National Marine Fisheries Service
Endangered Species Act Section 7
Biological Opinion

Title:	Biological Opinion on the Issuance of Scientific Research Permit No. 21485 to Jooke Robbins (Center for Coastal Studies) for Research on Marine Mammals in the Western North Atlantic Ocean
Consultation Conducted By:	Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce
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1 INTRODUCTION

The Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7(a)(2) of the ESA requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Federal agencies must do so in consultation with National Marine Fisheries Service (NMFS) for threatened or endangered species (ESA-listed) or designated critical habitat that may be affected by the action that are under NMFS jurisdiction (50 C.F.R. §402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS concurs with that determination for species under NMFS jurisdiction, consultation concludes informally (50 C.F.R. §402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS provides an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize listed species or destroy or adversely modify critical habitat, NMFS provides reasonable and prudent alternatives that can be taken by the Federal agency or the applicant and allow the action to proceed in compliance with section 7(a)(2) of the ESA. If an incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking on the species and includes reasonable and prudent measures NMFS considers necessary or appropriate to minimize such impacts and terms and conditions to implement the reasonable and prudent measures.

The action agency for this consultation is NMFS, Office of Protected Resources, Permits and Conservation Division (hereafter the Permits and Conservation Division). The Permits and Conservation Division proposes to issue a scientific research permit pursuant to section 10(a)(1)(A) of the ESA and section 104 of the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 U.S.C. §1361 et seq.). Permit No. 21485 would be issued to Jooke Robbins, Ph.D., Center for Coastal Studies, 5 Holway Avenue, Provincetown, Massachusetts 02657. The purpose of the proposed permit is to allow an exception to the moratorium and prohibition on takes established under the ESA and MMPA in order to allow the Center for Coastal Studies (Dr. Jooke Robbins) to conduct scientific research on marine mammals in the western North Atlantic from Maine to Florida along the United States East Coast and south to Puerto Rico.

Under the ESA 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 regulation (50 C.F.R. §222.102) as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." While the U.S. Fish and Wildlife Service further defines harass by regulation (50 C.F.R. §17.3), until NMFS promulgates a regulatory definition, we rely on NMFS' interim guidance, which defines harass as an act that create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (NMFSPD 02-110-19).

Under the MMPA take is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 U.S.C. 1361 et seq.) and further defined by regulation (50 C.F.R. §216.3) as "to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal." This includes, without limitation, any of the following:

- The collection of dead animals, or parts thereof;
- The restraint or detention of a marine mammal, no matter how temporary;
- Tagging a marine mammal;
- The negligent or intentional operation of an aircraft or vessel;
- The doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal;
- Feeding or attempting to feed a marine mammal in the wild.

For purposes of this action, the two levels of harassment are further defined under the MMPA as any act or pursuit, torment, or annoyance which:

- Has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or,
- Has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment). Under NMFS regulation, Level B harassment does not include an act that has the potential to injure a marine mammal or marine mammal stock in the wild.

NMFS' interim ESA harass definition does not specifically equate MMPA Level A or Level B harassment, but shares some similarities with both in the use of the terms "injury/injure" and a focus on a disruption of behavior patterns. Since the proposed permit would authorize take under both the ESA and MMPA, our ESA analysis, which relies on NMFS' interim guidance on the ESA term harass, may result in different conclusions than those reached by the Permits and Conservation Division in their MMPA analysis. Given that the MMPA takes a more conservative approach in considering any act that has the potential to disrupt behavioral patterns as harassment, while under the ESA such acts must significantly disrupt normal behavioral patterns, there may be circumstances in which an act is considered harassment, and thus take, under the MMPA but not the ESA.

This consultation, biological opinion (opinion), and incidental take statement, were completed in accordance with section 7(a)(2) and 7(b) of the statute (16 U.S.C. 1536 (a)(2)), associated implementing regulations (50 C.F.R. §402), and agency policy and guidance was conducted by NMFS, Office of Protected Resources, Endangered Species Act Interagency Cooperation Division (hereafter referred to as "we").

This document represents NMFS ESA Interagency Cooperation Division's opinion on the effects of the issuance of Permit No. 21485 on North Atlantic right whales (*Eubalaena glacialis*), bowhead whales (*Balaena mysticetus*), blue whales (*Balaenoptera musculus*), fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), sperm whales (*Physeter macrocephalus*), green sea turtles (*Chelonia mydas*) (North Atlantic Distinct Population Units [DPS]), hawksbill sea turtles (*Eretmochelys imbricata*), Kemp's ridley sea turtles (*Lepidochelys kempii*), leatherback sea turtles (*Dermochelys coriacea*), loggerhead sea turtles (*Caretta caretta*) (Northwest Atlantic Ocean DPS) and olive ridley sea turtles (*Lepidochelys olivacea*) [non-Mexico Pacific Coast Breeding Colonies, (i.e. "All Other Areas" Listing Unit, hereafter referred to as "All Other Areas")] as well as critical habitat designated for North Atlantic right whales and the Northwest Atlantic Ocean DPS of loggerhead sea turtles. A complete record of this consultation is on file at the NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

We have previously conducted 10 ESA section 7 consultations on research permits for the Center for Coastal Studies since 1980. Dr. Jooke Robbins was the applicant on two of these permits (Permit Nos. 16325 and 633-1778). The proposed research activities under Permit No. 21485 are a continuation of work conducted under Permit No. 16325 (2012 through 2018) and Permit No. 633-1778 (2006 through 2012). The previous opinions for Permit Nos. 16325 and 633-1778 determined that the issuance of the permits to authorize research activities were not likely to jeopardize the continued existence of ESA-listed species, or result in destruction or adverse modification of designated critical habitat.

In this consultation, we build upon our long-term evaluation of the Center for Coastal Studies' research activities from these previous consultations, but here consider these previous research permits as part of the Environmental Baseline (Section 9) and evaluate the effects of authorizing the Center for Coastal Studies to continue to conduct research activities under Permit No. 21485.

1.2 Consultation History

This opinion is based on information provided in the permit application, correspondence and discussions with the Permits and Conservation Division and the applicant, previous biological opinions and annual reports for research permits on which researchers at the Center for Coastal Studies were Principal Investigators or Co-Investigators, biological opinions and annual reports for other similar research activities for which we have conducted ESA section 7 consultations, and the best scientific and commercial data available from the literature.

Our communication with the Permits and Conservation Division regarding this consultation is summarized as follows:

- On March 13, 2018, we received the application from the Permits and Conservation Division, which they received from the applicant on October 31, 2017.
- On March 23, 2018, we provided comments to the Permits and Conservation Division on the application.
- On April 9, 2018, the Permits and Conservation Division sent their and our comments to the applicant.
- On May 7, 2018, the Permits and Conservation Division sent us a memorandum requesting formal consultation and an initiation package regarding the issuance of Permit No. 21485. The Permits and Conservation Division requested our review of the initiation package and additional information requests be submitted by June 8, 2018 and that formal consultation be concluded by September 24, 2018, in order to ensure issuance of the permit by October 1, 2018.
- On May 8, 2018, the Permits and Conservation Division provided us previous biological opinions, annual reports, and permits from similar research activities conducted on similar or additional species.
- On July 5, 2018, the Permits and Conservation Division provided us a revised application, updated references, and map of the Gulf of Maine action area.
- On August 27, 2018, we determined there was sufficient information to initiate formal consultation and provided the Permits and Conservation Division with an initiation memorandum.

2 The Assessment Framework

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 C.F.R. §402.02).

"Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of an ESA-listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 C.F.R. §402.02).

An ESA section 7 assessment involves the following steps:

Description of the Proposed Action (Section 3): We describe the proposed action and those aspects (or stressors) of the proposed action that may have direct or indirect effects on the physical, chemical, and biotic environment.

Interrelated and Interdependent Actions (Section 4): We identify interrelated and interdependent actions. *Interrelated* actions are those that are part of a larger action and depend on that action for their justification. *Interdependent* actions are those that do not have independent use, apart from the action under consideration.

Potential Stressors (Section 5): We identify the stressors that could occur as a result of the proposed action and affect ESA-listed species and designated critical habitat.

Action Area (Section 6): We describe the action area with the spatial extent of those stressors.

Species and Critical Habitat Not Likely to be Adversely Affected (Section 7): We identify the ESA-listed species and designated critical habitat that are likely to either not be affected or are not likely to be adversely affected by the stressors.

Status of Species and Critical Habitat Likely to be Adversely Affected (Section 8): We identify the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time and evaluate the status of those species as well as the condition and current function of designated critical habitat.

Environmental Baseline (Section 9): We describe the environmental baseline in the action area including: past and present impacts of Federal, state, or private actions and other human activities in the action area; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and impacts of state or private actions that are contemporaneous with the consultation in process.

Effects of the Action (Section 10): We identify the number, age (or life stage), and gender of ESA-listed individuals that are likely to be exposed to the stressors and the populations or sub-populations to which those individuals belong. We also consider whether the action "may affect" designated critical habitat. This is our exposure analysis. We evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond given their probable exposure. We also consider how the action may affect designated critical habitat. This is our response analyses. We assess the consequences of these responses of individuals that are likely to be exposed to the populations those individuals represent, and the species those populations comprise. This is our risk analysis. The adverse modification analysis considers the impacts of the proposed action on the essential habitat features and conservation value of designated critical habitat.

Cumulative Effects (Section 11): Cumulative effects are the effects to ESA-listed species and designated critical habitat of future state or private activities that are reasonably certain to occur within the action area. 50 C.F.R. §402.02. Effects from future Federal actions that are unrelated to the proposed action are not considered because they require separate ESA section 7 compliance.

Integration and Synthesis (Section 12): In this section we integrate the analyses in the opinion to summarize the consequences to ESA-listed species and designated critical habitat under NMFS' jurisdiction.

Conclusion (Section 13): With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the action area on populations or subpopulations and on essential habitat features when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or
- Appreciably diminish the value of designated critical habitat for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat.

If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives. See 50 C.F.R. §402.14.

In addition, we include an incidental take statement (Section 14) that specifies the impact of the take, reasonable and prudent measures to minimize the impact of the take, and terms and conditions to implement the reasonable and prudent measures (ESA section 7 (b)(4); 50 C.F.R. §402.14(i)). We also provide discretionary conservation recommendations that may be implemented by the action agency in Section 15; 50 C.F.R. §402.14(j). Finally, we identify the circumstances in which reinitiation of consultation is required (Section 16) 50 C.F.R. §402.16.

To comply with our obligation to use the best scientific and commercial data available, we collected information identified through searches of Google scholar, and literature cited sections of peer reviewed articles, species listing documentation, and reports published by government and private entities. This opinion is based on our review and analysis of various information sources, including:

- Information submitted by the Permits and Conservation Division and the applicant;
- Government reports (including NMFS biological opinions and stock assessment reports);
- NOAA technical memorandums; and
- Peer-reviewed scientific literature.

These resources were used to identify information relevant to the potential stressors and responses of ESA-listed species and designated critical habitat under NMFS' jurisdiction that may be affected by the proposed action to draw conclusions on risks the action may pose to the continued existence of these species and the value of designated critical habitat for the conservation of ESA-listed species.

3 DESCRIPTION OF THE PROPOSED ACTION

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies. The proposed action for this consultation is the Permits and Conservation Division's issuance of a scientific research permit pursuant to the requirements of the MMPA to the Center for Coastal Studies (Dr. Jooke Robbins).

The Permits and Conservation Division proposes to issue scientific research Permit No. 21485 to Dr. Jooke Robbins, Senior Scientist and Manager of the Humpback Whale Studies Program at the Center for Coastal Studies, to study marine mammals in U.S. and international waters in the western Atlantic Ocean. This includes the Gulf of Maine and waters along the U.S. East Coast and Puerto Rico. The ESA-listed cetaceans that will be targeted for the proposed research include blue, bowhead, fin, sei, and sperm whales. Research methods include vessel approaches, videography, photography and photogrammetry, and biological sampling (biopsy, sloughed skin, feces, and breath mucosa). The purpose of the activities is to research humpback whale biology, population ecology, and human impacts in the western Atlantic Ocean. The proposed research also aims to increase baseline understanding of the biology of blue, sei, minke, bowhead, sperm, and killer whales in this area. The permit would expire five years after the date of issuance, but may be extended for up to one year per Federal regulation (50 C.F.R. §216.39). The number of proposed annual takes for ESA-listed species is broken down by species in Table 1 and Table 2.

Table 1: Proposed permitted annual take for Endangered Species Act-listed species under Permit No. 21485 in the Gulf of Maine.

Species	Life Stage	Number of Takes*	Takes Per Animal Per Year	Procedures
Blue whale	Adult/Juvenile	30	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
Blue whale	Calf	10	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
Bowhead whale	Adult/Juvenile	10	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
Fin whale	All	300	20	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Underwater photo/videography
Fin whale	Calf	20	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
Fin whale	Adult/Juvenile	50	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
North Atlantic right whale	All	5	1	Incidental take

Species	Life Stage	Number of Takes*	Takes Per Animal Per Year	Procedures
Sei whale	All	50	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
Sei whale	Calf	10	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
Sperm whale	Adult/Juvenile	10	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography

*Takes = the maximum number of animals, not necessarily individuals, that may be targeted for research annually for the suite of procedures in each row of the table.

Table 2: Proposed permitted annual take for Endangered Species Act-listed species under Permit No. 21485 along the U.S. East coast (excluding Puerto Rico).

Species	Life Stage	Number of Takes*	Takes Per Animal Per Year	Procedures
Fin whale	All	50	20	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Underwater photo/videography
Fin whale	Adult/Juvenile	30	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography
Sei whale	Adult/Juvenile	30	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal; Sample, skin and blubber biopsy; Underwater photo/videography

*Takes = the maximum number of animals, not necessarily individuals, that may be targeted for research annually for the suite of procedures in each row of the table.

The proposed research activities would include a variety of research methodologies. These research activities will be directed towards a particular target animal or group of animals and are described in more detail below. In addition, non-target animals in the action areas may be unintentionally disturbed during these research activities.

3.1 Vessel Approaches

Under Permit No. 21485, researchers would be authorized to conduct vessel surveys and approach animals in water-borne vessels to carry out additional research activities described below. The research vessels would be up to 41 feet in length (R/V Shearwater, 41' diesel-powered, twin-screw, Jarvis-Newman; R/V Ibis, 30' rigid inflatable) and would be used throughout the action area (see Section 6) at speeds of usually 18.5 kilometers per hour (10 knots) or less. Comparable vessels may be substituted for logistical reasons, as well as small (15-20') inflatable boats with single outboard engines. Similar types of vessels would be used for research south of the Gulf of Maine. Sighting duration depends on several factors but each individual sighting can last as long as 1.5 hours. The research vessel would approach target animals from behind and match their speed and direction of travel in a position behind or alongside the animals at a distance of 100 yards. Researchers would then approach baleen whales and sperm whales to a distance of 100 feet for photography work and a distance ranging from 25 to 100 feet of the target whale to obtain a biopsy sample.

3.2 Photography, Photogrammetry, and Videography

Photographic identification (photo-identification) is a widely used method for identifying individual cetaceans, allowing researchers to track individuals, monitor reproduction and mortality, identify migrations, follow age and sex-dependent behavior and habitat use patterns, and monitor health (Hammond, Mizroch et al. 1990). Photo-identification also allows researchers to determine if anthropogenic risk varies by age and/or reproductive class (Van Der Hoop, Moore et al. 2013), which helps inform protected species management.

Cameras will be used to capture still photographs of flukes, dorsal fins, scars, and other body markings to identify individual animals and document evidence of injuries from entanglements from fishing gear or other debris. In conjunction with photography, photogrammetry may be used to calculate animal size with a laser range finder from the research vessel.

High definition video cameras may be used to document cetacean behavior above water. Underwater video would be recorded by a polecam operated by staff aboard the research vessel to document additional views of identifying features, especially scars. Whales would be approached with the polecam within one body length while the research vessel is operating at low (typically idle) speed.

3.3 Biological Sampling

The proposed research activities would include biopsy, skin, fecal, and breath mucosa sampling. Most of these samples would be collected from Gulf of Maine humpback (non-ESA listed) and fin whales of all sexes and ages, including mothers and calves.

3.3.1 Biopsy Sampling

Biopsy sampling is a widely used method for obtaining skin and blubber tissue from cetaceans for use in studies on genetics, contaminants, disease, foraging ecology, reproduction, and other physiological and biological processes (reviewed in Noren and Mocklin 2012).

Under Permit No. 21485, core samples of skin and superficial blubber tissue would be collected by stainless steel Ceta-Dart biopsy tips 10 mm in diameter and up to 60 mm in length fired from a crossbow (draw of 150 lbs or less) with a carbon fiber bolt. Biopsy sampling would always be carried out in conjunction with photo-identification efforts to ensure individual animals are not biopsied multiple times. Upon sampling, additional photographs would be taken to link the individual animal to the sample collected. The Center for Coastal Studies maintains a photographic database of these species, which assists in rapid identification of individuals in the field and determination of whether or not individuals have been previously biopsied.

