observations from fishermen which suggest that large whales swim through their nets rather than get caught in them (NMFS 2000), fin whales have been entangled by fishing gear off Newfoundland and Labrador in small numbers: a total of 14 fin whales are reported to have been captured in coastal fisheries in those two provinces between 1969 and 1990 (Lien 1994, Perkins and Beamish 1979). Of these 14 fin whales, 7 are known to have died as a result of that capture, although most of the animals that died were less than 15 meters in length (Lien 1994). Between 1999 and 2005, there were 10 confirmed reports of fin whales being entangled in fishing gear along the Atlantic Coast of the U.S. and the Maritime Provinces of Canada (Cole *et al.* 2005, Nelson *et al.* 2007). Of these reports, Fin whales were injured in 1 of the entanglements and killed in 3 entanglements. These data suggest that, despite their size and strength, fin whales are likely to be entangled and, in some cases, killed by gear used in modern fisheries.

Fin whales are also killed and injured in collisions with vessels more frequently than any other whale. Of 92 fin whales that stranded along the Atlantic Coast of the U.S. between 1975 and 1996, 31 (33%) showed evidence of collisions with ships (Laist *et al.* 2001). Between 1999 and 2005, there were 15 reports of fin whales being struck by vessels along the Atlantic Coast of the U.S. and the Maritime Provinces of Canada (Cole *et al.* 2005, Nelson *et al.* 2007). Of these reports, 13 were confirmed as ship strikes which were reported as having resulted in the death of 11 fin whales.

Ship strikes were identified as a known or potential cause of death in 8 (20%) of 39 fin whales that stranded on the coast of Italy in the Mediterranean Sea between 1986 and 1997 (Laist *et al.* 2001). Throughout the Mediterranean Sea, 46 of the 287 fin whales that are recorded to have stranded between 1897 and 2001 were confirmed to have died from injuries sustained by ship strikes (Panigada *et al.* 2006). Most of these fin whales (n = 43), were killed between 1972 and 2001 and the highest percentage (37 of 45 or ~82%) were killed in the Ligurian Sea and adjacent waters, where the Pelagos Sanctuary for Marine Mammals was established. In addition to these ship strikes, there are numerous reports of fin whales being injured as a result of ship strikes off the Atlantic coast of France and the United Kingdom (Jensen and Silber 2003).

Status

Fin whales were listed as endangered under the ESA in 1970. In 1976, the IWC protected fin whales from commercial whaling (Allen 1980). Fin whales are listed as endangered on the IUCN Red List of Threatened Animals (Baillie and Groombridge 1996). They are also protected by the Convention on International Trade in Endangered Species of wild flora and fauna and the MMPA. Critical habitat has not been designated for fin whales.

It is difficult to assess the current status of fin whales because (1) there is no general agreement on the size of the fin whale population prior to whaling and (2) estimates of the current size of the different fin whale populations vary widely (NMFS 2007). We may never know the size of the fin whale population prior to whaling. Based on sighting and CPUE data and a population model, Ohsumi and Wada (1974) estimated that there were 8,000–11,000 fin whales in the eastern North Pacific in 1973. The most current (1979) estimate of the population size of fin whales in the Southern Ocean is 85,200 (no coefficient of variance or confidence interval was provided) based on the history of catches and trends in catches per unit of effort (IWC 1979).

According to the fin whale recovery plan (NMFS 2010), the best abundance estimate available for the Western North Atlantic stock is 2,269 (CV = 0.37) from August 2006 with a minimum population estimate of 1,678 (Waring *et al.* 2009). However, based on data produced by surveys conducted between 1978-1982 and other data gathered between 1966 and 1989, Hain *et al.* (1992) estimated that the population of fin whales in the western North Atlantic Ocean (specifically, between Cape Hatteras, North Carolina, and Nova Scotia) numbered about 1,500 whales in the winter and 5,000 whales in the spring and summer. Because authors do not always reconcile "new" estimates with earlier estimates, it is not clear whether the current "best" estimate represents a refinement of the estimate that was based on older data or whether the fin whale population in the North Atlantic has declined by about 50% since the early 1980s.

The East Greenland-Iceland fin whale population was estimated at 10,000 animals (95 % confidence interval = 7,600 - 14,200), based on surveys conducted in 1987 and 1989 (Buckland *et al.* 1992). The number of eastern Atlantic fin whales, which includes the British Isles-Spain-Portugal population, has been estimated at 17,000 animals (95% confidence interval = 10,400 -28,900; Buckland *et al.* 1992). These estimates are both more than 15 years old and the data available do not allow us to determine if they remain valid.

Forcada *et al.* (1996) estimated there were 3,583 fin whales in the western Mediterranean (standard error = 967; 95% confidence interval = 2,130 - 6,027), which is similar to an estimate published by Notarbartolo-di-Sciara *et al.* (2003). In the Mediterranean's Ligurian Sea (which includes the Pelagos Whale Sanctuary and the Gulf of Lions), Forcada *et al.* (1995) estimated there were 901 fin whales (standard error = 196.1).

Regardless of which of these estimates, if any, come closest to actual population sizes, these estimates suggest that the global population of fin whales consists of tens of thousands of individuals. Based on ecological theory and demographic patterns derived from several hundred imperiled species and populations, fin whales appear to exist at population sizes that are large enough to avoid demographic phenomena that are known to increase the extinction probability of species that exist as "small" populations (that is, "small" populations experience phenomena such as demographic stochasticity, inbreeding depression and Allee effects, among others, that cause their population size to become a threat in and of itself). As a result, we assume that fin whales are likely to be threatened more by exogenous threats such as anthropogenic activities (primarily whaling, entanglement, and ship strikes) or natural phenomena (such as disease, predation, or changes in the distribution and abundance of their prey in response to changing climate) than endogenous threats caused by the small size of their population.

Nevertheless, based on the evidence available, the number of fin whales that are recorded to have been killed or injured in the past 20 years by human activities or natural phenomena, does not appear to be increasing the extinction probability of fin whales, although it may slow the rate at which they recover from population declines that were caused by commercial whaling.

Diving and Social Behavior

The percentage of time fin whales spend at the surface varies. Some authors have reported that fin whales make 5-20 shallow dives with each of these dives lasting 13-20 seconds followed by a deep dive lasting between 1.5 and 15 minutes (Gambell 1985). Other authors have reported that the fin whale's most common dives last between 2 and 6 minutes, with 2 to 8 blows between dives (Hain *et al.* 1992, Watkins 1981).

In waters off the Atlantic Coast of the U.S. individual fin whales or pairs represented about 75% of the fin whales observed during the Cetacean and Turtle Assessment Program (Hain *et al.* 1992). Individual whales or groups of less than five individuals represented about 90% of the observations (out of 2,065 observations of fin whales, the mean group size was 2.9, the modal value was 1, and the range was 1 – 65 individuals; Hain *et al.* 1992).

Vocalizations and Hearing

The sounds fin whales produce underwater are one of the most studied *Balaenoptera* sounds. Fin whales produce a variety of low-frequency sounds in the 10-200 Hz band (Watkins 1981; Watkins *et al.* 1987a; Edds 1988; Thompson *et al.* 1992). The most typical signals are long, patterned sequences of short duration (0.5-2s) infrasonic pulses in the 18-35 Hz range (Patterson and Hamilton 1964). Estimated source levels are as high as 190 dB (Patterson and Hamilton 1964; Watkins *et al.* 1987a; Thompson *et al.* 1992; McDonald *et al.* 1995). In temperate waters intense bouts of long patterned sounds are very common from fall through spring, but also occur to a lesser extent during the summer in high latitude feeding areas (Clark and Charif 1998). Short sequences of rapid pulses in the 20-70 Hz band are associated with animals in social groups (McDonald *et al.* 1995, Clark personal communication, McDonald personal communication). Each pulse lasts on the order of one second and contains twenty cycles (Tyack 1999).

During the breeding season, fin whales produce a series of pulses in a regularly repeating pattern. These bouts of pulsing may last for longer than one day (Tyack 1999). The seasonality and stereotype of the bouts of patterned sounds suggest that these sounds are male reproductive displays (Watkins *et al.* 1987a), while the individual counter-calling data of McDonald *et al.* (1995) suggest that the more variable calls are contact calls. Some authors feel there are geographic differences in the frequency, duration and repetition of the pulses (Thompson *et al.* 1992).

As with other vocalizations produced by baleen whales, the function of fin whale vocalizations is unknown, although there are numerous hypotheses (which include: maintenance of inter-individual distance, species and individual recognition, contextual information transmission, maintenance of social organization, location of topographic features, and location of prey resources; see the review by Thompson *et al.* 1992 for more information on these hypotheses). Responses to conspecific sounds have been demonstrated in a number of mysticetes, and there is no reason to believe that fin whales do not communicate similarly (Edds-Walton 1997). The low-frequency sounds produced by fin whales have the potential to travel over long distances, and it is possible that long-distance communication occurs in fin whales (Payne and Webb 1971; Edds-Walton 1997). Also, there is speculation that the sounds may function for long-range echolocation of large-scale geographic targets such as seamounts, which might be used for orientation and navigation (Tyack 1999).

North Atlantic Right Whale

Distribution

Right whales exist as three separate species: North Atlantic right whales (*Eubalaena glacialis*) that are distributed seasonally from the Gulf of Mexico north to waters off Newfoundland and Labrador (on the western Atlantic) and from northern Africa and Spain north to waters north of Scotland and Ireland (the Shetland and Orkney Islands; on the eastern Atlantic coast); North Pacific right whales (*E. japonica*) that historically ranged seasonally from the coast of Baja California north to the northern Bering Sea (on the eastern Pacific) and the south China Sea north to the Sea of Okhotsk and the Kamchatka Peninsula (on the

western Pacific); and Southern right whales (*E. australis*) which historically ranged across the Southern Ocean, including waters off southern Australia, New Zealand, Chile, Argentina, and southern Africa (north to Madagascar). This Opinion will only discuss the North Atlantic right whale.