During a biopsy attempt, the research vessel would be directly abeam and 25 to 100 feet from the whale. Biopsy samples would be collected from the upper flank of the animal in an area below or posterior to the dorsal fin, usually while the animal arches its back as it begins to dive. The biopsy bolt and tip assembly would then float in the water after the sample is collected by means of a foam stop collar/float attached to the bolt. Researchers would wait until the animal has moved out of the area to retrieve the biopsy sample collected by the floating bolt. Biopsy collection from a particular animal would be terminated after a successful attempt or three unsuccessful attempts.

3.3.2 Sloughed Skin Sampling

Researchers would scan the water for floating samples of sloughed skin from active whales. Once the animal or animals have vacated the area, these samples would be collected from the water using a long-handled sieve or net.

Storage of sloughed skin samples would depend upon how each sample will be analysed later. Those intended for use in genetic analyses would be preserved in a dimethyl sulfoxide (DMSO)/salt solution, RNAlater, or ethanol. Skin samples for toxicology and stable isotopes would be frozen without chemical preservatives. Samples for bacterial analysis would typically be frozen but those intended for microscopy would be stored in a 2 percent glutaraldehyde and 2 percent formalin solution in phosphate buffered saline.

3.3.3 Fecal Sampling

Fecal sampling is a well-established non-invasive sample collection method that can be used to assess reproductive hormones, stress, parasites, red tide effects, diet composition, energetics, and nutrition (reviewed in Hunt, Moore et al. 2013).

If whales are seen defecating, fecal samples would be collected from the water with a net or scoop after the animal or animals have left the area. Fecal samples will be used for endocrinology studies and will be stored frozen without chemical preservatives.

3.3.4 Breath Mucosa Sampling

Breath mucosa samples would be collected from surfacing whales as they exhale. Sampling equipment would be attached to the far end of a pole 10 meters in length, which would be held over the nares of an exhaling whale while the research vessel matches the speed and direction of travel of the whale. Depending on how the sample would be analyzed, the sampling equipment would consist of nylon fabric, a polystyrene plate, or a petri dish. Breath mucosa samples would be used for endocrinology studies and will be stored frozen without chemical preservatives.

3.4 Export and Import

The proposed permit would authorize the import, export, and re-export of tissue samples for analysis. Samples are expected to be exported to the Netherlands and Australia. Such sample material would be archived and analyzed for endocrinology, aging, microbiome, toxicology, and stable isotope studies.

3.5 Conservation Measures

The Permits and Conservation Division's proposed issuance of Permit No. 21485 to Dr. Jooke Robbins requires mitigation measures to minimize potential adverse effects of the proposed research activities. See the Appendix below for the terms and conditions the Permits and Conservation Division propose to include in this permit. Mitigation measures to minimize effects are also included in the researcher's permit application. These measures were considered throughout our *Exposure and Response Analysis* (Sections 10.1.1 and 10.1.2).

3.5.1 Vessel Approaches

Researchers would approach animals cautiously and terminate efforts if they determine the approach may interfere with reproduction, feeding, or other vital functions. Similarly, efforts to approach mother-calf pairs would also be terminated if approaches may be interfering with pair-bonding or other vital functions. Research vessels would not be deliberately positioned between the mother and calf and when possible the researchers would sample the calf first to minimize reaction from the mother.

3.5.2 Photography, Photogrammetry, and Videography

Underwater videography would be accomplished with polecams operated from the vessel in lieu of divers. These operations will be conducted by research assistants trained in photography or videography. Approaches for underwater videography would be terminated if the animal exhibits adverse/evasive changes in behavior.

3.5.3 Biological Sampling

3.5.3.1 Biopsy Sampling

Biopsy sampling would always be carried out in conjunction with photo-identification efforts to ensure individual animals are not biopsied multiple times. Approaches would be terminated if the animal exhibits repetitive, strong, adverse reactions to the activity or vessel.

The biopsy tips would be kept in individual packages until use and would be handled with gloves. To keep them as sterile as possible following their use and prior to their re-use, the tips would be cleaned with a soap solution scrub, rinsed with fresh water, and air-dried. When possible, the tips would then be sterilized in an autoclave. Otherwise, the tips would be soaked in a 6 percent hydrogen peroxide solution for at least 20 minutes and then soaked for five minutes in a 10 percent sodium hydroxide bleach solution. Biopsy samples would be cryogenically frozen without chemical preservatives until they can be processed in the lab.

3.5.3.2 Skin Sampling

Sloughed skin samples will be collected from the water using a long-handled sieve or net only after the animal or animals have vacated the area.

3.5.3.3 Fecal Sampling

Fecal samples will be collected from the water with a net or scoop only after the animal or animals have vacated the area.

3.5.3.4 Breath Sampling

As with biopsy sampling attempts, breath sampling attempts will be terminated if the animal exhibits repetitive, strong, adverse reactions to the activity or vessel.

4 Interrelated and Interdependent Actions

Interrelated actions are those that are part of a larger action and depend on that action for their justification. *Interdependent* actions are those that do not have independent utility apart from the action under consideration. For this consultation, we consider all vessel transit associated with research activities as interdependent. Thus, we evaluate the effects of vessel transit on ESA-listed species and so include all water traversed during such transits as part of the action area.

5 Potential Stressors

Stressors are any physical, chemical, or biological entity that may induce an adverse response either in an ESA-listed species or their designated critical habitat. The issuance of Permit No. 21485 would authorize several research activities that may expose ESA-listed marine mammals within the action area to a variety of stressors. Each research activity presents a unique set of stressors, as further detailed below. Given the directed nature of the proposed research, all research activities directed only at non-ESA listed cetaceans are not expected to present any stressors to the ESA-listed cetaceans found in the action areas, and so these activities are not considered further.

There are three main activities we expect to produce stressors: vessel activity, biological sampling (biopsies and exhaled breath mucosa), and polecam operation. The potential stressors we expect to result from vessels are pollution, vessel strike, vessel noise, and vessel close approaches. Regarding biological sampling, collection of exhaled breath mucosa may result in unintentional, direct physical contact with the animal. Stressors we expect to result from biopsies include direct physical contact with the animal, a minor puncture wound, and tissue collection. Biopsies and underwater videography via polecam can also carry the stressor of a closer vessel approach than is typical for other vessel survey activities. Polecam operation from the research vessel can carry the additional stressors of direct animal contact and visual disturbances.

Photography and photogrammetry will follow close approaches, but are not expected to present any additional stressors other than those associated with vessel surveys and close approaches by vessels and aircraft. Given their non-invasive nature, fecal sampling, sloughed skin sampling, photography, and photogrammetry are not expected to produce any stressors aside from those associated with vessel surveys and close approaches by vessels.

6 Action Area

Action area means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 C.F.R. §402.02).

The area where most of the proposed research activities would occur under Permit No. 21485 is shown in Figure 1, which includes waters in and adjacent to the Gulf of Maine. Research activities may also occur along the U.S. East Coast and in waters around Puerto Rico. As such, the action area for this consultation includes waters in the Gulf of Maine (Figure 1) as well those along the U.S. East Coast and around Puerto Rico. Under Permit No. 21485, research activities within the action area would occur throughout the year, weather permitting and when logistically feasible, for the duration of the permit. Gulf of Maine sampling is expected to occur from March through December, sampling off the U.S. East Coast is expected to occur from November through May, and sampling around Puerto Rico will likely occur between December and April.

The proposed duration of the scientific research permits is five years. In accordance with Federal regulations (50 C.F.R. §216.39), the duration of a permit may be extended for up to one year via a minor amendment to allow uninterrupted continuation of research if a new five-year permit application has been received and is in-process. In such cases, no additional takes will be authorized during the extension; any takes that were allocated for the fifth year of the permit that were not used may be used during the extension. Thus, the annual takes proposed in the draft permit may be extended for use over a six-year period.

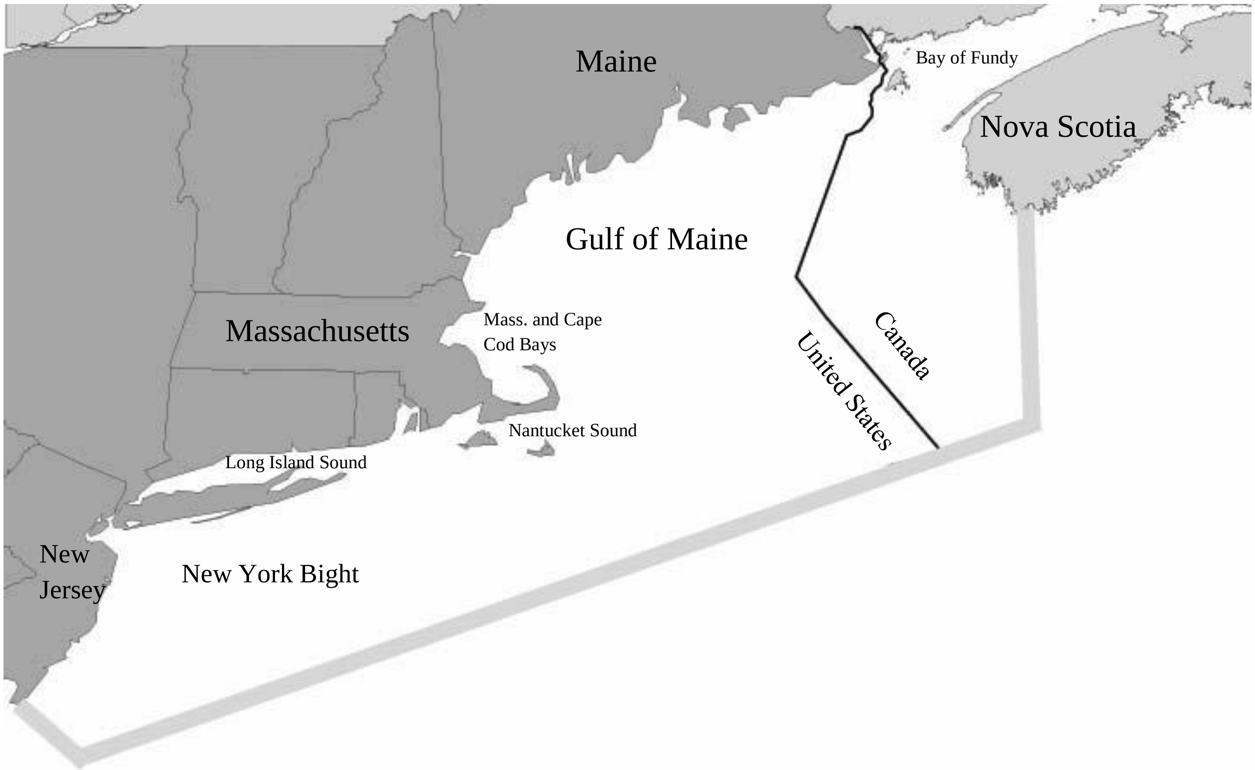

Figure 1: Map of the area where the majority of the proposed research activities (bounded by the thick, light-gray line) would occur under Permit No. 21485.

7 Species and Critical Habitat Not Likely to be Adversely Affected

This section identifies the ESA-listed species under NMFS jurisdiction that may occur within the action areas that are not likely to be adversely affected by the proposed action. NMFS uses two criteria to identify the ESA-listed or critical habitat that are not likely to be adversely affected by the proposed action, as well as the effects of activities that are interrelated to or interdependent with the Federal agency's proposed action. The first criterion is exposure, or some reasonable expectation of a co-occurrence, between one or more potential stressors associated with the proposed activities and ESA-listed species or designated critical habitat. If we conclude that an ESA-listed species or designated critical habitat is not likely to be exposed to the proposed activities, we must also conclude that the species or critical habitat is not likely to be adversely affected by those activities.

The second criterion is the probability of a response given exposure. ESA-listed species or designated critical habitat that is exposed to a potential stressor but is likely to be unaffected by the exposure is also not likely to be adversely affected by the proposed action. We applied these criteria to the species ESA-listed in Table 1 and we summarize our results below.

An action warrants a "may affect, not likely to be adversely affected" finding when its effects are wholly *beneficial, insignificant* or *discountable*. *Beneficial* effects have an immediate positive effect without any adverse effects to the species or habitat. Beneficial effects are usually discussed when the project has a clear link to the ESA-listed species or its specific habitat needs and consultation is required because the species may be affected.

Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect.

Discountable effects are those that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and that would be an adverse effect if it did impact a listed species), but it is very unlikely to occur.

In this section, we evaluate effects to several ESA-listed species and designated critical habitat that may be affected, but are not likely to be adversely affected, by the proposed action, as determined by the Permits and Conservation Division. For the ESA-listed species, we focus specifically on stressors associated with the issuance of Permit No. 21485 and their effects on these species. The effects of the stressors associated with the proposed action are evaluated in Section 5. The species potentially occurring within the action area that may be affected, but are not likely to be adversely affected, are listed in Table 3, along with their regulatory status, designated critical habitat, and recovery plan.

Table 3: Endangered Species Act-listed species potentially occurring in the action area for Permit No. 21485 that may be affected, but are not likely to be adversely affected.

Species	ESA Status	Critical Habitat	Recovery Plan
Cetaceans			
North Atlantic Right Whale (*Eubalaena glacialis*)	E – 73 FR 12024	81 FR 4837	70 FR 32293 08/2004
Marine Reptiles			
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 FR 20057	63 FR 46693	FR Not Available 10/1991 – U.S. Atlantic
Hawksbill Turtle (*Eretmochelys imbricata)*	E – 35 FR 8491	63 FR 46693	57 FR 38818 08/1992 – U.S. Caribbean, Atlantic, and Gulf of Mexico
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --	03/2010 – U.S. Caribbean, Atlantic, and Gulf of Mexico 09/2011
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	79 FR 39856	74 FR 2995 10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 01/2009 – Northwest Atlantic
Olive Ridley Turtle (*Lepidochelys olivacea*) All Other Areas	T – 43 FR 32800	-- --	-- --

DPS=Distinct Population Segment
E=Endangered
T=Threatened

7.1 North Atlantic Right Whales

Under Permit No. 21485, non-target ESA-listed North Atlantic right whales may occasionally be present with targeted cetaceans. The only activity that has the potential to cause disturbance to these non-target whale species is a close vessel approach. Researchers would not purposefully approach this species, and thus, no disturbance is expected to occur. Nonetheless, a close approach to this species could occur if researchers are unable to identify whale species from a distance. This situation, however, is unlikely since this species is easily distinguished from the target species by morphology (e.g., North Atlantic right whales lack a dorsal fin, have a heart-shaped blow, and clusters of callosities on the top of the rostrum), with the exception of bowhead whales, which have a similar appearance. However, bowhead whales are much less common throughout the action area than North Atlantic right whales. Dr. Robbins has been studying large whales for over two decades, thus, researchers should be able to identify and avoid North Atlantic right whales if they are in the area. If spotted, researchers would not purposefully approach within 50 meters (164 feet) or pursue this non-target ESA-listed species and would stop research activities and move to another area or wait until they have left the area.

While ship strikes during research operations are possible, we are aware of only two instances of any research vessel ever striking a whale in thousands of hours at sea (Wiley, Mayo et al. 2016). Given the rarity of ship strikes of large whale species during all research activities from historical data, the slow speeds at which Dr. Robbins would operate, and the extensive experience she and her research team have in spotting large whales at sea, we believe the likelihood of one of her research vessels striking a North Atlantic right whale is extremely low, and thus discountable.

Discharge from research vessels in the form of leakages of fuel or oil is possible, though effects of any spills would have minimal, if any, effects on North Atlantic right whales. Given the experience of the researchers and boat operators in conducting research activities in the action area, it is unlikely that spills or discharges would occur. Therefore, the likelihood of these effects occurring are discountable.

In summary, we concur with the Permits and Conservation Division that the issuance of Permit No. 21485 may affect, but is not likely to adversely affect North Atlantic right whales, and we will not discuss this species further in this opinion.

7.2 Endangered Species Act-Listed Sea Turtles

The proposed actions under Permit No. 21485 spatially overlap with several non-target ESA-listed sea turtle species and/or DPSs including the North Atlantic DPS of green turtles, hawksbill turtles, Kemp’s ridley turtles, leatherback turtles, the Northwest Atlantic Ocean DPS of loggerhead turtles, and olive ridley turtles (All Other Areas). These species may occasionally be present with targeted cetaceans, but would not be directly approached within 50 meters (164 feet) or pursued during research activities.

Research activities that have the potential to disturb sea turtles include vessel activities, biological sampling activities, and underwater videography targeting cetaceans. Researchers would not purposely approach sea turtles, would constantly be on the lookout for cetaceans, and thus be able to spot sea turtles at a distance (approximately 100 to 200 meters, Epperly, Avens et al. 2002), well before they are be expected to respond to research vessels (Hazel, Lawler et al. 2007). Furthermore, if a sea turtle were spotted researchers would stop research activities and move to another area or wait until the sea turtle has left the area. If a sea turtle is exposed to vessel surveys it would likely be brief and temporary and result in short-term behavioral reactions, such as swimming away from the vessel, that are not expected to have fitness consequences.

The likelihood of ship strikes of sea turtles is also expected to be extremely unlikely given that researchers would adhere to slow vessel transit speeds (usually 18.5 kilometers per hour [10 knots] or less) and the numerous observers on lookout for cetaceans would also be able to spot sea turtles that surface for air. In addition, we are not aware of any case of a cetacean research vessel striking a sea turtle. For these reasons, we find it is extremely unlikely that a research vessel will strike a sea turtle, and thus such effects related to the operation of vessels to perform cetacean research are discountable.

In summary, we concur with the Permits and Conservation Division that the issuance of Permit No. 21485 may affect, but is not likely to adversely affect the North Atlantic DPS of green turtles, hawksbill turtles, Kemp's ridley turtles, leatherback turtles, the Northwest Atlantic Ocean DPS of loggerhead turtles, and olive ridley turtles (All Other Areas) and we will not discuss these species further in this opinion.

7.3 Designated Critical Habitat

7.3.1 North Atlantic Right Whale Critical Habitat

Designated critical habitat for the North Atlantic right whale is found in the action area in the southeast United States (calving habitat) and northeast United States (foraging area) (81 FR 4837 and 59 FR 28805). The designated areas include important foraging waters in the Gulf of Maine and Georges Bank Region and calving waters off the coast of North Carolina, South Carolina, Georgia, and Florida. The physical and biological features essential to the conservation of the species found in this area include the physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate the zooplankton species C. *finmarchicus* for right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes; low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing C. *finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins; late stage C. *finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region; and diapausing C. *finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region.

While the proposed research activities would directly overlap with these essential features, very few if any, effects are possible. The proposed activities would not significantly alter the physical or oceanographic conditions within the action area, as only very minor changes in water flow and current would be expected from vessel traffic and no changes in ocean bathymetry would occur. Furthermore, during daylight hours, when all research would occur, *C. finmarchicus* are often found below the surface, which would minimize disturbance from vessel traffic (Baumgartner, Lysiak et al. 2011). Thus, effects to these features are discountable. Vessel pollution, vessel noise, and prey sampling could also directly impact *C. finmarchicus*. However, vessel pollution would be minimal, diluted, and likely not reach them, and we could not find any evidence suggesting that sound (from vessels or prey mapping equipment) alters the densities of copepods (Bennet, Falter et al. 1994). Finally, the proposed activities would in no way alter the sea state, temperature, or water depth and so effects to these features are also deemed discountable. As a result, we conclude that the issuance of Permit No. 21485 may affect, but is not likely to adversely affect designated North Atlantic right whale critical habitat, and therefore right whale critical habitat is not addressed further in this opinion**.**

7.3.2 Endangered Species Act-Listed Sea Turtle Critical Habitat

The action area co-occurs with designated critical habitat of green turtles (North Atlantic DPS). On September 2, 1998, NMFS designated critical habitat for green sea turtles (63 FR 46694), which include coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators. This area provides important developmental habitat for the species. Due to its location, this critical habitat would be accessible by individuals of the North Atlantic DPS.

The action area co-occurs with designated critical habitat of hawksbill turtles. On September 2, 1998, NMFS established critical habitat for hawksbill sea turtles around Mona and Monito Islands, Puerto Rico (63 FR 46693). Aspects of these areas that are important for hawksbill sea turtle survival and recovery include important natal development habitat, refuge from predation, shelter between foraging periods, and food for hawksbill sea turtle prey.

The action area co-occurs with designated critical habitat of leatherback turtles. On March 23, 1979, leatherback critical habitat was identified adjacent to Sandy Point, St. Croix, Virgin Islands from the 183 meter isobath to mean high tide level between 17° 42’12” N and 65°50’00” W (44 FR 17710). This habitat is essential for nesting, which has been increasingly threatened since 1979, when tourism increased significantly, bringing nesting habitat and people into close and frequent proximity; however, studies do not support significant critical habitat deterioration. On January 20, 2012, NMFS issued a final rule to designate additional critical habitat for the leatherback sea turtle (50 CFR 226). This designation includes approximately 43,798 square kilometers stretching along the California coast from Point Arena to Point Arguello east of the 3000 meter depth contour; and 64,760 square kilometers stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The designated areas comprise approximately 108558 square kilometers of marine habitat and include waters from the ocean surface down to a maximum depth of 80 meters. They were designated specifically because of the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

Lastly, the action area co-occurs with designated critical habitat of loggerhead turtles (Northwest Atlantic Ocean DPS). NMFS designated critical habitat for this species in 2014 (79 FR 39856). The specific areas identified by NMFS were included because they provide protection to loggerhead sea turtles which include Neritic (nearshore reproductive, foraging, winter, breeding, and migratory) and *Sargassum* habitat. The primary constituent elements of reproductive habitat include: (1) nearshore waters directly off the highest density nesting beaches and their adjacent beaches as identified in 50 CFR 17.95(c) to 1.6 km offshore; (2) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and (3) waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents. The primary constituent elements of breeding habitat include: (1) high densities of reproductive male and female loggerheads; (2) proximity to primary Florida migratory corridor; and (3) proximity to Florida nesting grounds. The primary constituent elements of *Sargassum* habitat include: (1) convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; (2) *Sargassum* in concentrations that support adequate prey abundance and cover; (3) available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods; and (4) sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., greater than 10 m depth. The primary constituent elements of migratory habitat include: (1) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways and (2) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.

Since the vessel operation is temporary (i.e., not a permanent structure), the research activities would not prevent turtles from accessing marine habitat and nesting beaches. The proposed activities would not involve anchoring, altering substrate, or collection of sea turtle prey (marine plants, invertebrates, and jellyfish). It is therefore discountable that the temporary operation of a vessel to study cetaceans at the water surface would result in alteration of the identified essential features of green turtle (North Atlantic DPS), hawksbill turtle, leatherback turtle, and loggerhead turtle (Northwest Atlantic Ocean DPS) nearshore critical habitat, which include access to habitat, *Sargassum*, water chemistry, live bottom habitat, and prey species. Hence the quantity, quality, or availability of the essential physical or biological features are not likely to be adversely affected. Therefore, we determine that the issuance of Permit No. 21485 may affect, but is not likely to adversely affect designated critical habitat for the four previously mentioned species and will not be addressed further in this opinion.

8 Status of Species and Critical Habitat Likely to be Adversely Affected

This section identifies the ESA-listed species that occur within the action area that may be affected by the proposed issuance of Permit No. 21485 (Table 4). The regulatory status, designated critical habitat, and recovery plan references for these species are also included in Table 4.

Table 4: Endangered Species Act-listed species that are likely to be adversely affected by the issuance of Permit No. 21485.

Species	ESA Status	Critical Habitat	Recovery Plan
Cetaceans			
Blue Whale (*Balaenoptera musculus)*	E – 35 FR 18319	-- --	07/1998
Bowhead Whale (*Balaena mysticetus*)	E – 35 FR 18319	-- --	-- --
Fin Whale (*Balaenoptera physalus)*	E – 35 FR 18319	-- --	75 FR 47538 07/2010
Sei Whale (*Balaenoptera borealis*)	E – 35 FR 18319	-- --	12/2011
Sperm Whale (*Physeter macrocephalus*)	E – 35 FR 18319	-- --	75 FR 81584 12/2010

DPS=Distinct Population Segment
E=Endangered
T=Threatened

This section identifies and examines the status of each species that would be affected by the proposed actions. The status includes the existing level of risk that the ESA-listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution," which is part of the jeopardy determination as described in 50 C.F.R. §402.02. More detailed information on the status and trends of these ESA-listed species, and their biology and ecology can be found in the listing regulations and critical habitat designations published in the *Federal Register*, status reviews, recovery plans, and on this NMFS Web site: https://www.fisheries.noaa.gov/topic/endangered-species-conservation, among others.

8.1 Blue Whale

The blue whale is a widely distributed baleen whale found in all major oceans (Figure 2).

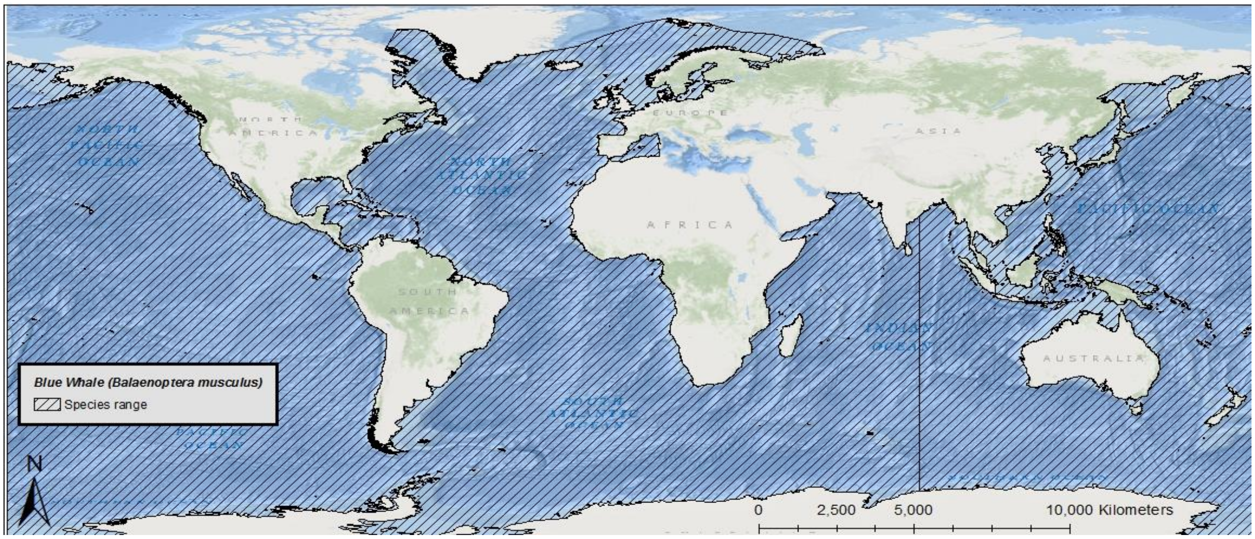

Figure 2: Map identifying the range of the endangered blue whale.

Blue whales are the largest animal on earth and distinguishable from other whales by a long-body and comparatively slender shape, a broad, flat "rostrum" when viewed from above, proportionally smaller dorsal fin, and are a mottled gray color that appears light blue when seen through the water. Most experts recognize at least three subspecies of blue whale, *B. m. musculus*, which occurs in the Northern Hemisphere, *B. m. intermedia*, which occurs in the Southern Ocean, and *B. m. brevicauda*, a pygmy species found in the Indian Ocean and South Pacific. The blue whale was originally listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 1998), recent stock assessment reports (Carretta, Oleson et al. 2016, Muto, Helker et al. 2016, Waring, Josephson et al. 2016), and status review (COSEWIC 2002) were used to summarize the life history, population dynamics and status of the species as follows.

8.1.1 Life History

The average life span of blue whales is eighty to ninety years. They have a gestation period of ten to twelve months, and calves nurse for six to seven months. Blue whales reach sexual maturity between five and fifteen years of age with an average calving interval of two to three years. They winter at low latitudes, where they mate, calve and nurse, and summer at high latitudes, where they feed. Blue whales forage almost exclusively on krill and can eat approximately 3,600 kilograms daily. Feeding aggregations are often found at the continental shelf edge, where upwelling produces concentrations of krill at depths of 90 to 120 meters.

8.1.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the blue whale.

The global, pre-exploitation estimate for blue whales is approximately 181,200 (IWC 2007). Current estimates indicate approximately 5,000 to 12,000 blue whales globally (IWC 2007). Blue whales are separated into populations by ocean basin in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere. There are three stocks of blue whales designated in United States waters: the Eastern North Pacific Ocean (current best estimate N=1,647, N_{min}=1,551) (VanBlaricom, Ruediger et al. 1993), Central North Pacific Ocean (N=81, N_{min}=38), and Western North Atlantic Ocean (N=400 to 600, N_{min}=440). In the Southern Hemisphere, the latest abundance estimate for Antarctic blue whales is 2,280 individuals in 1997/1998 (95 percent confidence intervals 1,160 to 4,500 (Branch 2007). While no rangewide estimate for pygmy blue whales exists (Thomas, Reeves et al. 2016), the latest estimate for pygmy blue whales off the west coast of Australia is 662 to 1,559 individuals based on passive acoustic monitoring (McCauley and Jenner 2010), or 712 to 1,754 individuals based on photographic mark-recapture (Jenner 2008).

Current estimates indicate a growth rate of just under three percent per year for the eastern North Pacific stock (Calambokidis 2009). An overall population growth rate for the species or growth rates for the two other individual U.S. stocks are not available at this time. In the Southern Hemisphere, population growth estimates are available only for Antarctic blue whales, which estimate a population growth rate of 8.2 percent per year (95 percent confidence interval 1.6 to 14.8 percent) (Branch 2007).

Little genetic data exist on blue whales globally. Data from Australia indicates that at least populations in this region experienced a recent genetic bottleneck, likely the result of commercial whaling, although genetic diversity levels appear to be similar to other, non-threatened mammal species (Attard, Beheregaray et al. 2010). Consistent with this, data from Antarctica also demonstrate this bottleneck but high haplotype diversity, which may be a consequence of the recent timing of the bottleneck and blue whales long lifespan (Sremba, Hancock-Hanser et al. 2012). Data on genetic diversity of blue whales in the Northern Hemisphere are currently unavailable. However, genetic diversity information for similar cetacean population sizes can be applied. Stocks that have a total population size of 2,000 to 2,500 individuals or greater provide for maintenance of genetic diversity resulting in long-term persistence and protection from substantial environmental variance and catastrophes. Stocks that have a total population of 500 individuals or less may be at a greater risk of extinction due to genetic risks resulting from inbreeding. Stock population at low densities (less than 100) are more likely to suffer from the ‘Allee’ effect, where inbreeding and the heightened difficulty of finding mates reduces the population growth rate in proportion with reducing density.

In general, distribution is driven largely by food requirements; blue whales are more likely to occur in waters with dense concentrations of their primary food source, krill. While they can be found in coastal waters, they are thought to prefer waters further offshore (Figure 1). In the North Atlantic Ocean, the blue whale range extends form the subtropics to the Greenland Sea. They are most frequently sighted in waters of eastern Canada with a majority of sightings taking place in the Gulf of St. Lawrence. In the North Pacific Ocean, blue whales range from Kamchatka to southern Japan in the west and from the Gulf of Alaska and California to Costa Rica in the east. They primarily occur off the Aleutian Islands and the Bering Sea. In the northern Indian Ocean, there is a "resident" population of blue whales with sightings being reported from the Gulf of Aden, Persian Gulf, Arabian Sea, and across the Bay of Bengal to Burma and the Strait of Malacca. In the Southern Hemisphere, distributions of subspecies *(B. m. intermedia* and *B. m. brevicauda*) can be segregated. The subspecies *B. m. intermedia* occurs in relatively high latitudes south of the "Antarctic Convergence" (located between 48 and 61° South latitude) and close to the ice edge. The subspecies *B. m. brevicauda* is typically distributed north of the Antarctic Convergence.

8.1.3 Status

The blue whale is endangered as a result of past commercial whaling. In the North Atlantic, at least 11,000 blue whales were taken from the late nineteenth to mid-twentieth centuries. In the North Pacific, at least 9,500 whales were killed between 1910 and 1965. Commercial whaling no longer occurs, but blue whales are threatened by ship strikes, entanglement in fishing gear, pollution, harassment due to whale watching, and reduced prey abundance and habitat degradation due to climate change. Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats; however, the species has not recovered to pre-exploitation levels.

8.1.4 Critical Habitat

No critical habitat has been designated for the blue whale.

8.1.5 Recovery Goals

See the 1998 Final Recovery Plan for the blue whale for complete down listing/delisting criteria for each of the following recovery goals.

1. Determine stock structure of blue whale populations occurring in U.S. waters and elsewhere
2. Estimate the size and monitor trends in abundance of blue whale populations
3. Identify and protect habitat essential to the survival and recovery of blue whale populations
4. Reduce or eliminate human-caused injury and mortality of blue whales
5. Minimize detrimental effects of directed vessel interactions with blue whales
6. Maximize efforts to acquire scientific information from dead, stranded, and entangled blue whales
7. Coordinate state, federal, and international efforts to implement recovery actions for blue whales

8. Establish criteria for deciding whether to delist or downlist blue whales.

8.2 Bowhead Whale

The bowhead whale is a circumpolar baleen whale found throughout high latitudes in the Northern Hemisphere (Figure 3).