In the western Atlantic Ocean, right whales generally occur in northwest Atlantic waters west of the Gulf Stream and are most commonly associated with cooler waters (21 C). North Atlantic right whales are most abundant in Cape Cod Bay between February and April (Hamilton and Mayo 1990 Schevill *et al*. 1986, Watkins and Schevill 1982), in the Great South Channel in May and June (Kenney *et al.* 1986, Payne *et al*. 1990), and off Georgia and Florida from mid-November through March (Slay *et al*. 1996). Right whales also frequent the Bay of Fundy, Browns and Baccaro Banks (in Canadian waters), Stellwagen Bank and Jeffrey's Ledge in the spring and summer months, and use mid-Atlantic waters as a migratory pathway between the winter calving grounds and their spring and summer nursery feeding areas in the Gulf of Maine. North Atlantic right whales are not found in the Caribbean Sea and have been recorded only rarely in the Gulf of Mexico.

Population Structure

NMFS recognizes two extant groups of right whales in the North Atlantic Ocean (*E. glacialis*): an eastern population and a western population. A third population may have existed in the central Atlantic (migrating from east of Greenland to the Azores or Bermuda), but appears to be extinct, if it existed as a distinct population at all (Perry *et al*. 1999).

The degree to which the two extant populations of North Atlantic right whales are connected through immigration or emigration is unknown, but the two populations have historically been treated as if they are isolated populations. Nevertheless, on 5 January 2009, a North Atlantic right whale that had been observed in the Bay of Fundy on 24 September 2008 was observed in the Azore Islands (38 22.698 N and 28 30.341W) which demonstrates that at least one right whale migrated across the Atlantic (L. Steiner, post on MarMam, 7 January 2009).

Threats to the Species

<u>Natural threats</u>. Several researchers have suggested that the recovery of right whales in the northern hemisphere has been impeded by competition with other whales for food (Rice 1974, Scarff 1986). Mitchell (1975) analyzed trophic interactions among baleen whales in the western North Atlantic and noted that the foraging grounds of right whales overlapped with the foraging grounds of sei whales and both preferentially feed on copepods. Reeves *et al.* (1978) noted that several species of whales feed on copepods in the eastern North Pacific, so that the foraging pattern and success of right whales would be affected by other whales as well. Mitchell (1975) argued that the right whale population in the North Atlantic had been depleted by several centuries of whaling before steam-driven boats allowed whalers to hunt sei whales; from this, he hypothesized that the decline of the right whale population made more food available to sei whales and helped their population to grow. He then suggested that competition with the sei whale population impedes or prevents the recovery of the right whale population.

<u>Anthropogenic threats</u>. Several human activities are known to threaten North Atlantic right whales: whaling, commercial fishing, shipping, and water pollution. Historically, whaling represented the greatest threat to every population of right whales and was ultimately responsible for their listing as an endangered species. As its legacy, whaling reduced North Atlantic right whales to about 300 individuals in the western North Atlantic Ocean; the North Atlantic right whales population in the eastern North Atlantic Ocean is probably much smaller, although we cannot estimate the size of that population from the data available.

Of the current threats to North Atlantic right whales, entanglement in commercial fishing gear and ship strikes currently pose the greatest threat to the persistence of North Atlantic right whales. Along the Atlantic Coast of the U.S. and the Maritime Provinces of Canada, there were 33 confirmed reports of right whales being entangled in fishing gear between 2006 and 2010 (Henry et al. 2012). Of these, right whales were injured in five of the entanglements and killed in four entanglements.

In the same region, there were 13 confirmed reports of right whales being struck by vessels between 2006 and 2010 (Henry et al. 2012). Of these, right whales were injured in one of the ship strikes and killed in five ship strikes. In April 2009, a research vessel in the Stellwagen Bank National Marine Sanctuary struck a North Atlantic right whale while transiting to port. Pictures of the whale taken minutes after the strike revealed that the propeller had struck and cut the animal. Although the animal was injured the injury was deemed not life threatening.

The rate at which North Atlantic right whales are killed or injured by ship strikes and in entanglements also appears to be somewhat variable, or possibly increasing: from 1999 to 2003, about 2.6 right whales were killed per year; from 2001 to 2005, an average of 3.2 right whales were killed per year (NMFS 2005, Waring *et al*. 2007). The most recent estimate of anthropogenic mortality and serious injury available shows a rate of 3.0 right whales per year from 2006 to 2010. Of these, 1.2 were attributed to ship strikes and 1.8 were attributed to entanglements (Henry *et al*. 2012).

Status

Right whales (*E. glacialis* and *E. australis*) were listed as endangered under the ESA in 1970. In April, 2008, NMFS divided northern right whales into two separate listings: North Atlantic right whales (*E. glacialis*) and North Pacific right whales (*E. japonica*). All three species (*E. glacialis*, *E. japonica*, and Southern right whales, *E. australis*) are listed as endangered. Since 1949, the northern right whale has been protected from commercial whaling by the International Whaling Commission. They are also protected by the Convention on International Trade in Endangered Species of wild flora and fauna and the MMPA. NMFS designated critical habitat for the North Atlantic population of right whales on 3 June 1994 (59 FR 28793), and this remains in effect for the North Atlantic right whale.

The legacy effects of whaling appear to have had and continue to have greatest effect on endangered North Atlantic right whales by reducing them to a population size that is sufficiently small to experience "small population dynamics" (Caughley 1994, Lande 1993, Lande *et al*. 2003, Melbourne and Hastings 2008). Kraus *et al*. (2005) estimated that about 350 individual right whales, including about 70 mature females, occur in the western North Atlantic. The western North Atlantic population numbered at least 361 individuals in 2005 and at least 396 in 2010 (Waring et al. 2012).

At these population sizes, we would expect North Atlantic right whales to have higher probabilities of becoming extinct because of demographic stochasticity, demographic heterogeneity (Coulson *et al*. 2006, Fox *et al*. 2006) —including stochastic sex determination (Lande *et al*. 2003) — and the effects of these phenomena interacting with environmental variability. Demographic stochasticity refers to the randomness in the birth or death of an individual in a population, which results in random variation on how many young that individuals produce during their lifetime and when they die. Demographic heterogeneity refers to variation in lifetime reproductive success of individuals in a population (generally, the number of reproductive adults an individual produces over their reproductive lifespan), such that the deaths of different individuals have different effects on the growth or decline of a population (Coulson *et al*. 2006). Stochastic sex determination refers to the randomness in the sex of offspring such that sexual ratios in population fluctuate over time (Melbourne and Hastings 2008).

At small population sizes, populations experience higher extinction probabilities because of their population size, because stochastic sexual determination can leave them with all males or all females (which occurred to the heath hen and dusky seaside sparrow just before they became extinct), or because the loss of individuals with high reproductive success has a disproportionate effect on the rate at which the population declines (Coulson *et al*. 2006). In general, an individual's contribution to the growth (or decline) of the population it represents depends, in part, on the number of individuals in the population: the smaller the population, the more the performance of a single individual is likely to affect the population's growth or decline (Coulson *et al*. 2006). Given the small size of the northern right whale population, the performance ("fitness" measured as the longevity of individuals and their reproductive success over their lifespan) of individual whales would be expected to have appreciable consequences for the growth or decline of the northern right whale population. Evidence of the small population dynamics of North Atlantic right whales

appears in demographic models that suggest that the death or survival of one or two individual animals is sufficient to determine whether North Atlantic right whales are likely to accelerate or abate the rate at which their population continues to decline (Fujiwara and Caswell 2001).

These phenomena would increase the extinction probability of northern right whales and amplify the potential consequences of human-related activities on this species. Based on their population size and population ecology (that is, slow-growing mammals that give birth to single calves with several years between births), we assume that right whales would have elevated extinction probabilities because of exogenous threats caused by anthropogenic activities that result in the death or injury of individual whales (for example, ship strikes or entanglement) and natural phenomena (such as disease, predation, or changes in the distribution and abundance of their prey in response to changing climate) *as well as* endogenous threats resulting from the small size of their population. Based on the number of other species in similar circumstances that have become extinct (and the small number of species that have avoided extinction in similar circumstances), the longer North Atlantic right whales remain in these circumstances, the greater their extinction probability becomes.

Diving and Social Behavior

Right whales dive as deep as 306 m (Mate *et al.* 1992). In the Great South Channel, average diving time is close to 2 minutes; average dive depth is 7.3 m with a maximum of 85.3 m (Winn *et al.* 1994). In the U.S. Outer Continental Shelf the average diving time is about 7 min although maximum dive durations are considerably longer (CeTAP 1982). For example, Baumgartner and Mate (2003) reported right whale feeding dives were characterized by a rapid descent from the surface to a particular depth between 80 and 175 m (262 to 574 ft) with animals remaining at those depths for 5 to 14 min, then ascending quickly to the surface (Baumgartner and Mate 2003). Longer surface intervals have been observed for reproductively active females and their calves (Baumgartner and Mate, 2003).

Northern right whales are primarily seen in groups of less than 12, most often singles or pairs (Jefferson *et al.* 1993). They may form larger groups while on feeding or breeding areas (Jefferson *et al.* 1993).

Vocalizations

North Atlantic right whales produce a variety of sounds, including moans, screams, gunshots, blows, upcalls, downcalls, and warbles that are often linked to specific behaviors (Matthews et al., 2001; Laurinolli et al., 2003; Vanderlaan et al., 2003; Parks et al., 2005; Parks and Tyack, 2005). Sounds can be divided into three main categories: (1) blow sounds; (2) broadband impulsive sounds; and (3) tonal call types (Parks and Clark, 2007). Blow sounds are those coinciding with an exhalation; it is not known whether these are intentional communication signals or just produced incidentally (Parks and Clark, 2007).

Broadband sounds include non-vocal slaps (when the whale strikes the surface of the water with parts of its body) and the “gunshot” sound; data suggests that the latter serves a communicative purpose (Parks and Clark, 2007). Tonal calls can be divided into simple, low-frequency, stereo-typed calls and more complex, frequency-modulated, higher-frequency calls (Parks and Clark 2007). Most of these sounds range in frequency from 0.02 to 15 kHz (dominant frequency range from 0.02 to less than 2 kHz; durations typically range from 0.01 to multiple seconds) with some sounds having multiple harmonics (Parks and Tyack 2005).

Source levels for some of these sounds have been measured as ranging from 137 to 192 dB root-mean-square (rms) re 1 Pa-m (decibels at the reference level of one micro Pascal at one meter) (Parks *et al*., 2005; Parks and Tyack, 2005). Parks and Clark (2005) suggested that the frequency of right whale vocalizations increases significantly during the period from dusk until dawn. Recent morphometric analyses of North Atlantic right whale inner ears estimates a hearing range of approximately 0.01 to 22 kHz based on established marine mammal models (Parks *et a*l. 2004, Parks and Tyack 2005, Parks *et al*. 2007). In addition, Parks *et al*. (2007) estimated the functional hearing range for right whales to be 15 Hz to 18 kHz.

Sei Whale

Distribution

Sei whales occur in every ocean except the Arctic Ocean. 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 remains largely unknown (Perry *et al.* 1999). Sei whales are often associated with deeper waters and areas along the continental shelf edge (Hain *et al.* 1985); however, this general offshore pattern of sei whale distribution is disrupted during occasional incursions into more shallow and inshore waters (Waring *et al.* 2004).

In the western Atlantic Ocean, sei whales occur from Labrador, Nova Scotia, and Labrador in the summer months and migrate south to Florida, the Gulf of Mexico, and the northern Caribbean (Gambell 1985, Mead 1977). In the eastern Atlantic Ocean, sei whales occur in the Norwegian Sea (as far north as Finnmark in northeastern Norway), occasionally occurring as far north as Spitsbergen Island, and migrate south to Spain, Portugal, and northwest Africa (Jonsgård and Darling 1974, Gambell 1985).

In the North Pacific Ocean, sei whales occur from the Bering Sea south to California (on the east) and the coasts of Japan and Korea (on the west). During the winter, sei whales are found from 20° - 23°N (Masaki 1977; Gambell 1985). Horwood (1987) reported that 75 - 85% of the North Pacific population of sei whales resides east of 180° longitude.

Sei whales occur throughout the Southern Ocean during the summer months, although they do not migrate as far south to feed as blue or fin whales. During the austral winter, sei whales occur off Brazil and the western and eastern coasts of Southern Africa and Australia.

Population Structure

The population structure of sei whales is largely unknown because there are so few data on this species. The International Whaling Commission's Scientific Committee groups all of the sei whales in the entire North Pacific Ocean into one population (Donovan 1991). However, some mark-recapture, catch distribution, and morphological research suggest more than one "stock" of sei whales may exist in the Pacific: one between 175°W and 155°W longitude, and another east of 155°W longitude (Masaki 1977); however, the amount of movement between these "stocks" suggests that they probably do not represent demographically-isolated populations as we use this concept in this Opinion.

Mitchell and Chapman (1977) divided sei whales in the western North Atlantic in two populations, one that occupies the Nova Scotian Shelf and a second that occupies the Labrador Sea. Sei whales are most common on Georges Bank and into the Gulf of Maine and the Bay of Fundy during spring and summer, primarily in deeper waters. There are occasional influxes of sei whales further into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy.

Threats to the Species

Natural threats. Sei whales appear to compete with blue, fin, and right whales for prey and that competition may limit the total abundance of each of the species (Rice 1974, Scarff 1986). As discussed previously in the narratives for fin and right whales, the foraging areas of right and sei whales in the western North Atlantic Ocean overlap and both whales feed preferentially on copepods (Mitchell 1975).

Anthropogenic threats. Two human activities are known to threaten sei whales: whaling and shipping. Historically, whaling represented the greatest threat to every population of sei whales and was ultimately responsible for listing sei whales as an endangered species. From 1910 to 1975, approximately 74,215 sei whales were caught in the entire North Pacific Ocean (Horwood 1987, Perry *et al.* 1999). From the early 1900s, Japanese whaling operations consisted of a large proportion of sei whales: 300 - 600 sei whales were killed per year from 1911 to 1955. The sei whale catch peaked in 1959, when 1,340 sei whales were killed. In 1971, after a decade of high sei whale catch numbers, sei whales were scarce in Japanese waters.

In the North Atlantic Ocean, sei whales were hunted from land stations in Norway and Iceland in the early- to mid-1880s, when blue whales started to become more scarce. In the late 1890s, whalers began hunting sei whales in Davis Strait and off the coasts of Newfoundland. In the early 1900s, whalers from land stations on the Outer Hebrides and Shetland Islands started to hunt sei whales. Between 1966 and 1972, whalers from land stations on the east coast of Nova Scotia engaged in extensive hunts of sei whales on the Nova Scotia shelf, killing about 825 sei whales (Mitchell and Chapman 1977).

Sei whales are occasionally killed in collisions with vessels. Of 3 sei whales that stranded along the Atlantic Coast of the U.S. between 1975 and 1996, 2 showed evidence of collisions with ships (Laist *et al.* 2001). Between 1999 and 2010, there were 6 reports of sei whales being struck by vessels along the Atlantic Coast of the U.S. and the Maritime Provinces of Canada (Cole *et al.* 2005, Nelson *et al.* 2007, Henry et al. 2012). Five of these ship strikes were reported as having resulted in the death of the sei whale.

Sei whales are occasionally found entangled. Along the Atlantic Coast of the U.S. and the Maritime Provinces of Canada, there were 3 confirmed reports of fin whales being entangled in fishing gear between 2006 and 2010 (Henry et al. 2012). Of these, fin whales were injured in two of the entanglements and killed in one.

Status

Sei whales were listed as endangered under the ESA in 1973. In the North Pacific, the International Whaling Commission began management of commercial taking of sei whales in 1970, and sei whales were given full protection in 1985 (Allen 1980). Sei whales are also protected by the Convention on International Trade in Endangered Species of wild flora and fauna and the Marine Mammal Protection Act. They are listed as endangered under the IUCN Red List of Threatened Animals (Baillie and Groombridge 1996). Critical habitat has not been designated for sei whales.

Prior to commercial whaling, sei whales in the north Pacific are estimated to have numbered 42,000 individuals (Tillman 1977), although Ohsumi and Fukuda (1975) estimated that sei whales in the north Pacific numbered about 49,000 whales in 1963, had been reduced to 37,000 or 38,000 whales by 1967, and reduced again to 20,600 to 23,700 whales by 1973. Japanese and Soviet catches of sei whales in the North Pacific and Bering Sea increased from 260 whales in 1962 to over 4,500 in 1968 and 1969, after which the sei whale population declined rapidly (Mizroch *et al.* 1984). When commercial whaling for sei whales ended in 1974, the population of sei whales in the North Pacific had been reduced to between 7,260 and 12,620 animals (Tillman 1977). In the same year, the north Atlantic population of sei whales was estimated to number about 2,078 individuals, including 965 whales in the Labrador Sea group and 870 whales in the Nova Scotia group (IWC 1977, Mitchell and Chapman 1977).

The 2004 abundance estimate of 386 is considered the best available for the Nova Scotia stock of sei whales (Waring et al. 2012). There have been no direct estimates of sei whale abundance in the entire (or eastern) North Pacific based on sighting surveys, but two abundance estimates based on recent line transect surveys of California, Oregon, and Washington waters are 74 (CV=0.88) and 215 (CV=0.71) sei whales, respectively (Forney 2007, Barlow 2010)

Like blue whales, the information available on the status and trend of sei whales do not allow us to reach any conclusions about the extinction risks facing sei whales as a species, or particular populations of sei whales. With the limited data available on sei whales, we do not know whether these whales exist at population sizes large enough to avoid demographic phenomena that are known to increase the extinction probability of species that exist as “small” populations (that is, “small” populations experience phenomena such as demographic stochasticity, inbreeding depression and Allee effects, among others, that cause their population size to become a threat in and of itself) or if sei whales are threatened more by exogenous threats such as anthropogenic activities (primarily whaling, entanglement, and ship strikes) or natural phenomena (such as disease, predation, or changes in the distribution and abundance of their prey in response to changing climate). However, sei whales have historically exhibited sudden increases in abundance in particular areas followed by sudden decreases in number. Several authors have reported

"invasion years" in which large numbers of sei whales appeared off areas like Norway and Scotland, followed the next year by sudden decreases in population numbers (Jonsgård and Darling 1974).

With the evidence available, we do not know if this year-to-year variation still occurs in sei whales. However, if sei whales exist as a fraction of their historic population sizes, large amounts of variation in their abundance would increase the extinction probabilities of individual populations (Fagan and Holmes 2006, Fagan *et al.* 1999, 2001).

Diving and Social Behavior

Generally, sei whales make 5-20 shallow dives of 20-30 sec duration followed by a deep dive of up to 15 min (Gambell 1985). The depths of sei whale dives have not been studied, however the composition of their diet suggests that they do not perform dives in excess of 300 meters. Sei whales are usually found in small groups of up to 6 individuals, but they commonly form larger groupings when they are on feeding grounds (Gambell 1985).

Vocalizations and Hearing

There is a limited amount of information on the vocal behavior of sei whales. McDonald et al. (2005) recorded sei whale vocalizations off the Antarctic Peninsula that included broadband sounds in the 100-600 Hz range with 1.5 second duration and tonal and upsweep call in the 200-600 Hz range 1-3 second duration. During visual and acoustic surveys conducted in the Hawaiian Islands in 2002, Rankin and Barlow (2007) recorded 107 sei whale vocalizations, which they classified as two variations of low-frequency downswept calls. The first variation consisted of sweeps from 100 Hz to 44 Hz, over 1.0 seconds. The second variation, which was more common (105 out of 107) consisted of low frequency calls which swept from 39 Hz to 21 Hz over 1.3 seconds. These vocalizations are different from sounds attributed to sei whales in the Atlantic and Southern Oceans but are similar to sounds that had previously been attributed to fin whales in Hawaiian waters.

A general description of the anatomy of the ear for cetaceans is provided in the preceding description of the blue whale.