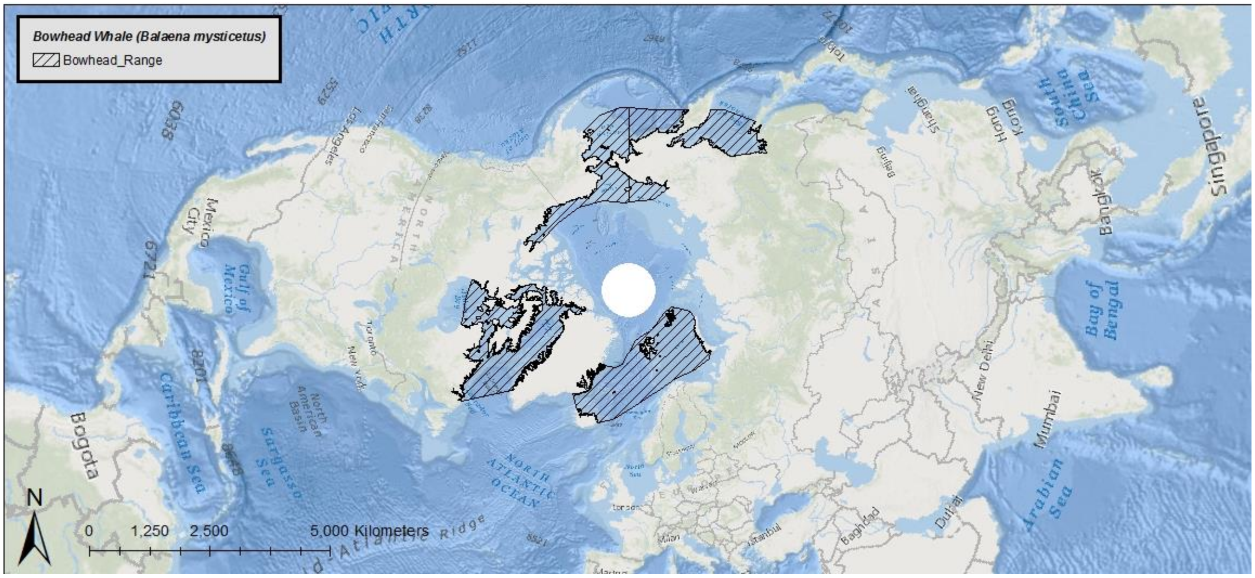

Figure 3: Map identifying the range of the endangered bowhead whale.

Bowheads are baleen whales distinguishable from other whales by a dark body with a distinctive white chin, no dorsal fin, and a bow-shaped skull that takes up about 35 percent of their total body length. The bowhead whale was originally listed as endangered on December 2, 1970.

Information available from the recent stock assessment report (Muto, Helker et al. 2017) and the scientific literature was used to summarize the life history, population dynamics, and status of the species as follows.

8.2.1 Life History

The average lifespan of bowhead whales is unknown; however, some evidence suggests that they can live for over one hundred years. They have a gestation period of 13 to 14 months and it is unknown how long calves nurse. Sexual maturity is reached around twenty years of age with an average calving interval of three to four years. They spend the winter associated with the southern limit of the pack ice and move north as the sea ice breaks up and recedes during spring. Bowhead whales use their large skulls to break through thick ice and feed on zooplankton (crustaceans like copepods, euphausiids, and mysids), other invertebrates, and fish.

8.2.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the bowhead whale.

The global, pre-exploitation estimate for bowhead whales is 30,000 to 50,000 animals. There are currently four or five recognized stocks of bowhead whales, the Western Arctic (or Bering-Chukchi-Beaufort) stock, the Okhotsk Sea stock, the Davis Strait and Hudson Bay stock (sometimes considered separate stocks), and the Spitsbergen stock (Rugh and Shelden 2009). The only stock thought to be found within United States waters is the Western Arctic stock. The 2011 ice-based abundance estimate puts this stock, the largest remnant stock, at over 16,892 (N_{min}=16,091) individuals. Prior to commercial whaling, there may have been 10,000 to 23,000 whales in this stock (Rugh and Shelden 2009). Historically the Davis Strait and Hudson Bay stock may have contained over 11,000 individuals, but now it is thought to number around 7,000 bowhead whales (Cosens, Cleator et al. 2006). In the Okhotsk Sea, there were originally more than 3,000 bowhead whales, but now there are only about 300 to 400. The Spitsbergen stock originally had about 24,000 bowhead whales and supported a huge European fishery, but today is thought to only contain tens of whales (Shelden and Rugh 1995).

Current estimates indicate approximately 16,892 (N_{min}=16,091) bowhead whales in the Western Arctic stock, with an annual growth rate of 3.7 percent (Givens, Edmondson et al. 2013). While no quantitative estimates exist, the Davis Strait and Hudson Bay stock is also thought to be increasing (COSEWIC 2009). We could find no information on population trends for the Okhotsk Sea stock. Likewise, no information is available on the population trend for the Spitsbergen stock, but it is thought to be nearly extinct.

Genetic studies conducted on the Western Arctic stock of bowhead whales revealed 68 different haplotypes defined by 44 variable sites (Leduc, Martien et al. 2008) making it the most diverse stock of bowhead whales. These results are consistent with a single stock with genetic heterogeneity related to age cohorts and indicate no historic genetic bottlenecks (Rugh, Demaster et al. 2003). In the Okhotsk Sea stock, only four to seven mitochondrial DNA haplotypes have been identified, three of which are shared with the Western Arctic stock, indicating lower genetic diversity, as might be expected given its much smaller population size (MacLean 2002, LeDuc, Dizon et al. 2005, Alter, Rosenbaum et al. 2012). The Davis Strait and Hudson Bay stock has 23 mitochondrial DNA haplotypes, making it more diverse than the Okhotsk stock but less diverse than the large Western Arctic stock (Alter, Rosenbaum et al. 2012). Based on historic mitochondrial DNA, the Spitsbergen stock previously had at least 58 mitochondrial DNA haplotypes, but its current genetic diversity remains unknown (Borge, Bachmann et al. 2007). However, given its near extirpation, it likely has low genetic diversity.

The Western Arctic stock is found in waters around Alaska, the Okhotsk Sea stock in eastern Russia waters, the Davis Strait and Hudson Bay stock in northeastern waters near Canada, and the Spitsbergen stock in the northeastern Atlantic Ocean (Rugh and Shelden 2009) (Figure 3).

8.2.3 Status

The bowhead whale is endangered because of past commercial whaling. Prior to commercial whaling, thousands of bowhead whales existed. Global abundance declined to 3,000 by the 1920's. Bowhead whales may be killed under "aboriginal subsistence whaling" provisions of the

International Whaling Commission. Additional threats include ship strikes, fisheries interactions (including entanglement), contaminants, and noise. The species' large population size and increasing trends indicate that it is resilient to current threats.

8.2.4 Critical Habitat

No critical habitat has been designated for the bowhead whale.

8.2.5 Recovery Goals

There is currently no recovery plan available for the bowhead whale.

8.3 Fin Whale

The fin whale is a large, widely distributed baleen whale found in all major oceans and comprised of three subspecies: *B. p. physalus* in the Northern Hemisphere, and *B. p. quoyi* and *B. p. patachaonica* (a pygmy form) in the Southern Hemisphere (Figure 4).

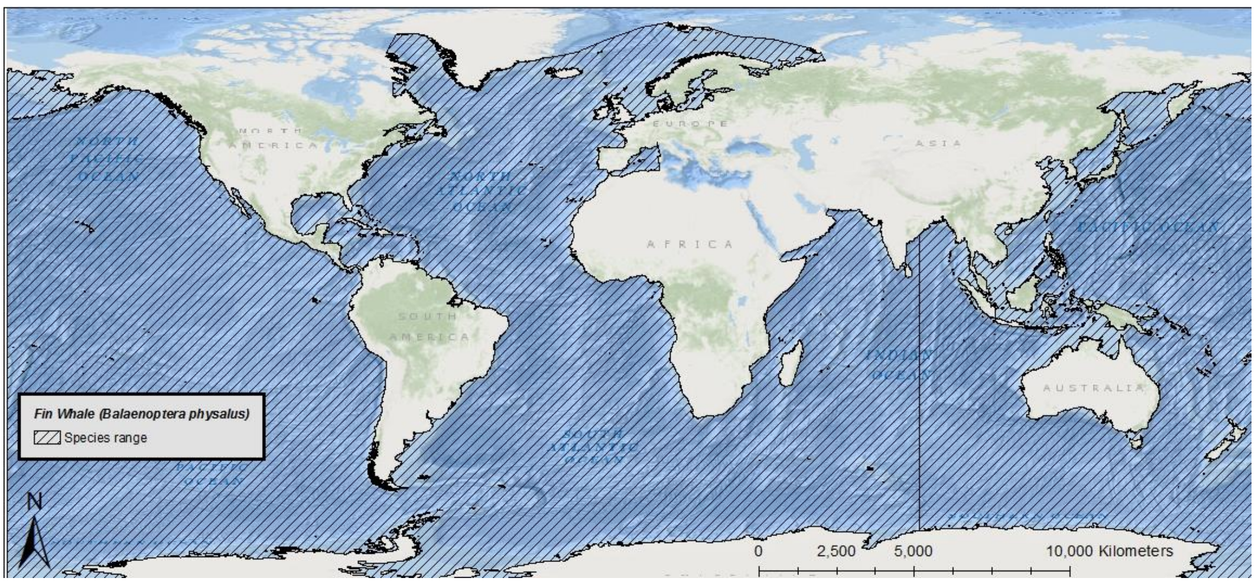

Figure 4: Map identifying the range of the endangered fin whale.

Fin whales are distinguishable from other whales by a sleek, streamlined body, with a V-shaped head, a tall falcate dorsal fin, and a distinctive color pattern of a black or dark brownish-gray body and sides with a white ventral surface. The lower jaw is gray or black on the left side and creamy white on the right side. The fin whale was originally listed as endangered on December 2, 1970.

Information available from the recovery plan (NMFS 2010), recent stock assessment reports (Carretta, Forney et al. 2017, Hayes, Josephson et al. 2017, Muto, Helker et al. 2017), and status review (NMFS 2011) were used to summarize the life history, population dynamics and status of the species as follows.

8.3.1 Life History

Fin whales can live, on average, 80 to 90 years. They have a gestation period of less than one year, and calves nurse for six to seven months. Sexual maturity is reached between six and ten years of age with an average calving interval of two to three years. They mostly inhabit deep, offshore waters of all major oceans. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed, although some fin whales appear to be residential to certain areas. Fin whales eat pelagic crustaceans (mainly euphausiids or krill) and schooling fish such as capelin, herring, and sand lice.

8.3.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the fin whale.

The pre-exploitation estimate for the fin whale population in the North Pacific Ocean was 42,000 to 45,000 (Ohsumi and Wada 1974). In the North Atlantic Ocean, at least 55,000 fin whales were killed between 1910 and 1989. Approximately 704,000 fin whales were killed in the Southern Hemisphere from 1904 to 1975. Of the three to seven stocks in the North Atlantic Ocean (approximately 50,000 individuals), one occurs in United States waters, where the best estimate of abundance is 1,618 individuals (N_{min}=1,234); however, this may be an underrepresentation as the entire range of stock was not surveyed (Palka 2012). There are three stocks in United States Pacific Ocean waters: Northeast Pacific [minimum 1,368 individuals], Hawaii (approximately 58 individuals [N_{min}=27]) and California/Oregon/Washington (approximately 9,029 [N_{min}=8,127] individuals) (Nadeem, Moore et al. 2016). The International Whaling Commission also recognizes the China Sea stock of fin whales, found in the Northwest Pacific Ocean, which currently lacks an abundance estimate (Reilly, Bannister et al. 2013). Abundance data for the Southern Hemisphere stock are limited; however, there were assumed to be somewhat more than 15,000 in 1983 (Thomas, Reeves et al. 2016).

Current estimates indicate approximately 10,000 fin whales in United States Pacific Ocean waters, with an annual growth rate of 4.8 percent in the Northeast Pacific stock and a stable population abundance in the California/Oregon/Washington stock (Nadeem, Moore et al. 2016). Overall population growth rates and total abundance estimates for the Hawaii stock, China Sea stock, western North Atlantic stock, and Southern Hemisphere fin whales are not available at this time.

Archer, Morin et al. (2013) recently examined the genetic structure and diversity of fin whales globally. Full sequencing of the mitochondrial DNA genome for 154 fin whales sampled in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere, resulted in 136 haplotypes, none of which were shared among ocean basins suggesting differentiation at least at this geographic scale. However, North Atlantic Ocean fin whales appear to be more closely related to the Southern Hemisphere population, as compared to fin whales in the North Pacific

Ocean, which may indicate a revision of the subspecies delineations is warranted. Generally speaking, haplotype diversity was found to be high both within oceans basins, and across. Such high genetic diversity and lack of differentiation within ocean basins may indicate that despite some populations having small abundance estimates, the species may persist long-term and be somewhat protected from substantial environmental variance and catastrophes.

There are over 100,000 fin whales worldwide, occurring primarily in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere where they appear to be reproductively isolated. The availability of prey, sand lice in particular, is thought to have had a strong influence on the distribution and movements of fin whales.

8.3.3 Status

The fin whale is endangered as a result of past commercial whaling. Prior to commercial whaling, hundreds of thousands of fin whales existed. Fin whales may be killed under "aboriginal subsistence whaling" in Greenland, under Japan's scientific whaling program, and Iceland's formal objection to the International Whaling Commission's ban on commercial whaling. Additional threats include ship strikes, reduced prey availability due to overfishing or climate change, and noise. The species' overall large population size may provide some resilience to current threats, but trends are largely unknown.

8.3.4 Critical Habitat

No critical habitat has been designated for the fin whale.

8.3.5 Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover fin whale populations. These threats will be discussed in further detail in the *Environmental Baseline* (Section 9) of this opinion. See the 2010 Final Recovery Plan for the fin whale for complete downlisting/delisting criteria for both of the following recovery goals.

1. Achieve sufficient and viable population in all ocean basins.
2. Ensure significant threats are addressed.

8.4 Sei Whale

The sei whale is a widely distributed baleen whale found in all major oceans (Figure 5).

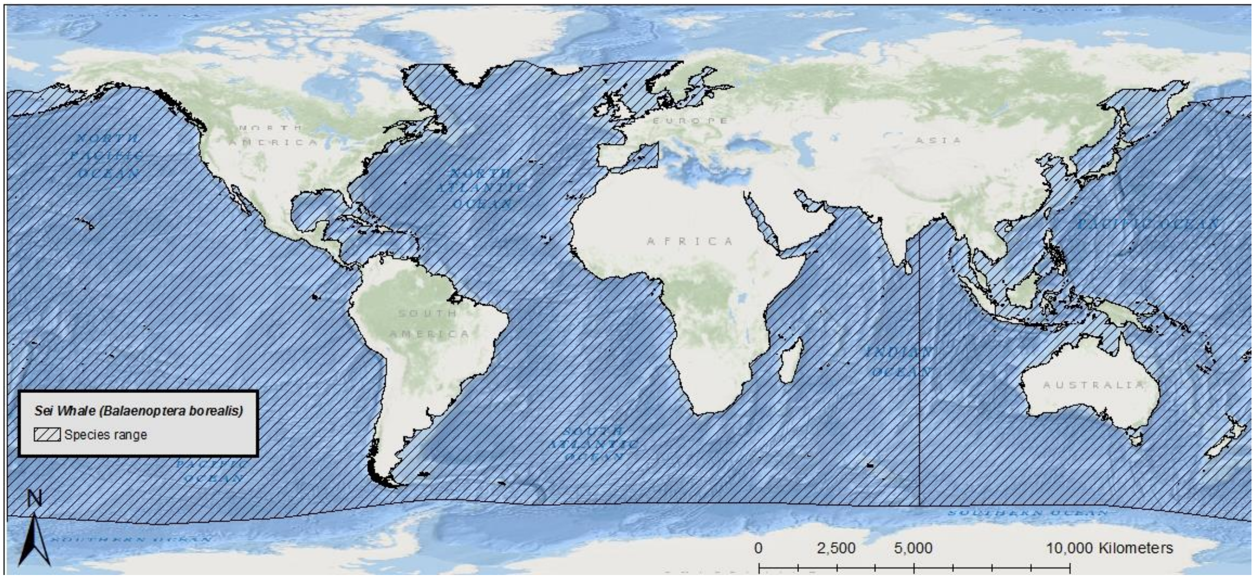

Figure 5: Map identifying the range of the endangered sei whale.

Sei whales are distinguishable from other whales by a long, sleek body that is dark bluish-gray to black in color and pale underneath, and a single ridge located on their rostrum. The sei whale was originally listed as endangered on December 2, 1970.

Information available from the recovery plan (NMFS 2011), recent stock assessment reports (Carretta, Forney et al. 2017, Hayes, Josephson et al. 2017, Muto, Helker et al. 2017), and status review (NMFS 2012) were used to summarize the life history, population dynamics, and status of the species as follows.

8.4.1 Life History

Sei whales can live, on average, between 50 and 70 years. They have a gestation period of ten to 12 months, and calves nurse for six to nine months. Sexual maturity is reached between six and 12 years of age with an average calving interval of two to three years. Sei whales mostly inhabit continental shelf and slope waters far from the coastline. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed on a range of prey types, including: plankton (copepods and krill) small schooling fishes, and cephalopods.

8.4.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the sei whale.

Two sub-species of sei whale are recognized, *B. b. borealis* in the Northern Hemisphere and *B. b. schlegellii* in the Southern Hemisphere. There are no estimates of pre-exploitation abundance for the North Atlantic Ocean. Models indicate that total abundance declined from 42,000 to 8,600 individuals between 1963 and 1974 in the North Pacific Ocean. More recently, the North Pacific Ocean population was estimated to be 29,632 (95 percent confidence intervals 18,576 to

47,267) between 2010 and 2012 (IWC 2016, Thomas, Reeves et al. 2016). In the Southern Hemisphere, pre-exploitation abundance is estimated at 65,000 whales, with recent abundance estimated at 9,800 to 12,000 whales. Three relatively small stocks occur in U.S. waters: Nova Scotia (N=357, N_{min}=236), Hawaii (N=178, N_{min}=93), and Eastern North Pacific (N=519, N_{min}=374). Population growth rates for sei whales are not available at this time as there are little to no systematic survey efforts to study sei whales.

Based on genetic analyses, there appears to be some differentiation between sei whale populations in different ocean basins. An early study of allozyme variation at 45 loci found some genetic differences between Southern Ocean and the North Pacific sei whales (Wada and Numachi 1991). However, more recent analyses of mtDNA control region variation show no significant differentiation between Southern Ocean and the North Pacific sei whales, though both appear to be genetically distinct from sei whales in the North Atlantic (Baker and Clapham 2004, Huijser, Bérubé et al. 2018). Within ocean basin, there appears to be intermediate to high genetic diversity and little genetic differentiation despite there being different managed stocks (Danielsdottir, Duke et al. 1991, Kanda, Goto et al. 2006, Kanda, Goto et al. 2011, Kanda, Matsuoka et al. 2013, Kanda, Matsuoka et al. 2015, Huijser, Bérubé et al. 2018).

Sei whales are distributed worldwide, occurring in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere.

8.4.3 Status

The sei whale is endangered as a result of past commercial whaling. Now, only a few individuals are taken each year by Japan; however, Iceland has expressed an interest in targeting sei whales. Current threats include ship strikes, fisheries interactions (including entanglement), climate change (habitat loss and reduced prey availability), and anthropogenic sound. Given the species' overall abundance, they may be somewhat resilient to current threats. However, trends are largely unknown, especially for individual stocks, many of which have relatively low abundance estimates.

8.4.4 Critical Habitat

No critical habitat has been designated for the sei whale.

8.4.5 Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover sei whale populations. These threats will be discussed in further detail in the *Environmental Baseline* (Section 9) of this opinion. See the 2011 Final Recovery Plan for the sei whale for complete downlisting/delisting criteria for both of the following recovery goals.

1. Achieve sufficient and viable populations in all ocean basins.
2. Ensure significant threats are addressed.

8.5 Sperm Whale

The sperm whale is a widely distributed species found in all major oceans (Figure 6).

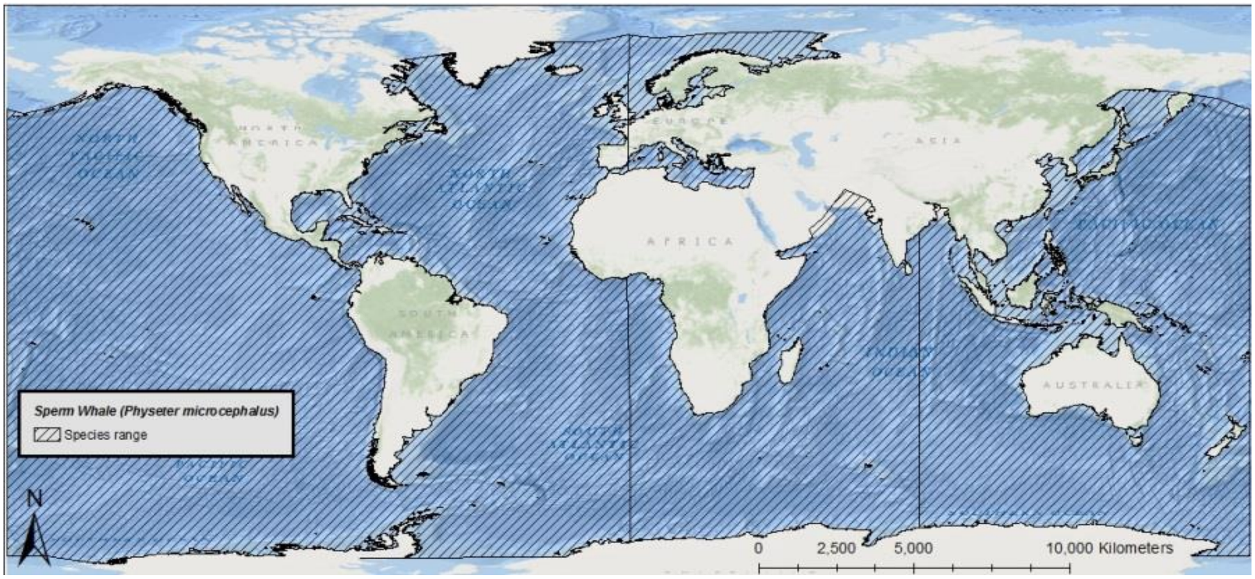

Figure 6: Map identifying the range of the endangered sperm whale.

Sperm whales are the largest toothed whale and distinguishable from other whales by its extremely large head, which takes up to 25 to 35 percent of its total body length and a single blowhole asymmetrically situated on the left side of the head near the tip. The sperm whale was originally listed as endangered on December 2, 1970.

Information available from the recovery plan (NMFS 2010), recent stock assessment reports (Carretta, Forney et al. 2017, Hayes, Josephson et al. 2017, Muto, Helker et al. 2017), and status review (NMFS 2015) were used to summarize the life history, population dynamics, and status of the species as follows.

8.5.1 Life History

The average lifespan of sperm whales is estimated to be at least 50 years (Whitehead 2009). They have a gestation period of one to one and a half years, and calves nurse for approximately two years. Sexual maturity is reached between seven and 13 years of age for females with an average calving interval for four to six years. Male sperm whales reach full sexual maturity in their twenties. Sperm whales mostly inhabit areas with a water depth of 600 meters (1,968 feet) or more, and are uncommon in waters less than 300 meters (984 feet) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid; other prey includes octopus and demersal fish (including teleosts and elasmobranchs).

8.5.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the sperm whale.

The sperm whale is the most abundant of the large whale species, with total abundance estimates between 200,000 and 1,500,000. The most recent estimate indicated a global population of between 300,000 and 450,000 individuals (Whitehead 2009). The higher estimates may be approaching population sizes prior to commercial whaling. There are no reliable estimates for sperm whale abundance across the entire Atlantic Ocean. However, estimates are available for two to three U.S. stocks in the Atlantic Ocean, the Northern Gulf of Mexico stock, estimated to consists of 763 individuals (N_{min}=560) and the North Atlantic stock, underestimated to consist of 2,288 individuals (N_{min}=1,815). There are insufficient data to estimate abundance for the Puerto Rico and U.S. Virgin Islands stock. In the northeast Pacific Ocean, the abundance of sperm whales was estimated to be between 26,300 and 32,100 in 1997. In the northeast Pacific Ocean, the abundance of sperm whales was estimated to be between 26,300 and 32,100 in 1997. In the eastern tropical Pacific Ocean, the abundance of sperm whales was estimated to be 22,700 (95 percent confidence intervals 14,800 to 34,600) in 1993. Population estimates are also available for two to three U.S. stocks that occur in the Pacific Ocean, the California/Oregon/Washington stock, estimated to consist of 2,106 individuals (N_{min}=1,332), and the Hawaii stock, estimated to consist of 3,354 individuals (N_{min}=2,539). There are insufficient data to estimate the population abundance of the North Pacific stock. We are aware of no reliable abundance estimates specifically for sperm whales in the South Pacific Ocean, and there is insufficient data to evaluate trends in abundance and growth rates of sperm whale populations at this time. There is insufficient data to evaluate trends in abundance and growth rates of sperm whales at this time.

Ocean-wide genetic studies indicate sperm whales have low genetic diversity, suggesting a recent bottleneck, but strong differentiation between matrilineally related groups (Lyrholm and Gyllensten 1998). Consistent with this, two studies of sperm whales in the Pacific Ocean indicate low genetic diversity (Mesnick, Taylor et al. 2011, Rendell, Mesnick et al. 2012). Furthermore, sperm whales from the Gulf of Mexico, the western North Atlantic Ocean, the North Sea, and the Mediterranean Sea all have been shown to have low levels of genetic diversity (Engelhaupt, Hoelzel et al. 2009). As none of the stocks for which data are available have high levels of genetic diversity, the species may be at some risk to inbreeding and 'Allee' effects, although the extent to which is currently unknown. Sperm whales have a global distribution and can be found in relatively deep waters in all ocean basins. While both males and females can be found in latitudes less than 40°, only adult males venture into the higher latitudes near the poles.

8.5.3 Status

The sperm whale is endangered as a result of past commercial whaling. Although the aggregate abundance worldwide is probably at least several hundred thousand individuals, the extent of depletion and degree of recovery of populations are uncertain. Commercial whaling is no longer allowed, however, illegal hunting may occur at biologically unsustainable levels. Continued threats to sperm whale populations include ship strikes, entanglement in fishing gear, competition for resources due to overfishing, population, loss of prey and habitat due to climate change, and noise. The species' large population size shows that it is somewhat resilient to current threats.

8.5.4 Critical Habitat

No critical habitat has been designated for the sperm whale.

8.5.5 Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover sperm whale populations. These threats will be discussed in further detail in the *Environmental Baseline* (Section 9) of this opinion. See the 2010 Final Recovery Plan for the sperm whale for complete downlisting/delisting criteria for both of the following recovery goals.

1. Achieve sufficient and viable populations in all ocean basins.
2. Ensure significant threats are addressed.

9 ENVIRONMENTAL BASELINE

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 C.F.R. §402.02). In this section, we discuss the environmental baseline within the action area as it applies to species that are likely to be adversely affected by the proposed action.

9.1 Climate Change

According to the Fourth National Climate Assessment, "Global climate is changing rapidly compared to the pace of natural variations in climate that have occurred throughout Earth's history" (Hayhoe et al. 2018). The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 1.0 degrees Celsius over the period 1901 through 2016 (Hayhoe et al. 2018). The Atlantic Ocean appears to be warming faster than all other ocean basins except perhaps the southern oceans (Cheng, Trenberth et al. 2017). In the western North Atlantic Ocean surface temperatures have been unusually warm in recent years (Blunden and Arndt 2016). A study by Polyakov, Alexeev et al. (2009), suggests that the North Atlantic Ocean overall has been experiencing a general warming trend over the last 80 years of 0.031±0.0006 degrees Celsius per decade in the upper 2,000 meters (6,561.7 feet) of the ocean. Additional consequences of climate change include increased ocean stratification, decreased sea-ice extent, altered patterns of ocean circulation, and decreased ocean oxygen levels (Doney, Ruckelshaus et al. 2012). Further, ocean acidity has increased by 26 percent since the beginning of the industrial era (IPCC 2014) and this rise has been linked to climate change. Climate change is also expected to increase the frequency of extreme weather and climate events including, but not limited to, cyclones, tropical storms, heat waves, and droughts (IPCC 2014). Climate change has the potential to impact species abundance, geographic distribution, migration patterns, and susceptibility to disease and contaminants, as well as the timing of seasonal activities and community composition and structure (Macleod, Bannon et al. 2005, Robinson, Learmonth et al. 2005, Kintisch 2006, Learmonth, Macleod et al. 2006, Mcmahon and Hays 2006, Evans and Bjørge 2013, IPCC 2014). Though predicting the precise consequences of climate change on highly mobile marine species, such as many of those considered during this consultation, is difficult (Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring.

Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney, Ruckelshaus et al. 2012). Hazen et al. (2012) examined top predator distribution and diversity in the Pacific Ocean in light of rising sea surface temperatures using a database of electronic tags and output from a global climate model. They predicted up to a 35 percent change in core habitat area for some key marine predators in the Pacific Ocean, with some species predicted to experience gains in available core habitat and some predicted to experience losses. Notably, leatherback turtles were predicted to gain core habitat area, whereas loggerhead turtles and blue whales were predicted to experience losses in available core habitat. McMahon and Hays (2006) predicted increased ocean temperatures will expand the distribution of leatherback turtles into more northern latitudes. The authors noted this is already occurring in the Atlantic Ocean. MacLeod (2009) estimated, based upon expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, with 47 percent predicted to experience unfavorable conditions (e.g., range contraction). Willis-Norton, Hazen et al. (2015) acknowledge there will be both habitat loss and gain, but overall climate change could result in a 15 percent loss of core pelagic habitat for leatherback turtles in the eastern South Pacific Ocean.

Similarly, climate-related changes in important prey species populations are likely to affect predator populations. For example, blue whales, as predators that specialize in eating krill, are likely to change their distribution in response to changes in the distribution of krill (Payne, Nicholas et al. 1986, Payne, Wiley et al. 1990, Clapham, Young et al. 1999). Pecl and Jackson (2008) predicted climate change will likely result in squid that hatch out smaller and earlier, undergo faster growth over shorter life-spans, and mature younger at a smaller size. This could have negative consequences for species such as sperm whales, whose diets can be dominated by cephalopods. For ESA-listed species that undergo long migrations, if either prey availability or habitat suitability is disrupted by changing ocean temperatures regimes, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott 2009).

This review provides some examples of impacts that may occur as the result of climate change. While it is difficult to accurately predict the consequences of climate change to the species considered in this opinion, a range of consequences, from beneficial to adverse effects are expected.

9.2 Oceanic Temperature Regimes

Oceanographic conditions in the North Atlantic Ocean can be altered due to periodic shifts in atmospheric patterns caused by the North Atlantic oscillation. Such climatic events can alter habitat conditions and prey distribution for ESA-listed species (Beamish 1993, Mantua, Hare et al. 1997, Hare and Mantua 2001, Benson and Trites 2002, Stabeno, Bond et al. 2004, Mundy 2005, Mundy and Cooney 2005). For example, decade-scale climatic regime shifts have been related to changes in zooplankton in the North Atlantic Ocean (Fromentin and Planque 1996), and decadal trends in the North Atlantic oscillation (Hurrell 1995) can affect the position of the Gulf Stream (Taylor, Jordon et al. 1998) and other circulation patterns in the North Atlantic Ocean that act as migratory pathways for various marine species, especially fish.

The North Atlantic oscillation is a large-scale, dynamic phenomenon that exemplifies the relationship between the atmosphere and the ocean. The North Atlantic oscillation has global significance as it affects sea surface temperatures, wind conditions, and ocean circulation of the North Atlantic Ocean (Stenseth, Mysterud et al. 2002). The North Atlantic oscillation is an alteration in the intensity of the atmospheric pressure difference between the semi-permanent high-pressure center over the Azores Islands and the sub-polar low pressure center over Iceland (Stenseth, Mysterud et al. 2002). Sea-level atmospheric pressure in the two regions tends to vary in a “see-saw” pattern – when the pressure increases in Iceland it decreases in the Azores and vice-versa (i.e., the two systems tend to intensity or weaken in synchrony). The North Atlantic oscillation is the dominant mode of decadal-scale variability in weather and climate in the North Atlantic Ocean region (Hurrell 1995).

Since ocean circulation is wind and density driven, it is not surprising to find that the North Atlantic oscillation appears to have a direct effect on the position and strength of important North Atlantic Ocean currents. The North Atlantic oscillation influences the latitude of the Gulf Stream Current and accounts for a great deal of the interannual variability in the location of the current; in years after a positive North Atlantic oscillation index, the north wall of the Gulf Stream (south of New England) is located farther north (Taylor, Jordon et al. 1998). Not only is the location of the Gulf Stream Current and its end-member, the North Atlantic Current, affected by the North Atlantic oscillation, but the strength of these currents is also affected. During negative North Atlantic oscillation years, the Gulf Stream System (i.e., Loop, Gulf Stream, and North Atlantic Currents) not only shifted southward but weakened, as witnessed during the predominantly negative North Atlantic oscillation phase of the 1960s; during the subsequent 25-year period of predominantly positive North Atlantic oscillation, the currents intensified to a record peak in transport rate, reflecting an increase of 25 to 33 percent (Curry and McCartney 2001). The location and strength of the Gulf Stream System are important, as this major current system is an essential part of the North Atlantic climate system, moderating temperatures and weather from the U.S. to Great Britain and even the Mediterranean Sea region. Pershing, Greene et al. (2001) also found that the upper slope-water system off the east coast of the U.S. was affected by the North Atlantic oscillation and was driven by variability in temperature and transport of the Labrador Current. During low North Atlantic oscillation periods, especially that seen in the winter of 1996, the Labrador Current intensified, which led to the advance of cold slope water along the continental shelf as far south as the mid-Atlantic Bight in 1998 (Pershing, Greene et al. 2001, Greene and Pershing 2003). Variability in the Labrador Current intensity is linked to the effects of winter temperatures in Greenland and its surroundings (e.g., Davis Strait, Denmark Strait), on sea-ice formation, and the relative balance between the formation of deep and intermediate water masses and surface currents.