Bowhead whale

Description of the species

Currently, five bowhead whale stocks have been identified: Sea of Okhotsk, Davis Strait, Hudson Bay, offshore waters of Spitsbergen, and the western Arctic, with only the latter occurring in U.S. waters, and most stocks consist of a few dozens to hundreds of individuals (Ivashchenko & Clapham 2010; IWC 1992; NMFS 2006i). Genetically, significant genetic differentiation exists between these areas (Givens et al. 2010; Ivashchenko & Clapham 2010). However, genetic analyses have thus far not clearly identified differences, particularly between Atlantic stocks, although some differentiation in haplotypes appears to exist between Hudson Bay and Davis Strait individuals in some areas (but not in all areas) (Bachmann et al. 2010; Heide-Jorgensen & Postma 2006; Postma & Cosens 2006). Genetic differentiation appears to be high within the western Arctic stock, which likely represents a single population (Givens et al. 2010).

Distribution

Bowhead whales only occur at high latitudes in the northern hemisphere and have a disjunctive circumpolar distribution (Reeves 1980). Bowhead whales are found in the western Arctic (Bering, Chukchi, and Beaufort Seas), the Canadian Arctic and West Greenland (Baffin Bay, Davis Strait, and Hudson Bay), the Okhotsk Sea (eastern Russia), and the Northeast Atlantic from Spitzbergen westward to eastern Greenland. In the Chukchi Sea, bowheads are found in all months of the year (mainly west and southwest of Point Barrow) and distribution does not appear linked to changes in sea ice cover (Clarke & Ferguson. 2010b). Bowheads inhabiting the Okhotsk Sea appear to reside there year-round (Ivashchenko & Clapham 2010). Historically, bowhead whale range has extended into the eastern Atlantic, in which basin it is estimated that 52,500 individuals once lived (Allen et al. 2006).

Movement and habitat

The majority of the western Arctic stock migrates annually from wintering areas (November to March) in the northern Bering Sea, through the Chukchi in spring (March through June), to the Beaufort Sea where they spend much of the summer (mid-May through November) before returning again to the Bering Sea in fall. In the Chukchi Sea, bowheads are generally found in waters between 50 and 200 m deep (Clarke & Ferguson. 2010b). However, individuals in the Beaufort Sea appear to strongly favor shallower areas less than 50 m and preferably shallower than 20 m (Clarke & Ferguson. 2010a). Feeding appears to preferentially occur in 154-157º longitude in the Beaufort Sea (Clarke & Ferguson. 2010a). During their migrations north, they are forced between land and pack ice around Point Barrow, Alaska. They spend most of the summer in relatively ice-free waters of the Beaufort Sea, but they are associated with sea ice the rest of the year (Moore & Reeves 1993). During their autumn migration, bowhead whales preferentially select nearshore shelf waters, except if there are heavy ice conditions, in which case they select slope habitat. Not all bowhead whales follow this migration and some over-summer in the Bering and Chukchi Seas.

Growth and reproduction

Reproductive activities for bowhead whales occur throughout the year, but conception takes place in late winter or early spring. Some whales may be unable to conceive, as there is evidence of pseudohermaphroditism in a relatively high percentage (two of 76 whales sampled) of male bowhead whales (Philo et al. 1992). Gestation lasts 12 to 16 months and the calving interval is between 3.5 and seven years (Nerini et al. 1984; Tarpley et al. 1995). Bowhead whales take approximately two decades to become sexually mature, when they reach approximately 40 to 46 feet in length (IWC 2004; Nerini et al. 1984; Schell & Saupe 1993; Schell et al. 1989). Disko Bay, Canada has been proposed as a breeding site for bowheads in the Baffin Bay stock and Foxe Bay has been proposed as a calf-rearing site (Heide-Jorgensen et al. 2010b).

Feeding

Bowhead whales in the North Pacific feed on euphausiids and copepods, which make up most of their diets (Heide-Jorgensen et al. 2010a; Lowry 1993). However, based upon a very few stomach samples, bowheads may have significant dietary flexibility, ranging from oceanic to benthic and epibenthic invertebrate prey (Pomerleau et al. 2011).

Diving

Bowhead diving behavior is situational (Stewart 2002). Calves dive for very short periods and their mothers tend to dive less frequently and for shorter durations. Feeding dives tend to last from 3 to 12 minutes and may extend to the relatively shallow bottom in the Beaufort Sea. "Sounding" dives average between 7 and 14 minutes. When individuals migrate through pack ice, dives tend to become longer and deeper, presumably to navigate through areas where breathing holes may not be accessible. However, when harassed by whalers, bowheads are known to dive for as long as 80 minutes.

Status and trends

Bowhead whales were originally listed as endangered in 1970 (35 FR 18319), and this status remained since the inception of the ESA in 1973. Bowhead whale abundance prior to commercial whaling in the western Arctic has been estimated at 10,400 to 23,000 (Woodby & Botkin 1993). At the end of commercial whaling the species had declined to between 1,000 and 3,000 bowhead whales in the western Arctic. The current minimum population estimate is 9,472 whales, and in 2001 the population was estimated at 10,545 individuals (Angliss & Outlaw 2008). Also in 2001, 121 calves were counted, which is the most calves recorded in a single year. The population has been increasing at approximately 3.1% from 1978 to 1993 and more recently by about 3.5% annually (Angliss & Outlaw 2008). Punt (2010) estimated the rate of increase for bowhead whales in the Bering-Chukchi-Beaufort Sea region to be 3.9% annually (0.84 SE) between 1978 and 2001.

This upward population trend is consistent with impressions of local hunters and western Arctic recovery may warrant delisting in the future (Gerber et al. 2007; Noongwook et al. 2007). It is also estimated that

1,229 individuals reside in the Spitsbergen stock, which also exceeds prior abundance estimates and sightings are occurring on a more regular basis (Gilg & Born 2005; Heide-Jorgensen et al. 2007). In 2009, a calf was spotted off northeast Greenland; the first observed in the Spitsbergen stock in 18 years (Boertmann & Nielsen. 2010). Hansen et al. (2010) estimated 1,105 individuals in Isabella Bay, Canada in September 2009. The eastern Canada-western Greenland stock appears to be increasing robustly based upon age at sexual maturity and calving interval data (Koski et al. 2010).

Natural threats. Little is known of diseases and natural death in the western Arctic bowhead whale population, but the mortality rate is thought to be low (Koski et al. 1993). Bowhead whales have been subjects of killer whale attacks and, because of their robust size and slow swimming speed, tend to form small groups and fight killer whales when confronted and may cause killer whale mortality with their flukes (Ford & Reeves 2008). Individuals have been known to be trapped by sea ice for extended periods, which may pose a lethal threat.

Anthropogenic threats. Bowhead whales began declining precipitously with directed whaling efforts in the Bering Sea between 1850 and 1870, when an estimated 60% of individuals were harvested (Braham 1984). Harvests declined after 1870, although whaling efforts continued, including illegal Soviet whaling (Ivashchenko & Clapham 2010). Subsistence harvests continue at present, with 31 of 38 whales struck by Alaskan native harpoons killed and landed in 2009, which is roughly similar to annual landings over the past decade (Suydam et al. 2004; Suydam et al. 2009; Suydam et al. 2010; Suydam et al. 2005; 2006; Suydam et al. 2003; Suydam & George. 2004; Suydam et al. 2002).

Present threats to bowhead whales include interactions with crab pots, nets, and ship propellers at low levels. Between 1978 and 2004, eight bowheads were observed entangled and five had propeller scars (NMFS 2006i). These bowheads likely became entangled as a result of "skimming" prey at the water's surface and becoming entangled with debris. More significant are the number of bowhead whales taken by native tribes from the western Arctic stock: 14 to 72 individuals, or 0.1 to 0.5% of the stock population annually. Under this system, 832 individuals are known to have been taken from 1974 to 2003. However, these hunts are closely monitored and accessed for negative impacts on population number and structure and serve to maintain tribal culture. Individuals are known to have been taken by native tribes in Canada and Russia, although in extremely low numbers. Another potential threat is the documented reduction in sea ice, weather, or temperature conditions that has resulted from global warming (Tynan & DeMaster 1997). It is unknown what effects these large scale changes may have (NMFS 2006i).

Several contaminants have been isolated from bowhead whale tissues in low concentrations, including organochlorines, mercury, lead, arsenic, zinc, copper, cadmium, selenium, and silver (Dehn et al. 2006; O'Hara et al. 2006; Rosa et al. 2007b). Rosa et al. (2008) measured metal concentrations in the liver that included zinc (6.99 to 135.11 mg/kg wet weight), copper (1.09 to 203.81 mg/kg), cadmium (0.003 to 50.91 mg/kg), selenium (0.06 to 3.77 mg/kg), silver (0.05 to 2.37 mg/kg), and mercury (0.001 to 0.47 mg/kg). These same metals in kidney are generally lower, but present; zinc (9.07 to 56.31 mg/kg wet weight), copper (0.76 to 7.94 mg/kg), cadmium (0.01 to 64.0 mg/kg), selenium (0.23 to 3.21 mg/kg), silver (0.01 to 0.06 mg/kg), and mercury (0.001 to 0.14 mg/kg). Thickening of the Bowman's capsules and fibrous tissue formations are associated with cadmium accumulation in the kidney. These changes may reduce kidney function, although bowheads seem to be able to withstand significant kidney pathology (Parrish et al. 2008). Bioaccumulation of these metals occurs with age, but differences between sexes have not been observed in metal concentration (Parrish et al. 2008). These concentrations are lower than in other studied cetaceans due to the lower level at which bowhead whales feed in the overall food chain (Dehn et al. 2006; Parrish et al. 2008). Hormonal concentrations suggest that contaminants are not presently a significant hindrance for bowhead whales (Rosa et al. 2007a). However, the development of Arctic regions for oil and gas can increase contaminant loads in the environment, prey species, and protected species such as bowhead whales. Organochlorine levels are also believed to accumulate in arctic regions (Tanabe et al. 1994), leading to concern over the potential bioaccumulation of these toxins in bowhead whales due to global sources.

Bowhead whales have also been shown to vacate areas in which drilling and seismic survey operations occur, apparently in response to sound (Davies 1997; Miller et al. 1999; Richardson 1995; Richardson &

Malme 1993; Schick & Urban 2000). It is possible that migratory routes have already shifted in response to anthropogenic sound (Richardson et al. 2004).