9.3 Whaling and Subsistence Harvesting

Large whale population numbers in the action area have historically been impacted by aboriginal hunting and early commercial exploitation, and some stocks were already reduced by 1864 (the beginning of the era of modern commercial whaling using harpoon guns as opposed to harpoons simply thrown by men). From 1864 to 1985, at least 2.4 million baleen whales (excluding minke whales) and sperm whales were killed (Gambell 1999). Prior to current prohibitions on whaling most large whale species were significantly depleted to the extent it was necessary to list them as endangered under the Endangered Species Preservation Act of 1966. In 1982, the International Whaling Commission issued a moratorium on commercial whaling beginning in 1986. There is currently no legal commercial whaling by International Whaling Commission Member Nations party to the moratorium; however, whales are still killed commercially by countries that field objections to the moratorium (i.e., Iceland and Norway). Presently three types of whaling take place: (1) aboriginal subsistence whaling to support the needs of indigenous people; (2) special permit whaling; and (3) commercial whaling conducted either under objection or reservation to the moratorium. The reported catch and catch limits of large whale species from aboriginal subsistence whaling, special permit whaling, and commercial whaling can be found on the International Whaling Commission's website at: https://iwc.int/whaling. Additionally, the Japanese whaling fleet carries out whale hunts under the guise of "scientific research," though very few peer-reviewed papers have been published as a result of the program, and meat from the whales killed under the program is processed and sold at fish markets.

Norway and Iceland take whales commercially at present, either under objection to the moratorium decision or under reservation to it. These countries establish their own catch limits but must provide information on those catches and associated scientific data to the International Whaling Commission. The Russian Federation has also registered an objection to the moratorium decision but does not exercise it. The moratorium is binding on all other members of the International Whaling Commission. Norway takes minke whales in the North Atlantic Ocean within its Exclusive Economic Zone, and Iceland takes minke whales and fin whales in the North Atlantic Ocean, within its Exclusive Economic Zone (IWC 2012).

Under current International Whaling Commission regulations, aboriginal subsistence whaling is permitted for Denmark (Greenland, fin and minke whales, *Balaenoptera* spp.), the Russian Federation (Siberia, gray [*Eschrichtius robustus*], and bowhead [*Balaena mysticetus*] whales), St. Vincent and the Grendaines (Bequia, humpback whales [*Megaptera novaeangliae*]) and the U.S.

(Alaska, bowhead and gray whales). It is the responsibility of national governments to provide the International Whaling Commission with evidence of the cultural and subsistence needs of their people. The Scientific Committee provides scientific advice on safe catch limits for such stocks (IWC 2012). Based on the information on need and scientific advice, the International Whaling Commission then sets catch limits, recently in five-year blocks.

Scientific permit whaling has been conducted by Japan and Iceland. In Iceland, the stated overall objective of the research program was to increase understanding of the biology and feeding ecology of important cetacean species in Icelandic waters for improved management of living and marine resources based on an ecosystem approach. While Iceland stated that its program was intended to strengthen the basis for conservation and sustainable use of cetaceans, it noted that it was equally intended to form a contribution to multi-species management of living resources in Icelandic waters. Although these whaling activities operate outside of the action area, the whales killed in these whaling expeditions are part of the populations of whales (e.g., fin, sei, and sperm) occurring within the action area for this consultation.

Most current whaling activities occur outside of the action area. Regardless, prior exploitation is likely to have altered population structure and social cohesion of all whale species within the action area, such that effects on abundance and recruitment continued for years after harvesting has ceased. ESA-listed whale mortalities since 1985 resulting from whaling activities can be seen below in Table 5 (IWC 2017, IWC 2017, IWC 2017).

Table 5. Endangered Species Act-listed whale mortalities as the result of whaling since 1985.

Species	Commercial Whaling	Scientific Research	Subsistence
Bowhead Whale	-- --	-- --	1,592
Fin Whale	706	310	377
Sei Whale	-- --	1,429	3
Sperm Whale	388	56	-- --

Many of the whaling numbers reported represent minimum catches, as illegal or underreported catches are not included. For example, recently uncovered Union of Soviet Socialists Republics catch records indicate extensive illegal whaling activity between 1948 and 1979 (Ivashchenko, Brownell Jr. et al. 2014). Additionally, despite the moratorium on large-scale commercial whaling, catch of some of these species still occurs in the Atlantic Ocean whether it be under objection of the International Whaling Commission, for aboriginal subsistence purposes, or under International Whaling Commission scientific permit 1985 through 2013. Some of the whales killed in these fisheries are likely part of the same population of whales occurring within the action area for this consultation.

Historically, commercial whaling caused all of the large whale species to decline to the point where they faced extinction risks high enough to list them as endangered species. Since the end of large-scale commercial whaling, the primary threat to the species has been eliminated. Many whale species have not yet fully recovered from those historic declines. Scientists cannot determine if those initial declines continue to influence current populations of most large whale species in the Atlantic Ocean. For example, the North Atlantic right whale has not recovered from the effects of commercial whaling and continue to face very high risks of extinction because of their small population sizes and low population growth rates. In contrast, populations of species such as the humpback whale have increased substantially from post-whaling population levels and appear to be recovering despite the impacts of vessel strikes, interactions with fishing gear, and increased levels of ambient sound.

9.4 Vessel Strike

Vessels have the potential to affect animals through strikes, sound, and disturbance associated with 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 (Mann, Connor et al. 2000, Samuels, Bejder et al. 2000, Boren, Gemmell et al. 2001, Constantine 2001, Nowacek 2001). Whale watching, a profitable and rapidly growing business with more than nine million participants in 80 countries and territories, may increase these types of disturbance and negatively affected the species (Hoyt 2001).

Vessel strikes are considered a serious and widespread threat to ESA-listed marine mammals (especially large whales) and sea turtles. 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, Barco et al. 1993, Wiley, Asmutis et al. 1995). As vessels to become faster and more widespread, an increase in vessel interactions with cetaceans is to be expected. All sizes and types of vessels can hit whales, but most lethal and sever injuries are caused by vessels 80 meters (262.5 feet) or longer (Laist, Knowlton et al. 2001). For whales, studies show that the probability of fatal injuries from vessel strikes increases as vessels operate at speeds above 26 kilometers per hour (14 knots) (Laist, Knowlton et al. 2001). Evidence suggests that not all whales killed as a result of vessel strike are detected, particularly in offshore waters, and some detected carcasses are never recovered while those that are recovered may be in advanced stages of decomposition that preclude a definitive cause of death determination (Glass, Cole et al. 2010). The vast majority of commercial vessel strike mortalities of cetaceans are likely undetected and unreported, as most are likely never reported and most animals killed by vessel strike likely end up sinking rather than washing up on shore (Cassoff 2011). Kraus, Brown et al. (2005) estimated that 17 percent of vessel strikes are actually detected. Therefore, it is likely that the number of documented cetacean mortalities related to vessel strikes is much lower than the actual number of moralities associated with vessel strikes, especially for less buoyant species such as blue, humpback, and fin whales (Rockwood, Calambokidis et al. 2017). Rockwood, Calambokidis et al. (2017) modeled vessel strike mortalities of blue, humpback, and fin whales off California using carcass recovery rates of five and 17 percent and conservatively estimated that vessel strike mortality may be as high as

7.8, 2.0, and 2.7 times the recommended limit for blue, humpback, and fin whale stocks in this area, respectively.

Of 11 species of cetaceans known to be threatened by vessel strikes in the northern hemisphere, fin whales are the mostly commonly struck species, but North Atlantic right, gray, humpback, and sperm whales are also struck (Laist, Knowlton et al. 2001, Vanderlaan and Taggart 2007). In some areas, one-third of all fin whale and North Atlantic right whale strandings appear to involve vessel strikes (Laist, Knowlton et al. 2001). Vessel traffic within the action area can come from both private (e.g., commercial, recreational) and federal vessel (e.g., military, research), but traffic that is most likely to result in vessel strikes comes from commercial shipping.

The potential lethal effects of vessel strikes are particularly profound on species with low abundance. However, all whale species have the potential to be affected by vessel strikes. The latest five-year average mortalities and serious injuries related to vessel strikes for the ESA-listed cetacean stocks within U.S. waters likely to be found in the action area are given in Table 6 below (Hayes, Josephson et al. 2017, Henry, Cole et al. 2017). Data represent only known mortalities and serious injuries; more, undocumented mortalities and serious injuries for these and other stocks found within the action area have likely occurred.

Table 6. Five-year mortalities and serious injuries related to vessel strikes for Endangered Species Act-listed marine mammals within the action area.

Species	Number of Vessel Strikes	Annual Average
Fin Whale	8	1.6
Sei Whale	4	0.8
Sperm Whale	1	0.2

9.5 Whale Watching

Whale watching is a rapidly-growing industry with more than 3,300 operators worldwide, serving 13 million participants in 119 countries and territories (O'connor, Campbell et al. 2009). As of 2010, commercial whale watching was a one billion dollar global industry per year (Lambert, Hunter et al. 2010). Private vessels may partake in this activity as well. NMFS has issued certain regulations and guidelines relevant to whale watching. As noted previously, many of the cetaceans considered in this opinion are highly migratory, so may also be exposed to whale watching activity occurring outside of the action area.

Although considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational and scientific benefits, whale watching is not without potential negative impacts (reviewed in Parsons 2012). Whale watching has the potential to harass whales by altering feeding, breeding, and social behavior or even injure them if the vessel gets too close or strikes the animal. Preferred habitats may be abandoned if disturbance levels are too high.

Animals may also become more vulnerable to vessel strikes if they habituate to vessel traffic (Swingle, Barco et al. 1993, Wiley, Asmutis et al. 1995).

Several studies have examined the short-term effects of whale watch vessels on marine mammals. (Watkins 1986, Corkeron 1995, Au and Green 2000, Felix 2001, Erbe 2002, Magalhaes, Prieto et al. 2002, Williams, Trites et al. 2002, Richter, Dawson et al. 2003, Scheidat, Castro et al. 2004, Simmonds 2005). The whale's behavioral responses to whale watching vessels depended on the distance of the vessel from the whale, vessel speed, vessel direction, vessel sound, and the number of vessels. In some circumstances, whales do not appear to respond to vessels, but in other circumstances, whales change their vocalizations, surface time, swimming speed, swimming angle or direction, respiration rates, dive times, feeding behavior, and social interactions. Disturbance by whale watch vessels has also been noted to cause newborn calves to separate briefly from their mother's sides, which leads to greater energy expenditures by the calves (NMFS 2006).

Although numerous short-term behavioral responses to whale watching vessels were documented, little information is available on whether long-term negative effects result from whale watching (NMFS 2006). Christiansen, Rasmussen et al. (2014) estimated that cumulative time minke whales spent with whale watching boats in Iceland to assess the biological significance of whale watching disturbances and found that, through some whales were repeatedly exposed to whale watching boats throughout the feeding season, the estimated cumulative time they spent with boats was very low. Christiansen, Rasmussen et al. (2014) suggested that the whale watching industry, in its current state, is likely not having any long-term negative effects on vital rates.

It is difficult to precisely quantify or estimate the magnitude of the risks posed to marine mammals in general from vessel approaches associated with whale watching. Given the proposed seismic survey activities will not occur within 70 kilometers (37.8 nautical miles) of land, few (if any) whale watching vessels will be expected to co-occur with the proposed action's research vessel.

9.6 Fisheries

Fisheries constitute an important and widespread use of the ocean resources throughout the action area. Fisheries can adversely affect fish populations, other species, and habitats. Direct effects of fisheries interactions on marine mammals and sea turtles include entanglement and entrapment, which can lead to fitness consequences or mortality as a result of injury or drowning. Indirect effects include reduced prey availability, including overfishing of targeted species, and destruction of habitat. Use of mobile fishing gear, such as bottom trawls, disturbs the seafloor and reduces structural complexity. Indirect impacts of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats and have the potential to entangle or be ingested by marine mammals.

Fisheries can have a profound influence on fish populations. In a study of restrospective data, Jackson, Kirby et al. (2001) concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance of coastal ecosystems, including pollution and anthropogenic climatic change. Marine mammals are known to feed on several species of fish that are harvested by humans (Waring, Josephson et al. 2008). Thus, competition with humans for prey is a potential concern. Reductions in fish populations, whether natural or human-caused, may affect the survival and recovery of several populations.

9.7 Fisheries Interactions

Globally, 6.4 million tons of fishing gear is lost in the oceans every year (Wilcox, Heathcote et al. 2015). Entrapment and entanglement in fishing gear is a frequently documented source of human-caused mortality in cetaceans (see Dietrich, Cornish et al. 2007). Materials entangled tightly around a body part may cut into tissues, enable infection, and severely compromise an individual's health (Derraik 2002). Entanglements also make animals more vulnerable to additional threats (e.g., predation and vessel strikes) by restricting agility and swimming speed. The majority of cetaceans that die from entanglement in fishing gear likely sink at sea rather than strand ashore, making it difficult to accurately determine the extent of such mortalities. Between 1970 and 2009, two-thirds of mortalities of large whales in the Northwest Atlantic Ocean were attributed to human causes, primarily vessel strike and entanglement (Van der Hoop, Moore et al. 2013). In excess of 97 percent of entanglement is caused by derelict fishing gear (Baulch and Perry 2014).

Cetaceans are also known to ingest fishing gear, likely mistaking it for prey, which can lead to fitness consequences and mortality. Necropsies of stranded whales have found that ingestion of net pieces, ropes, and other fishing debris has resulted in gastric impaction and ultimately death (Jacobsen, Massey et al. 2010). As with vessel strikes, entanglement or entrapment in fishing gear likely has the greatest impact on populations of ESA-listed species with the lowest abundance (e.g., Kraus, Kenney et al. 2016). Nevertheless, all species of cetacean may face threats from derelict fishing gear.

The latest five-year average mortalities and serious injuries related to fisheries interactions for the ESA-listed cetacean stocks within U.S. waters likely to be found in the action area are given in Table 7 below (Hayes, Josephson et al. 2017, Henry, Cole et al. 2017). Data represent only known mortalities and serious injuries; more, undocumented moralities and serious injuries for these and other stocks found within the action area have likely occurred.

Table 7. Five-year mortalities and serious injuries related to fisheries interactions for Endangered Species Act-listed marine mammals within the action area.

Species	Number of Entanglements	Annual Average
Fin Whale	10	2
Sei Whale	2	0.4
Sperm Whale	2	0.4

In addition to these direct impacts, cetaceans may also be subject to indirect impacts from fisheries. Marine mammals probably consume at least as much fish as is harvested by humans (Kenney, Hyman et al. 1985). Many cetacean species (particularly fin and humpback whales) are known to feed on species of fish that are harvested by humans (Carretta, Oleson et al. 2016). Thus, competition with humans for prey is a potential concern. Reductions in fish populations, whether natural or human-caused, may affect the survival and recovery of ESA-listed cetacean populations. Even species that do not directly compete with human fisheries could be indirectly affected by fishing activities through changes in ecosystem dynamics. However, in general the effects of fisheries on whales through changes in prey abundance remain unknown.

9.8 Aquaculture

Aquaculture has the potential to impact protected species via entanglement and/or other interaction with aquaculture gear (i.e., buoys, nets, and lines), introduction or transfer of pathogens, increased vessel traffic and noise, impacts to habitat and benthic organisms, and water quality (Lloyd 2003, Clement 2013, Price and Morris 2013, Price, Keane et al. 2017). Current data suggest that interactions and entanglements of ESA-listed cetaceans with aquaculture gear are rare (Price, Keane et al. 2017). This may be because worldwide the number and density of aquaculture farms are low, and thus there is a low probability of interactions, or because they pose little risk of ESA-listed marine mammals and sea turtles. Nonetheless, given that some aquaculture gear, such as that used in longline mussel farming, is similar to gear used in commercial fisheries, aquaculture may impact ESA-listed cetaceans similar to fisheries and bycatch, as discussed above in Sections 9.6 and 9.7, respectively.

9.9 Pollution

Within the action area, pollution poses a threat to ESA-listed marine mammals and sea turtles. Pollution can come in the form of marine debris, pesticides, contaminants, and hydrocarbons.

9.9.1 Marine Debris

Marine debris is an ecological threat that is introduced into the marine environment through ocean dumping, littering, or hydrologic transport of these materials from land-based sources (Gallo, Fossi et al. 2018). Even natural phenomena, such as tsunamis and continental flooding, can cause large amounts of debris to enter the ocean environment (Watters, Yoklavich et al. 2010). Marine debris has been discovered to be accumulating in gyres throughout the oceans.

Marine mammals often become entangled in marine debris, including fishing gear (Baird, Mahaffy et al. 2015). Despite debris removal and outreach to heighten public awareness, marine debris in the environment has not been reduced (NRC 2008) and continues to accumulate in the ocean and along shorelines within the action area.

Marine debris affects marine habitats and marine life worldwide, primarily by entangling or choking individuals that encounter it (Gall and Thompson 2015). Entanglement in marine debris can lead to injury, infection, reduced mobility, increased susceptibility to predation, decreased feeding ability, fitness consequences, and morality for ESA-listed species in the action area. Entanglement can also result in drowning for air breathing marine species including sea turtles and cetaceans. The ingestion of marine debris has been documented to result in blockage or obstruction of the digestive tract, mouth, and stomach lining of various species and can lead to serious internal injury or mortality (Derraik 2002). In addition to interference with alimentary processes, plastics lodged in the alimentary tract could facilitate the transfer of pollutants into the bodies of whales and dolphins (Derraik 2002). Law, Moret-Ferguson et al. (2010) presented a time series of plastic content at the surface of the western North Atlantic Ocean and Caribbean Sea from 1986 through 2008. More than 60 percent of 6,136 surface plankton net tows collected small, buoyant plastic pieces. Data on marine debris in some locations of the action area is largely lacking; therefore, it is difficult to draw conclusions as to the extent of the problem and its impacts on populations of ESA-listed species.

Cetaceans are also impacted by marine debris, which includes: plastics, glass, metal, polystyrene foam, rubber, and derelict fishing gear (Baulch and Perry 2014, Li, Tse et al. 2016). Over half of cetacean species (including fin, sei, and sperm whales) are known to ingest marine debris (mostly plastic), with up to 31 percent of individuals in some populations containing marine debris in their guts and being the cause of death for up to 22 percent of individuals found stranded on shorelines (Baulch and Perry 2014).

Given the limited knowledge about the impacts of marine debris on marine mammals, it is difficult to determine the extent of the threats that marine debris poses to marine mammals. However, marine debris is consistently present and has been found in marine mammals in and near the action area. Fin whales in the Mediterranean Sea are exposed to high densities of microplastics on the feeding grounds, and in turn exposed to a higher oxidative stress because of the presence of plasticizers, an additive in plastics (Fossi, Marsili et al. 2016). In 2008, two sperm whales stranded along the California coast, with an assortment of fishing related debris (e.g., net scraps, rope) and other plastics inside their stomachs (Jacobsen, Massey et al. 2010). One whale was emaciated, and the other had a ruptured stomach. It was suspected that gastric impactions was the cause of both deaths. Jacobsen, Massey et al. (2010) speculated the debris likely accumulated over many years, possibly in the North Pacific gyre that will carry derelict Asian fishing gear into eastern Pacific Ocean waters. In January and February 2016, 30 sperm whales stranded along the coast of the North Sea (in Germany, the Netherlands, Denmark, France, and Great Britain); of the 22 dissected specimens, nine had marine debris in their gastrointestinal tracts. Most of it (78 percent) was fishing-related debris (e.g., nets, monofilament line) and the remainder (22 percent) was general debris (plastic bags, plastic buckets, agricultural foils) (Unger, Rebolledo et al. 2016).

Plastic debris is a major concern because it degrades slowly and many plastics float. The floating debris is transported by currents throughout the oceans and has been discovered accumulating in oceanic gyres (Law, Moret-Ferguson et al. 2010). Additionally, plastic waste in the ocean chemically attracts hydrocarbon pollutants such as polychlorinated biphenyl and dichlorodiphenyltrichloroethane. Fish, marine mammals, and sea turtles can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. It is expected that marine mammals and sea turtles may be exposed to marine debris over the course of the action although the risk of ingestion or entanglement and the resulting impacts are uncertain at the time of this consultation.

9.9.2 Pesticides and Contaminants

Exposure to pollution and contaminants have 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 and Ross 2002). Marine pollutants come from multiple municipal, industrial, and household as well as from atmospheric transport (Iwata 1993, Grant and Ross 2002, Garrett 2004, Hartwell 2004). Contaminants may be introduced by rivers, coastal runoff, wind, ocean dumping, dumping of raw sewage by boats and various industrial activities, including offshore oil and gas or mineral exploitation (Grant and Ross 2002, Garrett 2004, Hartwell 2004).

The accumulation of persistent organic pollutants, including polychlorinated-biphenyls, dibenzo-p-dioxins, dibenzofurans and related compounds, through trophic transfer may cause mortality and sub-lethal effects in long-lived higher trophic level animals (Waring, Josephson et al. 2016), including immune system abnormalities, endocrine disruption, and reproductive effects (Krahn, Hanson et al. 2007). Persistent organic pollutants may also facilitate disease emergence and lead to the creation of susceptible “reservoirs” for new pathogens in contaminated marine mammal populations (Ross 2002). Recent efforts have led to improvements in regional water quality and monitored pesticide levels have declined, although the more persistent chemicals are still detected and are expected to endure for years (Mearns 2001, Grant and Ross 2002).

Numerous factors can affect concentrations of persistent pollutants in marine mammals, such as age, sex and birth order, diet, and habitat use (Mongillo, Holmes et al. 2012). In marine mammals, pollutant contaminant load for males increases with age, whereas females pass on contaminants to offspring during pregnancy and lactation (Addison and Brodie 1987, Borrell, Bloch et al. 1995). Pollutants can be transferred from mothers to juveniles at a time when their bodies are undergoing rapid development, putting juveniles at risk of immune and endocrine system dysfunction later in life (Krahn, Hanson et al. 2009).

9.9.3 Hydrocarbons

There has never been a large-scale oil spill in the action area, but numerous small-scale vessel spills likely occur. A nationwide study examining vessel oil spills from 2002 through 2006 found that over 1.8 million gallons of oil were spilled from vessels in all U.S. waters (Dalton and Jin 2010). In this study, “vessel” included numerous types of vessels, including barges, tankers, tugboats, and recreational and commercial vessels, demonstrating that the threat of an oil spill can come from a variety of boat types. Below we review the effects of oil spills on marine mammals and sea turtles more generally. Much of what is known comes from studies of large oil spills such as the *Deepwater Horizon* oil spill since no information exists on the effects of small-scale oil spills within the action area.

Exposure to hydrocarbons released into the environment via oil spills and other discharges pose risks to marine species. Marine mammals are generally able to metabolize and excrete limited amounts of hydrocarbons, but exposure to large amounts of hydrocarbons and chronic exposure over time pose greater risks (Grant and Ross 2002). Acute exposure of marine mammals to petroleum products causes changes in behavior and may directly injure animals (Geraci 1990). The *Deepwater Horizon* oil spill in the Gulf of Mexico in 2010 led to the exposure of tens of thousands of marine mammals to oil, causing reproductive failure, adrenal disease, lung disease, and poor body condition. Sea turtles were also impacted, being mired and killed by oil at the water’s surface. Exposure also occurred via ingestion, inhalation, and maternal transfer of oil compounds to embryos; these effects are more difficult to assess, but likely resulted in sub-lethal effects and injury (Deepwater Horizon Trustees 2016).

Cetaceans have a thickened epidermis that greatly reduces the likelihood of petroleum toxicity from skin contact with oils (Geraci 1990), but they may inhale these compounds at the water’s surface and ingest them while feeding (Matkin and Saulitis 1997). For example, as a result of the *Deepwater Horizon* oil spill, sperm whales could have been exposed to toxic oil components through inhalation, aspiration, ingestion, and dermal exposure. There were 19 observations of 33 sperm whales swimming in *Deepwater Horizon* surface oil or that had oil on their bodies (Diaz 2015 as cited in Trustees 2016). The effects of oil exposure likely included physical and toxicological damage to organ systems and tissues, reproductive failure, and death. Whales may have experienced multiple routes of exposure at the same time, over intermittent timeframes and at varying rates, doses, and chemical compositions of oil based on observed impacts to bottlenose dolphins. Hydrocarbons also have the potential to impact prey populations, and therefore may affect ESA-listed species indirectly by reducing food availability.

As noted above, to our knowledge the past and present impacts of oil spills on ESA-listed species within the action area are limited to those associated with small-scale vessel spills. Nevertheless, we consider the documented effects of oil spills outside the action area, such as the *Deepwater Horizon* oil spill, examples of the possible impacts that oil spill can have on ESA-listed species.

9.10 Aquatic Nuisance Species

Aquatic nuisance species are aquatic and terrestrial organisms, introduced into new habitats throughout the U.S. and other areas of the world, that produce harmful impacts on aquatic ecosystems and native species (http://www.anstaskforce.gov). They are also referred to as invasive, alien, or non-indigenous species. Invasive species have been referred to as one of the top four threats to the world's oceans (Raaymakers and Hilliard 2002, Raaymakers 2003, Terdalkar, Kulkarni et al. 2005, Pughiuc 2010). Introduction of these species is cited as a major threat to biodiversity, second only to habitat loss (Wilcove, Rothstein et al. 1998). A variety of vectors are thought to have introduced non-native species including, but not limited to aquarium and pet trades, recreation, and ballast water discharges from ocean-going vessels. Common impacts of invasive species are alteration of habitat and nutrient availability, as well as altering species composition and diversity within an ecosystem (Strayer 2010). Shifts in the base of food webs, a common result of the introduction of invasive species, can fundamentally alter predator-prey dynamics up and across food chains (Moncheva and Kamburska 2002), potentially affecting prey availability and habitat suitability for ESA-listed species. They have been implicated in the endangerment of 48 percent of ESA-listed species (Czech and Krausman 1997).

9.11 Sound

The ESA-listed species that occur in the action area are regularly exposed to several sources of anthropogenic sounds. These include, but are not limited to maritime activities, aircraft, seismic surveys (exploration and research), and marine construction (dredging). Cetaceans generate and rely on sound to navigate, hunt, and communicate with other individuals and anthropogenic sound can interfere with these important activities (Nowacek, Thorne et al. 2007). The ESA-listed species have the potential to be impacted by either increased levels of anthropogenic-induced background sound or high intensity, short-term anthropogenic sounds.

Anthropogenic sound in the action areas may be generated by commercial and recreational vessels, sonar, aircraft, seismic surveys, in-water construction activities, wind farms, military activities, and other human activities. These activities occur to varying degrees throughout the year. The scientific community recognizes the addition of anthropogenic sound to the marine environment as a stressor that can possibly harm marine animals or significantly interfere with their normal activities (NRC 2005). The species considered in this opinion may be impacted by anthropogenic sound in various ways. Once detected, some sounds may produce a behavioral response, including but not limited to, changes in habitat to avoid areas of higher sound levels, changes in diving behavior, or (for cetaceans) changes in vocalization (MMC 2007).

Many researchers have described behavioral responses of marine mammals to sounds produced by boats and vessels, as well as other sound sources such as helicopters and fixed-wing aircraft, and dredging and construction (and Nowacek, Thorne et al. 2007, reviewed in Gomez, Lawson et al. 2016). Most observations have been limited to short-term behavioral responses, which included avoidance behavior and temporary cessation of feeding, resting, or social interactions; however, in terrestrial species habitat abandonment can lead to more long-term effects, which may have implications at the population level (Barber, Crooks et al. 2010). Masking may also occur, in which an animal may not be able to detect, interpret, and/or respond to biologically relevant sounds. Masking can reduce the range of communication, particularly long-range communication, such as that for blue and fin whales. This can have a variety of implications for an animal's fitness including, but not limited to, predator avoidance and the ability to reproduce successfully (MMC 2007). Recent scientific evidence suggests that marine mammals, including several baleen whales, compensate for masking by changing the frequency, source level, redundancy, or timing of their signals, but the long-term implications of these adjustments are currently unknown (Parks 2003, Mcdonald, Hildebrand et al. 2006, Parks 2009).

Despite the potential for these impacts to affect individual ESA-listed marine mammals, information is not currently available to determine the potential population level effects of anthropogenic sound levels in the marine environment (MMC 2007). For example, we currently lack empirical data on how sound impacts growth, survival, reproduction, and vital rates, nor do we understand the relative influence of such effects on the population being considered. As a result, the consequences of anthropogenic sound on ESA-listed marine mammals at the population or species scale remain uncertain, although recent efforts have made progress establishing frameworks to consider such effects (NAS 2017).

9.11.1 Vessel Sound and Commercial Shipping

Much of the increase in sound in the ocean environment is due to increased shipping, as vessels become more numerous and of larger tonnage (NRC 2003, Hildebrand 2009, Mckenna, Ross et al. 2012). Commercial shipping continues a major source of low-frequency sound in the ocean, particularly in the Northern Hemisphere where the majority of vessel traffic occurs. Although large vessels emit predominantly low frequency sound, studies report broadband sound from large cargo vessels above 2 kiloHertz. The low frequency sounds from large vessels overlap with many mysticetes predicted hearing ranges (7 Hertz to 35 kiloHertz) (NOAA 2018) and may mask their vocalizations and cause stress (Rolland, Parks et al. 2012). The broadband sounds from large vessels may interfere with important biological functions of odontocetes, including foraging (Holt 2008, Blair, Merchant et al. 2016). At frequencies below 300 Hertz, ambient sound levels are elevated by 15 to 20 dB when exposed to sounds from vessels at a distance (McKenna, Ross et al. 2013). Analysis of sound from vessels revealed that their propulsion systems are a dominant source of radiated underwater sound at frequencies less than 200 Hertz (Ross 1976). Additional sources of vessel sound include rotational and reciprocating machinery that produces tones and pulses at a constant rate. Other commercial and recreational vessels also operate within the action area and may produce similar sounds, although to a lesser extent given their much smaller size.

Individuals produce unique acoustic signatures, although these signatures may change with vessel speed, vessel load, and activities that may be taking place on the vessel. Peak spectral levels for individual commercial vessels are in the frequency band of 10 to 50 Hertz and range from 195 dB re: μPa^2-s at 1 meter for fast-moving (greater than 37 kilometers per hour [20 knots]) supertankers to 140 dB re: µPa^2-s at 1 meter for small fishing vessels (NRC 2003). Small boats with outboard or inboard engines produce sound that is generally highest in the mid-frequency (1 to 5 kiloHertz) range and at moderate (150 to 180 dB re: 1 µPa at 1 meter) source levels (Erbe 2002, Gabriele, Kipple et al. 2003, Kipple and Gabriele 2004). On average, sound levels are higher for the larger vessels, and increased vessel speeds result in higher sound levels. Measurements made over the period 1950 through 1970 indicated low frequency (50 Hertz) vessel traffic sound in the eastern North Pacific Ocean and western North Atlantic Ocean was increasing by 0.55 dB per year (Ross 1976, Ross 1993, Ross 2005). Whether or not such trends continue today is unclear. Most data indicate vessel sound is likely still increasing (Hildebrand 2009). However, the rate of increase appears to have slowed in some areas (Chapman and Price 2011), and in some places, ambient sound including that produced by vessels appears to be decreasing (Miksis-Olds and Nichols 2016). Efforts are underway to better document changes in ambient sound (Haver, Gedamke et al. 2018), which will help provide a better understanding of current and future impacts of vessel sound on ESA-listed species.

Sonar systems are used on commercial, recreational, and military vessels and may also affect cetaceans (NRC 2003). Although little information is available on potential effects of multiple commercial and recreational sonars to cetaceans, 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 (Nowacek, Thorne et al. 2007). However, military sonar, particularly low frequency active sonar, often produces intense sounds at high source levels, and these may impact cetacean behavior (Southall, Nowacek et al. 2016). For further discussion of military sound on the ESA-listed species considered in this opinion, see Section 9.12.

9.11.2 Aircraft

Aircraft within the action area may consist of small commercial or recreational airplanes or helicopters, to large commercial airliners. These aircraft produce a variety of sounds that could potentially enter the water and impact marine mammals or sea turtles. While it is difficult to assess these impacts, several studies have documented what appear to be minor behavioral disturbances in response to aircraft presence (Nowacek, Thorne et al. 2007).

9.11.3 Seismic Surveys

There are seismic survey activities involving towed airgun arrays that may occur within the action area. They are the primary exploration technique to locate oil and gas deposits, fault structure, and other geological hazards. These activities may produce noise that could impact ESA-listed cetaceans and sea turtles within the action area. These airgun arrays generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of ten to 20 seconds for extended periods (NRC 2003). Most of the energy from the airguns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235 to 240 dB at dominant frequencies of five to 300 Hertz (NRC 2003). Most of the sound energy is at frequencies below 500 Hertz, which is within the hearing range of baleen whales (Nowacek, Thorne et al. 2007). In the U.S., all seismic surveys involving the use of airguns with the potential to take marine mammals are covered by incidental take authorizations under the MMPA, and if they involve ESA-listed species, undergo formal ESA section 7 consultation. In addition, the Bureau of Ocean Energy Management authorizes oil and gas activities in domestic waters as well as the National Science Foundation and U.S. Geological Survey funds and/or conducts these activities in domestic and foreign waters, and in doing so, consults with NMFS to ensure their actions do not jeopardize the continued existence of ESA-listed species or adversely modify or destroy designated critical habitat. More information on the effects of these activities on ESA-listed species, including authorized takes, can be found in recent biological opinions.

There were two known low-energy seismic surveys that occurred near the Mid-Atlantic Ridge in the North Atlantic Ocean from June to August 2018. These included a National Science Foundation and United States Geological Survey funded seismic survey. Each of these surveys were conducted for research purposes and contained a MMPA incidental take authorization that were both subject to a separate ESA section 7 consultation. Each of these consultations resulted in a "no jeopardy" opinion.

9.11.4 Marine Construction

Marine construction in the action area that produces sound includes drilling, dredging, pile-driving, cable-laying, and explosions. These activities are known to cause behavioral disturbance and physical damage (NRC 2003). While most of these activities are coastal, offshore construction does occur.