North Pacific right whale

Description of the species

Many basic life history parameters of North Pacific right whales are unknown. All North Pacific right whales constitute a single population.

Distribution

Very little is known of the distribution of right whales in the North Pacific and very few of these animals have been seen in the past 20 years. Historical whaling records indicate that right whales ranged across the North Pacific north of 30° N latitude and occasionally as far south as 20° N, with a bimodal distribution longitudinally favoring the eastern and western North Pacific and occurring infrequently in the central North Pacific (Gregr & Coyle. 2009; Josephson et al. 2008a; Maury 1853; Scarff 1986; Scarff 1991; Townsend 1935). North Pacific right whales summered in the North Pacific and southern Bering Sea from April or May to September, with a peak in sightings in coastal waters of Alaska in June and July (Klumov 1962; Maury 1852; Omura 1958; Omura et al. 1969a; Townsend 1935). North Pacific right whale summer range extended north of the Bering Strait (Omura et al. 1969a). However, they were particularly abundant in the Gulf of Alaska from 145° to 151°W, and apparently concentrated in the Gulf of Alaska, especially south of Kodiak Islands and in eastern Aleutian Islands and southern Bering Sea waters (Berzin & Rovnin 1966; Braham & Rice 1984).

Current information on the seasonal distribution of right whales is spotty. In the eastern North Pacific, this includes sightings over the middle shelf of the Bering Sea, Bristol Bay, Aleutian and Pribilof Islands (Goddard & Rugh 1998; Hill & DeMaster 1998; Perryman et al. 1999; Wade et al. 2006b; Waite et al. 2003a). Some more southerly records also record occurrence along Hawaii, California, Washington, and British Columbia (Herman et al. 1980; Scarff 1986). However, records from Mexico and California may suggest historical wintering grounds in offshore southern North Pacific latitudes (Brownell et al. 2001a; Gregr & Coyle. 2009).

Growth and reproduction

While no reproductive data are known for the North Pacific, studies of North Atlantic right whales suggest calving intervals of two to seven years and growth rates that are likely dependent on feeding success (Best et al. 2001; Burnell 2001; Cooke et al. 2001; Kenney 2002; Knowlton et al. 1994; Reynolds et al. 2002). It is presumed that right whales calve during mid-winter (Clapham et al. 2004a). Western North Pacific sightings have been recorded along Japan, in the Yellow Sea, and Sea of Japan (Best et al. 2001; Brownell et al. 2001b, areas that are speculated to be important breeding and calving areas).Lifespans of up to 70 years can be expected based upon North Atlantic right whale data.

Feeding

Stomach contents from North Pacific right whales indicate copepods and, to a lesser extent, euphausiid crustaceans are the whales' primary prey (Omura et al. 1969b). North Pacific right whales have also been observed feeding on coccolithophore blooms (Tynan et al. 2001). Their diet is likely more varied than North Atlantic right whales, likely due to the multiple blooms of different prey available in the North Pacific from January through August (Gregr & Coyle. 2009). Based upon trends in prey blooms, it is predicted that North Pacific right whales may shift from feeding offshore to over the shelf edge during late summer and fall (Gregr & Coyle. 2009). North Pacific right whales, due to the larger size of North Pacific copepods, have been proposed to be capable to exploit younger age classes of prey as well as a greater variety of species. Also as a result, they may require prey densities that are one-half to one-third those of North Atlantic right whales (Gregr & Coyle. 2009). Right whales feed by continuously filtering prey through their baleen while moving, mouth agape, through patches of planktonic crustaceans. Right whales are believed to rely on a combination of experience, matrilinear learning, and sensing of oceanographic

conditions to locate prey concentrations in the open ocean (Gregr & Coyle. 2009; Kenney 2001).

Habitat

Habitat preference data are sparse for North Pacific right whales as well. Sightings have been made with greater regularity in the western North Pacific, notably in the Okhotsk Sea, Kuril Islands, and adjacent areas (Brownell et al. 2001b). In the western North Pacific, feeding areas occur in the Okhotsk Sea and adjacent waters along the coasts of Kamchatka and the Kuril Islands (IWC 2001).

Historical concentrations of sightings in the Bering Sea together with some recent sightings indicate that this region, together with the Gulf of Alaska, may represent an important summer habitat for eastern North Pacific right whales (Brownell et al. 2001b; Clapham et al. 2004a; Goddard & Rugh 1998; Scarff 1986; Shelden et al. 2005a). Few sighting data are available from the eastern North Pacific, with a single sighting of 17 individuals in the southeast Bering Sea being by far the greatest known occurrence (Wade et al. 2006a). Some further sightings have occurred in the northern Gulf of Alaska (Wade et al. 2006a). Recent eastern sightings tend to occur over the continental shelf, although acoustic monitoring has identified whales over abyssal waters (Mellinger et al. 2004). It has been suggested that North Pacific right whales have shifted their preferred habitat as a result of reduced population numbers, with oceanic habitat taking on a far smaller component compared to shelf and slope waters (Shelden et al. 2005b). The area where North Pacific right whales are densest in the Gulf of Alaska is between 150 and 170° W and south to 52° N (Shelden & Clapham 2006). A right whale was sighted southeast of Kodiak Island in July 1998 and acoustic detections have been made off Kodiak Island, although no detections occurred from April to August 2003 or in April 2009 (Munger et al. 2008; Rone et al. 2010; Waite et al. 2003b). The greatest frequency of call occurrence in the southerastern Bering Sea occurs from July to October (Munger et al. 2008).

Migration and movement

Historical sighting and catch records provide the only information on possible migration patterns for North Pacific right whales (Omura 1958; Omura et al. 1969a; Scarff 1986). During summer, whales have been found in the Gulf of Alaska, along both coasts of the Kamchatka Peninsula, the Kuril Islands, the Aleutian Islands, the southeastern Bering Sea, and in the Okhotsk Sea. Fall and spring distribution was the most widely dispersed, with whales occurring in mid-ocean waters and extending from the Sea of Japan to the eastern Bering Sea. In winter, right whales have been found in the Ryukyu Islands (south of Kyushu, Japan), the Bonin Islands, the Yellow Sea, and the Sea of Japan. Whalers never reported winter calving areas in the North Pacific and where calving occurs remains unknown (Clapham et al. 2004a; Gregr & Coyle. 2009; Scarff 1986). North Pacific right whales probably migrate north from lower latitudes in spring and may occur throughout the North Pacific from May through August north of 40º N from marginal seas to the Gulf of Alaska and Bering Sea, although absence from the central North Pacific has been argued due to inconsistencies in whaling records (Clapham et al. 2004b; Josephson et al. 2008b). This follows generalized patterns of migration from high-latitude feeding grounds in summer to more temperate, possibly offshore waters, during winter (Braham & Rice 1984; Clapham et al. 2004a; Scarff 1986).

Status and trends

The Northern right whale was originally listed as endangered in 1970 (35 FR 18319), and this status remained since the inception of the ESA in 1973. The early listing included both the North Atlantic and the North Pacific populations, although subsequent genetic studies conducted by Rosenbaum (2000) resulted in strong evidence that the North Atlantic and North Pacific right whales are separate species. Following a comprehensive status review, NMFS concluded that Northern right whales are indeed two separate species. In March 2008, NMFS published a final rule listing North Pacific and North Atlantic right whales as separate species (73 FR 12024).

Very little is known about right whales in the eastern North Pacific, which were severely depleted by commercial whaling in the 1800s (Brownell et al. 2001b). At least 11,500 individuals were taken by American whalers in the early- to mid-19th century, but harvesting continued into the 20th century (Best 1987). Illegal Soviet whaling took 372 individuals between 1963 and 1967 (Brownell et al. 2001a). In the last several decades there have been markedly fewer sightings due to a drastic reduction in number, caused

by illegal Soviet whaling in the 1960s (Doroshenko 2000). The current population size of right whales in the North Pacific is likely fewer than 1,000 animals compared to possibly 11,000 individuals or more prior to exploitation (NMFS 2006) (NMFS 1991b). Wade et al. (2011) used mark-recapture and genotyping methodologies that produced estimates of 31 and 28 individuals, respectively, for individuals in the Berring Sea (likely representing all individuals from the eastern North Pacific).

Abundance estimates and other vital rate indices in both the eastern and western North Pacific are not well established. Where such estimates exist, they have very wide confidence limits. Previous estimates of the size of the right whale population in the Pacific Ocean range from a low of 100-200 to a high of 220-500 (Berzin & Yablokov 1978; Braham & Rice 1984). Although Hill and DeMaster (1998) argued that it is not possible to reliably estimate the population size or trends of right whales in the North Pacific, Reeves et al. (2003) and Brownell et al. (2001) concluded that North Pacific right whales in the eastern Pacific Ocean exist as a small population of individuals while the western population of right whales probably consists of several hundred animals, although Clapham et al. (2005) placed this population at likely under 100 individuals (Wade et al. (2010) estimated 25-38 individuals). Brownell et al. (2001b) reviewed sighting records and also estimated that the abundance of right whales in the western North Pacific was likely in the low hundreds.

Scientists participating in a recent study utilizing acoustic detection and satellite tracking identified 17 right whales (10 males and 7 females) in the Bearing Sea, which is almost threefold the number seen in any previous year in the last four decades (Wade et al. 2006b). These sightings increased the number of individual North Pacific right whales identified in the genetic catalog for the eastern Bering Sea to 23. Amidst the uncertainty of the eastern North Pacific right whale's future, the discovery of females and calves gives hope that this endangered population may still possess the capacity to recover (Wade et al. 2006b). Available age composition of the North Pacific right whale population indicates most individuals are adults (Kenney 2002). Length measurements for two whales observed off California suggest at least one of these whales was not yet sexually mature and two calves have been observed in the Bering Sea (Carretta et al. 1994; Wade et al. 2006b). However, to date, there is no evidence of reproductive success (i.e., young reared to independence) in the eastern North Pacific. No data are available for the western North Pacific.

<u>Natural threats</u>. Right whales have been subjects of killer whale attacks and, because of their robust size and slow swimming speed, tend to fight killer whales when confronted (Ford & Reeves 2008). Similarly, mortality or debilitation from disease and red tide events are not known, but have the potential to be significant problems in the recovery of right whales because of their small population size.

<u>Anthropogenic threats</u>. Whaling for North Pacific right whales was discontinued in 1966 with the IWC whaling moratorium. However, North Pacific right whales remain at high risk of extinction. Demographic stressors include but are not limited to the following: (1) life history characteristics such as slow growth rate, long calving intervals, and longevity; (2) distorted age structure of the population and reduced reproductive success; (3) strong Allee effects; (4) habitat specificity or site fidelity; and (5) habitat sensitivity. The proximity of the other known right whale habitats to shipping lanes (e.g. Unimak Pass) suggests that collisions with vessels may also represent a threat to North Pacific right whales (Elvin & Hogart 2008).

Climate change may have a dramatic effect on survival of North Pacific right whales. Right whale life history characteristics make them very slow to adapt to rapid changes in their habitat (see Reynolds et al. 2002). They are also feeding specialists that require exceptionally high densities of their prey (see Baumgartner et al. 2003; Baumgartner & Mate 2003). Zooplankton abundance and density in the Bering Sea has been shown to be highly variable, affected by climate, weather, and ocean processes and in particular ice extent (Baier & Napp 2003; Napp & G.L. Hunt 2001). The largest concentrations of copepods occurred in years with the greatest southern extent of sea ice (Baier & Napp 2003). It is possible that changes in ice extent, density, and persistence may alter the dynamics of the Bering Sea shelf zooplankton community and in turn affect the foraging behavior and success of right whales. No data are available for the western North Pacific.

Critical habitat

In July 2006, NMFS designated two areas as critical habitat for right whales in the North Pacific (71 FR 38277). The areas encompass about 36,750 square miles of marine habitat, which include feeding areas within the Gulf of Alaska and the Bering Sea that support the species. The primary constituent element to this critical habitat is the presence of large copepods and oceanographic factors that concentrate these prey of North Pacific right whales. At present, this PCE has not been significantly degraded due to human activity. However, significant concern has been voiced regarding the impact that oceanic contamination of pollutants may have on the food chain and consequent bioaccumulation of toxins by marine predators. Changes due to global warming have also been raised as a concern that could affect the distribution or abundance of copepod prey for several marine mammals, including right whales.

ENVIRONMENTAL BASELINE

By regulation, environmental baselines for biological opinions include: the past and present impacts of all state, Federal, or private actions; other human activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation; and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). A number of human activities have contributed to the current status of whales in the action area. Some of those activities, most notably commercial whaling, occurred extensively in the past, ended, and no longer appear to affect these species, although the effects of the reduction likely persist today. Other human activities are ongoing and may continue to affect whales. The following discussion summarizes the principal phenomena that are known to affect the likelihood that these species will survive and recover in the wild. Here, we first describe the status of the species within the action area, then focus on threats that impact all species within the action area.

Humpback whales

There is one recognized management stock of humpback whales in the Atlantic (Gulf of Maine stock) and three management stocks of humpback whales are recognized within the North Pacific (the eastern North Pacific stock, the central North Pacific stock, and the western North Pacific stock). Population estimates for the entire North Pacific are estimated to be just under 20,000 animals (Calambokidis et al. 2008). The population is estimated to be growing six to seven percent annually (Carretta et al. 2008).

Gulf of Maine stock: Winter breeding areas are known to occur in the West Indies. Most breeding sites are found in the waters of the Dominican Republic but can extend throughout the Antillean arc, from Puerto Rico to the coast of Venezuela. The best available estimate for the Gulf of Maine (formerly Western North Atlantic) stock is 847 animals. This population is estimated to be growing at about six percent annually (Barlow and Clapham 1997).

Eastern North Pacific stock: The eastern North Pacific stock is referred to as the winter/spring population in coastal Central America and Mexico which migrates to the coast of California to southern British Columbia in summer/fall (Steiger et al., 1991; Calambokidis et al., 1993). The best available abundance estimate for this stock is 2,043 whales and appears to be increasing in abundance (Carretta et al., 2010).

Central North Pacific stock: The central North Pacific humpback whale stock is referred to as the winter/spring population of the Hawaiian Islands which migrates to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodiak (Baker et al., 1990; Perry et al., 1990; Calambokidis et al., 1997). Population estimates vary for this stock, but the most recent N_{min} was calculated to be 5,833 (Allen and Angliss, 2010). The stock appears to be increasing, with a PBR of 61.2 animals.

Western North Pacific stock: The western North Pacific Stock is referred to as the winter/spring population of Japan and probably migrates to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin, 1966; Nishiwaki, 1966; Darling, 1991). This population is estimated to include 938 individuals and the PBR is calculated to be 2.6. Current data indicate the population size is trending upwards but no confidence limits are available.

Sei whales
The best estimate of abundance for the Nova Scotia stock sei whales is 386. Current and maximum net productivity rates are unknown for this stock. However, it is estimated that this stock may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow et al. 1995). Sei whale abundance is greatest in U.S. waters mostly in the northern portions of the U.S. Atlantic Exclusive Economic Zone (EEZ)—the Gulf of Maine and Georges Bank during spring and summer. Within the Pacific U.S. EEZ, sei whales are divided into two discrete stocks: the Eastern North Pacific stock and the Hawaii stock.

Eastern North Pacific stock: The best abundance estimate for whales off the coasts of California, Oregon and Washington is 126 animals with an annual Potential Biological Removal (PBR) level of 0.17 (Caretta et al., 2010). No population trend is available for this stock.

Hawaii stock: The best abundance estimate for whales off Hawaii is 77 animals with an annual PBR level of 0.1 (Caretta et al., 2010). No population trend is available for this stock. There have been no reported fishery related mortality or serious injuries of sei whales in the Hawaiian Islands EEZ and is not considered to be a significant concern.

Fin whales
The best available estimate for the Western North Atlantic stock is 3,985. There are insufficient data to determine status and population trends for this stock. A recent NMFS 5-year Status Review of fin whales points out that there is a lack of ocean-wide status and trend information of fin whales (NMFS 2011). Three stocks of fin whales are recognized in Pacific U.S. waters:

California/Oregon/Washington stock: This stock is found along the U.S. west coast from California to Washington in waters out to 300 nmi. Because fin whale abundance appears lower in winter/spring in California (Dohl et al., 1983; Forney et al., 1995) and in Oregon (Green et al., 1992), it is likely that the distribution of this stock extends seasonally outside these coastal waters. The best available estimate of the stock's population size is 3,044 whales with a PBR of 16 whales (Carretta et al., 2010).

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

Hawaii stock: The best available abundance estimate for this stock is 174 whales based on a 2002 survey of the entire Hawaiian Islands EEZ (Barlow, 2003) with a PBR of 0.2 whales per year (Carretta et al., 2010). Data is not available to determine a population trend for this stock.

Blue whales
There are insufficient data to determine the status and trends of the blue whale population in the western North Atlantic stock (Waring et al. 2011). The Recovery Plan for the blue whale (NMFS 1998) summarizes what is known about blue whale abundance in the western North Atlantic and concludes that the population probably numbers in the low hundreds. More than 440 individuals were photo-identified in the Gulf of St. Lawrence between 1979-2009 (R. Sears, pers. comm., as quoted by Waring et al. 2011).

Within U.S. waters in the North Pacific, blue whales are divided into two stocks: Western and Eastern. Insufficient data are available to evaluate the current abundance or population trends of blue whale stocks in the western North Pacific. The best estimate of blue whale abundance in the eastern North Pacific is

2,842 animals with an annual PBR of six whales per year in U.S. waters. Along the California coast blue whale abundance has been increasing during the past two decades (Barlow 1994; Calambokidis & Barlow 2004; Calambokidis et al. 1990).

North Atlantic right whales

The western North Atlantic population size was estimated to be at least 361 individuals in 2005 based on a census of individual whales identified using photo-identification techniques. Research using the North Atlantic Right Whale Catalogue has indicated that, annually, between 14% and 51% of right whales are involved in entanglements (Knowlton et al. 2005). Ship strikes are also a major cause of mortality and injury to right whales (Kraus 1990; Knowlton and Kraus 2001). In records from 2003 through 2007, mortality and serious injury to right whales due to ship strikes were 2.8 whales per year (U.S. waters, 2.2; Canadian waters, 0.6). Given the small population size and low reproductive rate, human-related mortalities may be the principal factors inhibiting growth and recovery of the population. In order to reduce the threat of ship collisions with North Atlantic right whales, NMFS issued a final rule to implement speed restrictions in 2008.

North Pacific right whales

There are no reliable estimates of current abundance or trends for right whales in the North Pacific including the eastern or western population. For the western North Pacific, sighting survey estimates for the summer feeding ground indicate an abundance of around 900 in the Sea of Okhotsk. Over the past forty years, most sightings in the eastern North Pacific have been of single whales. However, during the last few years, small groups of right whales have been sighted (Wade et al., 2006, 2011).

Bowhead whales

The Western Arctic bowhead whale stock has been increasing in recent years; the estimate of 10,545 is between 19% and 105% of the pre-exploitation abundance (estimates ranging roughly from 10,000 to 55,000), and this stock may now be approaching its carrying capacity (Brandon and Wade 2004, 2006).

The estimated abundance of the Spitsbergen stock was 24,000 prior to commercial exploitation, but currently numbers less than one hundred. The Baffin Bay-Davis Strait stock was estimated at about 11,750 prior to commercial exploitation and the Hudson Bay-Fox Basin stock at about 450. The current abundance of the Baffin Bay-Davis Straight and Hudson Bay-Fox Basin stocks

Natural Sources of Stress and Mortality

Many whale species are preyed upon by killer whales and parasitized by the nematode, *Crassicauda boopis* (Dolphin 1987; Lambertsen 1986). Lethal strandings attributed to harmful algal blooms (Geraci et al. 1989) and lethal entrapment in ice have also been observed (Mitchell 1979).

Natural climatic variability and change may affect whales through changes 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 (Kintisch 2006; Learmonth et al. 2006; MacLeod et al. 2005; McMahon & Hays 2006; Robinson et al. 2005). Naturally occurring climatic patterns, such as the Pacific Decadal Oscillation and El Niño and La Niña events, are identified as major causes of changing marine productivity worldwide (Beamish et al. 1999; Benson & Trites 2002; Francis et al. 1998; Hare et al. 1999; Mantua et al. 1997). Gaps in information and the complexity of climatic interactions complicate the ability to predict the effects of climate change on whales (Kintisch 2006; Simmonds & Isaac 2007).

Anthropogenic Stressors

Commercial Harvest

Prior to 1900, aboriginal hunting and early commercial whaling on the high seas, using hand harpoons, took an unknown number of whales (Johnson & Wolman 1984). Modern commercial whaling removed ~50,000 whales annually. In 1965, the IWC banned the commercial hunting of whales. Although

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

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). These entanglements also make animals more vulnerable to additional dangers (e.g., predation and ship strikes) by restricting agility and swimming speed. Marine mammals that die from entanglement in commercial fishing gear often sink rather than strand ashore thus making it difficult to accurately determine the extent of such mortalities.

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. Reductions in fish populations, whether natural or human-caused, may affect listed whale populations and their recovery. Whales are known to feed on several species of fish that are harvested by humans (Waring et al. 2008); however, the magnitude of competition remains unknown.

Ship Strikes and Other Vessel Interactions

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

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).

Noise

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

Seismic surveys using towed airguns also occur within the action area and are the primary exploration technique 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 U.S., 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.

US Navy Activities
The U.S. Navy conducts training and other activities throughout coastal areas in the U.S. Throughout the life of this permit, they are likely to conduct anti-submarine, anti-air, anti-surface warfare activities and two training exercises in the action area.

Pollution
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. Whales become entangled in marine debris, or ingest it, which may lead to injury or death. 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 whales.

Pesticides and Contaminants. Exposure to pollution and contaminants has the potential to cause adverse health effects in marine species. 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 & Ross 2002). Marine pollutants come from multiple municipal, industrial and household as well as from atmospheric transport (Garrett 2004; Grant & Ross 2002; Hartwell 2004; Iwata 1993).

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 (Grant & Ross 2002; Mearns 2001).

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 & 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 they may inhale these compounds at the water's surface and ingest them while feeding (Matkin & Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability.

Conservation and Management Efforts
In 1946, the International Convention for the Regulation of Whaling began regulating commercial whaling. In 1966, the International Whaling Commission prohibited commercial whaling. The species listed above designated "endangered" under the Endangered Species Conservation Act in 1970 and under the Endangered Species Act in 1973. In 1972, they were listed as depleted under the Marine Mammal Protection Act (MMPA).

Several conservation and management efforts have been undertaken for whales in the action area. Recovery plans guide the protection and conservation of these species (NMFS 1991a). NMFS implements conservation and management activities for the species through its Regional Offices and Fishery Science Centers in cooperation with states, conservation groups, the public, and other federal agencies. They have placed observers aboard driftnet fishing vessels and vessels engaged in seismic activities to record and monitor takes. The Pacific Offshore Cetacean Reduction Plan requires acoustic pingers to help repel marine mammals from fishing operations. NMFS mitigates ship strikes and responds to whales in distress. Together with their partners, they educate the crew of whale watch vessels and other boat operators on safe boating practices.

EFFECTS OF THE PROPOSED ACTION

Pursuant to Section 7(a)(2) of the ESA, Federal agencies are directed to insure 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. 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.

Exposure Analyses

In accordance with Section 10(a)(1)(A) of the Endangered Species Act, the Permits Division determines the maximum number of exempted annual takes allowed (Table 1-4), should the permit be issued. It is important to emphasize that the take table defines the maximum level of take that would be permitted; it does not necessarily reflect the number of whales that *are likely* to be exposed to such activities. To determine the number of humpbacks that are likely to be exposed to such activities, we consider past efforts of the researchers (Table 5).

Table 5. Actual annual take of whales under the researchers previous permit No. 1058-1733

Year	No. tagged (dermal)	No. tagged (suction)	No. incidental take
2008	0	3 (humpback)	1 (humpback)
2009	0	0	0
2010	2 (sei)	15 (North Atlantic right)	4
2011	30 (bowhead)	8 (bowhead)	40 (North Atlantic right)

In 2008, the researchers suction-cup tagged three humpback whales in the Stellwagen Bank National Marine Sanctuary (NW Atlantic). One humpback whale was incidentally taken. No whales reacted to either close small boat approach or the attachment of tags; they exhibited normal feeding behavior prior and during small boat approaches. The researchers did not perform any permitted activities in 2009.

In 2010, the researchers suction-cup tagged 15 North Atlantic right whales in the Great South Channel Critical Habitat Area (NW Atlantic). No whales reacted to either close small boat approach or the attachment of tags; they exhibited normal feeding behavior prior and during small boat approaches.

In 2011, the researchers used implantable, dermal attachment tags to tag 8 bowhead whales in the Beaufort/Chukchi Seas. They incidentally harassed 40 North Atlantic right whales during boat-based surveys coupled with oceanographic and acoustic measurements in Cape Cod Bay. No whales reacted to either close small boat approach or the attachment of tags; they exhibited normal feeding behavior prior and during small boat approaches.

Given the previous exposure, we would expect the researchers to tag up to 67 whales with dermal tags, 33 whales with suction tags, and incidentally harass 88 whales (based on four standard deviations of the mean). We do not expect any females with calves to be approached. Based on previous observations, we

do not expect any whales to react to small boat approach or the attachment of tags (either dermal or suction).

Duration of Exposure
Based on the researchers' previous experience, we do not expect any approach or tagging to last more than an hour in duration.

Stocks Exposed
We expect the researchers could approach, tag, or incidentally harass any humpback, fin, blue, bowhead, sei, North Atlantic right, and/or North Pacific right whale in waters of the Northwest Atlantic, North Pacific, and Arctic Oceans.

Potential Stressors and Response Analyses
For each activity listed below, we first identify potential physical, chemical, or biotic stressors (presented in a bulleted list). We then describe likely responses to such stressors. Animal responses to human disturbance are similar to their responses to potential predators (Beale & Monaghan 2004; Frid & Dill 2002; Gill & Sutherland 2001; Lima 1998; Romero 2004). These responses include interruptions of essential behavior and physiological processes such as feeding, mating, resting, digestion, etc. Each of these can result in stress, injury, and increased susceptibility to disease and predation (Frid & Dill 2002; Romero 2004).

For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal (or physiological), or behavioral responses that might reduce the fitness of individuals. Ideally, response analyses would consider and weigh evidence of adverse consequences as well as evidence suggesting the absence of such consequences. When possible, we base the likelihood of a response on previously collected data describing humpback whale responses to similar stressors; however, when that data is not available, we use information from other species to proximate a humpback whale's response.

Acoustic, passive recording
- No stressors identified
- No responses or adverse effects expected

Vessel approach
- Vessel noise
- Visual disturbance
- Potential for vessel strike

Ships are a major source of anthropogenic noise in the ocean (NRC 2003). The researchers' vessels would emit predominantly low frequency sound, similar to the amount and frequency of noise as other vessels in the area. As previously stated, whales generate and rely on sound to navigate, hunt, and communicate with other individuals. Vessel noise in general has the potential to interfere with these important activities; however, it is unlikely that the use of a single vessel, in addition to the hundreds of ships operating in the action area, would have a significant effect on whales. Ship noise, which has increased steadily in recent decades, has not prevented several of these species from increasing in size in recent decades. Therefore, we conclude vessel noise is unlikely adversely affect individuals, and is thus unlikely to reduce the fitness of whales in the action area.

The mere sight of a ship also has the potential to disturb humpback whales as they feed and rest in the action area. Marine mammals often display great tolerance to boat traffic (Richardson et al. 1995). In the researchers' experience, they never observed separation of a mother and calf as a result of close boat approach. Therefore, visual disturbance is unlikely adversely affect individuals, and is thus unlikely to reduce the fitness of whales in the action area.

As previously described, ship strikes cause several whale deaths each year. To mitigate this risk, the investigators would conduct all vessel activities at safe operating speeds. They would slow the vessel as they approach a whale. They would have spotters to search for and monitor the whales. Given these precautions, we conclude that a ship strike would be highly unlikely and therefore would not reduce the fitness of humpback whales.

In conclusion, noise and visual disturbances to listed marine mammals that would result from the proposed activities are expected to be minor and short-lived. The chance of a ship strike is unlikely. Therefore, vessel approach activities are not likely to diminish the fitness of any whales.

Behavioral Observation

- No stressors identified, other than those associated with vessel approach
- No responses or adverse effects expected

Photography

- No stressors identified, other than those associated with vessel approach
- No responses or adverse effects expected

Instrumentation

- Potential for injury
- Potential for entanglement
- Hydrodynamic drag

The suction cup and dermal attachment tag types to be used for this action were previously analyzed for directed research permits Nos. 774-1714, 14097, and 1058-1733. These permits and Section 7 consultations concluded that:

- Suction cup attachments would be short-term (generally less than one day), and could be dislodged by the animal by maneuvering rapidly, breaching, or rubbing against a solid surface.
- The suction cup assembly could migrate along the skin of the whale, but because the tag would be attached caudal to the blowhole, movement would be toward the fluke of the animal and therefore would create no danger that the tag would cover the blowhole.
- The proportion of the suction cup assembly to the animal's size and weight would be such that any additional energetic demand created by hydrodynamic drag would likely be insignificant.
- The round cap midway along the anchor would ensure that the tag or anchor does not migrate deeper (i.e. muscle layer) into the whale after deployment.
- None of the attachment types would be likely to injure individuals or elicit more than a minimal, short-lived response from whales.

Impacts of currently authorized satellite tag types were found not to be significant, with the majority of effects (responses) occurring during the tagging event due to vessel approach and tag attachment and causing no more than short-term disturbance of animals (NMFS 2004, 2010c). In 2000, 71% of the 42 whales that were closely approached (within 10 m) showed no observable reaction (22 of 28 successfully tagged individuals and eight of 14 unsuccessfully tagged individuals). Of the remaining whales, reactions included lifting the head or flukes, arching the back, rolling to one side, rolling to one side and beating the flukes (on one occasion), or performing a head lunge (on one occasion) (Baumgartner and Mate 2003).

During field trials with the dermal attachment tag described here, Baumgartner et al. (submitted) reported a mild reaction (tail flick) to close boat approach and tagging in one humpback whale, but no reaction was reported in the other four humpback whale tagging events. Whales tagged with the dermal attachment tags swam at comparable speeds to those tagged with suction cup tags, and their diving behavior was likewise

similar to suction-cup tagged whales. Of eight bowhead whales tagged with the dermal attachment tag, only one had a mild reaction (tail flick); in all other cases, there was no overt reaction to close boat approach or tagging (Baumgartner et al. submitted). Three of the eight whales had unusually long dives upon tagging (4-10 minutes), indicating that some whales clearly had an immediate response, albeit relatively mild, to the tagging process. Respiration rates were monitored for both the tagged bowhead whales and four undisturbed whales; for the five whales tagged for roughly 1.5 hours or more, respiration rates were significantly higher in the first hour than in the second hour, but respiration rates during the second hour were comparable to those of undisturbed whales. These results suggest the response of bowhead whales to close approach and tagging lasts approximately one hour, but afterward, the whales behave (at least physiologically) like undisturbed whales.

The longer-term distress caused by dermal and sub-dermal attachment has been difficult to evaluate because of the paucity of follow-up studies on tagged animals. Much of the effort to characterize the long-term consequences of invasive tagging methods have concentrated on implantable tags (note that implantable tags are typically 1.8-2.6 cm in diameter, anchor in the muscle below the hypodermis, and are designed for long-term attachment; the proposed tag uses a 0.635-cm diameter needle, anchors in the epidermis and blubber, and is designed for short-term attachment). Several studies have sought to characterize the appearance of tagging wound sites both while the tag is implanted and after the tag is shed (Watkins et al. 1981, Kraus et al. 2000, Best and Mate 2007, Mate et al. 2007), but inferences about the health of the animal are difficult to make from superficial observations of these wounds. Mate et al. (2007) report resightings of over 40 of the 427 whales they tagged with implantable satellite transmitters from 1990 to 2005, and observed that while varying levels of swelling and scarring had been observed at the tag site, none of the animals were in poor health; they expressed the belief that "such swellings are not debilitating." In contrast, Weller (2008) reported that during a large whale tagging workshop convened by the Marine Mammal Commission and the National Marine Fisheries Service in 2005, "local and regional swelling [at the tag site] raised concern" among some workshop participants.

Baumgartner et al. (submitted) reported results from a detailed photographic follow-up study of humpback whales tagged with the dermal attachment tag described here. In the short term (i.e., in the few hours following tagging), the tag site looked very good with the delrin stop resting snugly against the skin with no sign of swelling, depression, bruising, protruding tissue, or damage to nearby skin. For two of the humpback whales, shedding of the anchor was documented within 2 and 5 days. Photographs within a day of anchor shedding indicated the wound site was very small (no larger than the needle itself), and was healing very well. Photographs taken over the ensuing weeks and months indicated complete healing.

For the humpback whales tagged with the dermal attachment described here, all were re-sighted in the same habitat both within the same year of tagging as well as in subsequent years (Baumgartner et al. submitted). Over the three months following tagging, all of the whales were re-sighted within 30 km of the location at which they were originally tagged. Confirmed re-sightings of three of the four whales persisted within 30 km of the tagging location for nearly five months after tagging. All were re-sighted in the same area the following year. Moreover, two of the tagged whales were reproductively mature females, and both produced calves in years following the tagging. One of these females calved during the winter following tagging, and was therefore pregnant when tagged.

The size of the dermal attachment needle (0.635 cm diameter, Figure 1) is comparable to a typical biopsy plug used to extract skin and blubber from large whales. Several studies have investigated the short-term effect of biopsying (Brown et al. 1991, 1994, Weinrich et al. 1992, Clapham and Matilla 1993, Gauthier and Sears 1999) and concluded that reactions are generally low to moderate. Weinrich et al. (1992) found that over the time scale of one week, re-sighting rates of biopsied and un-biopsied humpback whales were similar, and that re-sighting rates of biopsied whales over the course of a year in the area where they were biopsied was significantly higher than un-biopsied animals; these results suggest that whales do not substantially change their distribution because of biopsying. In addition to the diameter of the dermal attachment needle, its tip has also been designed to prevent long-term distress to the animal. For example, the needle has tapered cutting edges that create a clean opening that is slightly smaller than the diameter of the needle; this narrow hole should allow a tight fit between the needle and the surrounding tissue. The

cutting edges are also required to prevent epidermal cells and surface contaminants from being dragged into the dermis and potentially causing infection.

After detachment of the archival tag, only the needle remains attached to the whale. The needle is expected to produce a foreign body response such that rejection of the needle would occur. This process of rejection has been well documented in implanted satellite tags (Mate et al. 2007). Although detachment of the tag would remove a major source of drag on the needle that would have otherwise helped removal, the "stop" on the needle would provide some drag to help facilitate rejection. Shedding of the needle is anticipated to occur within a few days of implantation (see above for actual shedding times measured on humpback whales).

The suction-cup tags were designed to remain attached for at most several days. They can release from the whale in at least three ways. First, the animal can dislodge it by rapid movements, breaching, rubbing it on the seafloor, or by contact with another animal. Second, the tag can simply release on its own due to slow leakage of the seal between the cup and the animal's skin, repeated diving (i.e., pressure changes) working the suction cup loose, some other mechanical failure, or releasing with sloughed skin. Third, the tag has a release mechanism that uses an electrically corrosive wire assembly to release the tag package from the whale. If the tag became entangled in fishing gear or marine debris, it is highly likely that the tag would become detached from the whale. It is therefore, unlikely to entangle the whale in fishing gear.

Although both tags (dermal and suction-cup) would create drag, the proportion of this tag to a whale's size and weight is such that any drag effects would be insignificant. Any drag caused by the tags would not interfere with movement or foraging.

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

Tracking

- No stressors identified, other than those associated with vessel approach (but at least 100 m away)
- No responses or adverse effects expected

Incidental Harassment

- Vessel noise
- Visual disturbance

Non-target animals could potentially be harassed by vessel approaches during tagging operations. In addition, environmental sampling would be conducted in proximity to the tagged whale with a vertical profiler that contains a conductivity-temperature-depth instrument, fluorometer, optical plankton counter, and video plankton recorder. As described above, we do not anticipate that vessel noise is unlikely adversely affect individuals, and is thus unlikely to reduce the fitness of whales in the action area. Also described above, visual disturbance is unlikely adversely affect individuals, and is thus unlikely to reduce the fitness of whales in the action area.

Risk Analyses

None of the activities above are likely to reduce the fitness of any whale. Therefore, we do not expect the action to lower population viability or to threaten the continued survival of the species. Critical habitat is not likely to be adversely affected in any way by the activities of the researchers.

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 endangered whales in the action area. The Permits Division proposes to issue Permit No. 16388, which would authorize direct take of humpback, fin, blue, bowhead, sei, North Atlantic right, and North Pacific right whales in the Northwest Atlantic, North Pacific, and Arctic Oceans. The proposed activities under this permit include passive acoustic recordings, vessel approaches, photography, behavioral observation, dermal and suction-cup tagging, and tracking. The permit would be valid for 5 years.

The current and historic stressors to whales include natural mortality, depletion of populations due to overharvesting, fishing interactions, ship strikes, vessel interactions, noise, and scientific research. Commercial whaling depleted whales worldwide, but most populations have increased substantially since whaling was banned in 1965 (Reilly 2008). Ship strikes and entanglement in fishing gear now pose the largest threats to the species.

During the course of this consultation, we have identified potential stressors associated with the activities to be authorized under the proposed permit: potential boat strikes; vessel noise; visual disturbances; and tagging related injury, entanglement, or drag. 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.

As explained in the *Response Analyses* section of this Opinion, because of the slow speed and safe operating procedures of the researchers' vessels, boat strikes are extremely unlikely and therefore discountable. Vessel noise is expected to be minor and transitory and is therefore discountable. Visual disturbances that would result from vessel operation may adversely affect individuals, which would likely respond with avoidance behavior; however, these responses are expected to be brief and would not have any long-term consequences to individuals. Adverse effects as a result of tagging would be short-term

discomfort and stress; these responses are not expected to reduce the fitness of any individuals. Because the fitness of individuals would not be reduced, the viability of the populations they comprise would not be reduced. The activities described above would not destroy or adversely modify the critical habitat of any species.

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, we conclude that the activities authorized by the proposed issuance of scientific research permit No. 16388 are not likely to jeopardize the continued existence of any threatened or endangered species; furthermore, we conclude that the activities authorized by the proposed issuance of scientific research permit No. 16388 are not likely to adversely modify or destroy critical habitat.

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 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. *Calculation of Authorized Take.* We encourage the Permits Division to use previous levels of actual take to calculate future authorized take in their proposed permits.

2. Reporting of Actual Levels of Take. For this consultation, the Permits Division provided four annual reports as required of the researchers' previous permit. We encourage the Permits Division to continue to require and provide these annual reports, as they are a valuable resource for our response analyses. It would be helpful if these reports were available online, preferably in tabular format or as attachments on the Permit Division's APPS website (https://apps.nmfs.noaa.gov/).

3. *Research Coordination*. We encourage the Permits Division to track the number of individuals that are taken by multiple researchers and to gather data on how multiple takes affect an individual. We also encourage the Permits Division to coordinate research efforts among permitees to minimize overall takes.

In an effort for us to remain informed of actions minimizing or avoiding adverse effects on, or benefiting, listed species or their habitats, the Permits Division should notify the Endangered Species Act Interagency Cooperation 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. 16388. 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, The Permits Division must immediately request reinitiation of section 7 consultation.

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