9.12 Military Activities

The U.S. Navy conducts training, testing, and other military readiness activities on range complexes throughout coastal and offshore areas in the United States and on the high seas. The U.S. Navy's activities are conducted off the coast of the Atlantic Ocean and elsewhere throughout the world. During training, existing and established weapon systems and tactics are used in realistic situations to simulate and prepare for combat. Activities include: routine gunnery, missile, surface fire support, amphibious assault and landing, bombing, sinking, torpedo, tracking, and mine exercises. Testing activities are conducted for different purposes and include at-sea research, development, evaluation, and experimentation. The U.S. Navy performs testing activities to ensure that its military forces have the latest technologies and techniques available to them. The majority of the training and testing activities the U.S. Navy conducts in the action area are similar, if not identical to activities that have been occurring in the same locations for decades.

The U.S. Navy's activities produce sound and visual disturbance to marine mammals and sea turtles throughout the action area (NMFS 2015, NMFS 2015, NMFS 2017). Anticipated impacts from harassment due to the U.S. Navy's activities include changes from foraging, resting, milling, and other behavioral states that require low energy expenditures to traveling, avoidance, and behavioral states that require higher energy expenditures. Based on the currently available scientific information, behavioral responses that result from stressors associated with these training and testing activities are expected to be temporary and will not affect the reproduction, survival, or recovery of these species. Sound produced during U.S. Navy activities is also expected to result in instances of TTS and PTS to marine mammals. The U.S. Navy's activities constitute a federal action and take of ESA-listed marine mammals considered for these activities have previously undergone separate ESA section 7 consultation. Through these consultations with NMFS, the U.S. Navy has implemented monitoring and conservation measures to reduce the potential effects of underwater sound from activities on ESA-listed resources in the Atlantic Ocean. Conservation measures include employing visual observers and implementing mitigation zones during activities using active sonar and explosives.

In addition to these testing and training activities, the U.S. Navy operates Surveillance Towed Array Sensor System Low Frequency Active sonar (SURTASS LFA) within the action area, which utilizes low frequency sounds to detect and monitor submarines. SURTASS LFA has a coherent low-frequency signal with a duty cycle of less than 20 percent, operating for a maximum of only 255 hours per year for each system (or 432 hours per year in the past) or a total of 10.6 days per year. This compares to an approximate 21.9 million days per year for the world's shipping industry. Thus, SURTASS LFA sonar transmissions will make up a very small part of the human-caused sound pollution in the ocean.

Prior to 2017, the U.S. Navy used SURTASS LFA sonar in the western and central North Pacific Ocean. However, in 2017 the U.S. Navy requested programmatic section 7 consultation for the operation of SURTASS LFA sonar from August 2017 through 2022 in the non-polar region of the world's oceans (including within the action area). The consultation was concluded in August 2017 (NMFS 2017) and considered the U.S. Navy's SURTASS LFA program as well as specific SURTASS LFA operations.

9.13 Scientific Research Activities

Regulations for section 10(a)(1)(A) of the ESA allow issuance of permits authorizing take of certain ESA-listed species for the purposes of scientific research. Prior to the issuance of such a permit, the proposal must be reviewed for compliance with section 7 of the ESA. Scientific research permits issued by NMFS currently authorize studies of ESA-listed species in the Northwest Atlantic Ocean, some of which extend into portions of the action area for the proposed action. Marine mammals have been the subject of field studies for decades. The primary objective of most of these field studies has generally been monitoring populations or gathering data for behavioral and ecological studies. Over time, NMFS has issued dozens of permits on an annual basis for various forms of "take" of marine mammals in the action area from a variety of research activities.

Authorized research on ESA-listed marine mammals includes aerial and vessel surveys, close approaches, photography, videography, behavioral observations, active acoustics, remote ultrasound, passive acoustic monitoring, biological sampling (i.e., biopsy, breath, fecal, sloughed skin), and tagging. Research activities involve non-lethal "takes" of these marine mammals.

There have been numerous research permits issued since 2009 under the provisions of both the MMPA and ESA authorizing scientific research on marine mammals and sea turtles all over the world, including for research in the action area. The consultations which took place on the issuance of these ESA scientific research permits each found that the authorized research activities will have no more than short-term effects and will not result in jeopardy to the species or adverse modification of designated critical habitat.

Additional "take" is likely to be authorized in the future as additional permits are issued. There are currently at least 13 active permits that have been authorized by NMFS for research in the action area on the species considered in this opinion. It is noteworthy that monitoring and reporting indicate that the actual number of "takes" rarely approach the number authorized for each permit. Therefore, it is unlikely that the level of exposure indicated in each permit has or will occur in the near term. However, our analysis assumes that these "takes" will occur since they have been authorized. It is also noteworthy that these "takes" are distributed across the Atlantic Ocean. Although cetaceans are generally wide-ranging, we do not expect many of the authorized "takes" to involve individuals that will also be "taken" under the proposed research activities.

9.14 Impact of the Baseline on Endangered Species Act-Listed Species

Collectively, the stressors described above have had, and likely continue to have, lasting impacts on the ESA-listed species considered in this consultation. Some of these stressors result in mortality or serious injury to individual animals (e.g., vessel strikes and whaling), whereas others result in more indirect (e.g., fishing that impacts prey availability) or non-lethal (e.g., whale watching) impacts. Assessing the aggregate impacts of these stressors on the species considered in this opinion is difficult and, to our knowledge, no such analysis exists. This becomes even more difficult considering that many of the species in this opinion are wide ranging and subject to stressors in locations throughout and outside the action area.

We consider the best indicator of the aggregate impact of the *Environmental Baseline* on ESA-listed resources to be the status and trends of those species. As noted in Section 9, some of the species considered in this consultation are experiencing increases in population abundance, some are declining, and for others, their status remains unknown. Taken together, this indicates that the *Environmental Baseline* is impacting species in different ways. The species experiencing increasing population abundances are doing so despite the potential negative impacts of the *Environmental Baseline*. Therefore, while the *Environmental Baseline* may slow their recovery, recovery is not being prevented. For the species that may be declining in abundance, it is possible that the suite of conditions described in the *Environmental Baseline* is preventing their recovery. However, it is also possible that their populations are at such low levels (e.g., due to historical commercial whaling) that even when the species' primary threats are removed, the species may not be able to achieve recovery. At small population sizes, species may experience phenomena such as demographic stochasticity, inbreeding depression, and Allee effects, among others, that cause their limited population size to become a threat in and of itself. A thorough review of the status and trends of each species is discussed in the *Status of Species and Critical Habitat Likely to be Adversely Affected* section of this opinion.

10 Effects of the Action

Section 7 regulations define "effects of the action" as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 C.F.R. §402.02). Indirect effects are those that are caused by the proposed action and are later in time, but are reasonably certain to occur. This effects analyses section is organized following the stressor, exposure, response, risk assessment framework.

The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 C.F.R. §402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

In this section, we describe the probability of individuals of ESA-listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses to those individuals (given probable exposures) based on the available evidence. As described in Section 2, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, or lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the ESA-listed species those populations represent. For this consultation, we are particularly concerned about behavioral and stress-based physiological disruptions and potential unintentional mortality that may result in animals that fail to feed, reproduce, or survive because these responses are likely to have population-level consequences. The purpose of this assessment and, ultimately, of this consultation is to determine if it is reasonable to expect the proposed action to have effects on ESA-listed species that could appreciably reduce their likelihood of surviving and recovering in the wild.

10.1 Exposure and Response Analysis

The *Exposure Analysis* identifies, as possible, the number, age (or life stage), and gender of the ESA-listed individuals that are likely to be exposed to the stressors and the population(s) of sub-population(s) those individuals belong. The *Response Analysis* evaluates the available evidence to determine how individuals of those ESA-listed species are likely to respond given their probable exposure.

10.1.1 Exposure Analysis

In this section, we quantify the likely exposure of ESA-listed species to the activities and associated stressors that may result from the proposed action (Section 3). Table 1 and Table 2 specify the applicant's and the Permits and Conservation Division's proposed exposure to ESA-listed species associated with the proposed research activities. In accordance with our regulations (50 C.F.R §402), here we evaluate whether or not this proposed level of exposure is reasonably certain to occur.

Dr. Jooke Robbins indicated that the MMPA take number estimates in the permit application for Permit No. 21485 are based on monitoring of cetacean populations conducted by the Center for Coastal Studies and the relative encounter rates expected by researchers throughout the action area. Take estimates for blue, bowhead, sei, and sperm whales were based on the facilitation of adequate sample sizes, as Dr. Robbins expects to encounter these species more rarely or sporadically than fin whales. With this explanation of MMPA take number estimates, our own evaluation of these numbers in comparison to Dr. Jooke Robbin's and other researchers' annual reports for similar species and research activities, and the conservative assumption that all MMPA take that the Permits and Conservation Division authorize *could* occur, we adopt the exposure of ESA-listed species that are reasonably certain to occur as the number of animals specified in Table 1 and Table 2 for specific research activities.

10.1.2 Response Analysis

Given the exposure detailed above, in this section we describe the range of responses among ESA-listed cetaceans that may result from the stressors associated with the research activities that will be authorized under Permit No. 21485. These include stressors associated with vessel activities, biopsy sampling, and polecam operation. As discussed in Section 5, sloughed skin and fecal sampling are not expected to produce any stressors themselves. Thus, no response to these activities is expected beyond the response to the vessel surveys and close approaches needed to perform these activities. We assess potential lethal, sub-lethal (or physiological), or behavioral responses that might reduce the fitness of individuals. Our response analysis considers and weighs evidence of adverse consequences, as well as evidence suggesting the absence of such consequences.

In general, all the research activities described in Section 3 have the potential to cause some sort of disturbance. Responses by animals to human disturbance are similar to their responses to potential predators (Harrington and Veitch 1992, Lima 1998, Gill, Norris et al. 2001, Frid and Dill 2002, Frid 2003, Beale and Monaghan 2004, Romero 2004). These responses manifest themselves as stress responses in which an animal perceives human activity as a potential threat and undergoes physiological changes to prepare for a flight or fight response or more serious physiological changes with chronic exposure to stressors. They can also lead to interruptions of essential behavioral or physiological events, alteration of an animal's time budget, or some combinations of these responses (Sapolsky, Romero et al. 2000, Frid and Dill 2002, Romero 2004, Walker, Dee Boersma et al. 2005). Further, these responses have been associated with abandonment of sites (Sutherland and Crockford 1993), reduced reproductive success (Giese 1996, Mullner, Linsenmair et al. 2004), and the death of individual animals (Feare 1976, Daan 1996, Bearzi 2000).

The mammalian stress response involves the hypothalamic-pituitary-adrenal axis being stimulated by a stressor, causing a cascade of physiological responses, such as the release of the stress hormones adrenaline (epinephrine), glucocorticosteroids, and others (Thomson and Geraci 1986, St. Aubin and Geraci 1988, St. Aubin, Ridgway et al. 1996, Gulland, Haulena et al. 1999, Busch and Hayward 2009). These hormones can subsequently cause short-term weight loss, the liberation of glucose into the blood stream, impairment of the immune and nervous systems, elevated heart rate, body temperature, blood pressure, and alertness, and other responses (Thomson and Geraci 1986, Kaufman and Kaufman 1994, Dierauf and Gulland 2001, Dierauf and Gulland 2001, Cattet, Christison et al. 2003, Elftman, Norbury et al. 2007, Fonfara, Siebert et al. 2007, Noda, Akiyoshi et al. 2007, Mancia, Warr et al. 2008, Busch and Hayward 2009, Dickens, Delehanty et al. 2010). In some species, stress can also increase an individual's susceptibility to gastrointestinal parasitism (Greer 2008). In highly stressful circumstances, or in species prone to strong "fight-or-flight" responses, more extreme consequences can result, including muscle damage and death (Cowan and Curry 1998, Cowan and Curry 2002, Herraez, Sierra et al. 2007, Cowan and Curry 2008). The most widely recognized hormonal indicator of vertebrate stress, cortisol, normally takes hours to days to return to baseline levels following a significantly stressful event, but other hormones of the hypothalamic-pituitary-adrenal axis may persist for weeks (Dierauf and Gulland 2001). Mammalian stress levels can vary by age, sex, season, and health status (Peters 1983, Hunt, Rolland et al. 2006, Keay, Singh et al. 2006). In addition, smaller mammals tend to react more strongly to stress than larger mammals (Peters 1983, Hunt, Rolland et al. 2006, Keay, Singh et al. 2006).

In sum, the common underlying stressor of a human disturbance caused by the research activities that would occur under Permit No. 21485 may lead to a variety of different stress related responses. In addition to possibly causing a stress related response, each research activity is likely to produce unique responses as detailed further below. For incidental harassment that may result when animals are associated with individuals targeted for directed research, we expect responses to be similar to, or in most cases less than, those described below for each research activity, and above for general human disturbances.

10.1.2.1 Vessel Activity and Close Approaches

Vessel activity and close approaches conducted under Permit No. 21485 would expose ESA-listed cetaceans within the action areas to vessel traffic, discharge, and visual and auditory disturbances. As noted previously, most documentation does not present any stressors outside of those associated with vessel surveys and close approaches. The purpose of vessel surveys and close approaches is to allow researchers to conduct other activities, responses to which are described below in individual sections.

Vessel surveys necessarily involve transit within the marine environment, and the transit of any vessel in waters inhabited by whales carries the risk of striking a whale. Responses to a vessel strike can involve death, serious injury, or minor, non-lethal injuries. The probability of a vessel collision and the associated response depends, in part, on the size and speed of the vessel. The majority of vessel strikes of large whales occur when vessels are traveling at speeds greater than approximately 10 knots, with vessels traveling faster, especially large vessels (80 meters or greater), being more likely to cause serious injury or death (Laist, Knowlton et al. 2001, Jensen and Silber 2004, Vanderlaan and Taggart 2007, Conn and Silber 2013). As a result, in 2008 the NMFS established regulations requiring all vessels 19.8 meters or longer to travel at 10 knots or less in Seasonal Management Areas along the U.S. East Coast at certain times of the year to reduce the threat of ship collisions (78 FR 73726). In addition, NMFS establishes voluntary Dynamic Management Areas throughout the year in other areas where right whales have been observed, requesting mariners to route around these areas or transit through at 10 knots or less.

While vessel strikes are possible during all research vessel transits, we are aware of only two instances of any research vessel ever striking a whale in thousands of hours at sea, and both are thought to have been non-lethal (Wiley, Mayo et al. 2016). These vessel strike incidents are an important reminder that even with well-trained marine mammal observers and vessel operators, all vessels, even research vessels, have the potential to strike whales. Still, given the rarity of ships strikes of large whales during research activities, the extensive experience Dr. Robbins has in spotting cetaceans at sea, and the slow speeds (generally 18 kilometers per hour, about 10 knots) at which they would operate when near whales, we believe the likelihood of a vessel strike from research vessel transits is extremely unlikely. As such, we do not expect vessel strikes to occur, and in turn, we find effects from this stressor to be discountable. Therefore, we find that vessel transit associated with the proposed action may affect, but is not likely to adversely affect ESA-listed cetaceans (i.e., blue, bowhead, fin, sei, and sperm whales) and we will not discuss it further.

Discharge from research vessels in the form of leakages of fuel or oil is possible, though effects of any spills would have minimal, if any, effects on ESA-listed cetaceans. Given the experience of the researchers and boat operators in conducting research activities in the action areas, it is unlikely that spills or discharges would occur. If discharge does occur, the amounts of leakage would be small, disperse into the water, and not affect whales directly, or pose measurable hazards to their food sources. Therefore, we conclude that effects from this stressor are discountable, and may affect, but are not likely to adversely affect ESA-listed cetaceans (i.e., blue, bowhead, fin, sei, and sperm whales) and we will not discuss it further.

Close approaches by research vessels may cause visual or auditory disturbances to cetaceans and more generally disrupt their behavior, which may negatively influence essential functions such as breeding, feeding, and sheltering. Cetaceans react in a variety of ways to close vessel approaches. Responses range from little to no observable change in behavior to momentary changes in swimming speed and orientation, diving, surface and foraging behavior, and respiratory patterns, (Watkins, Moore et al. 1981, Hall 1982, Baker, Herman et al. 1983, Malme, Miles et al. 1983, Richardson, Greene et al. 1985, Au and Green. 2000, Baumgartner and Mate 2003, Jahoda, Lafortuna et al. 2003, Koehler 2006, Scheidat, Gilles et al. 2006, Isojunno and Miller 2015). Changes in cetacean behavior can correspond to vessel speed, size, and distance from the whale, as well as the number and frequency of vessels approaches (Baker, Perry et al. 1988, Beale and Monaghan 2004). Characteristics of the individual and/or the context of the approach, including age, sex, the presence of offspring, whether or not habituation to vessels has occurred, individual differences in reactions to stressors, and the behavioral state of the whales can also influence the responses to close vessel approaches (Baker, Perry et al. 1988, Wursig, Lynn et al. 1998, Gauthier and Sears 1999, Hooker, Baird et al. 2001, Lusseau 2004, Koehler 2006, Richter, Dawson et al. 2006, Weilgart 2007). Observations of large whales indicate that cow-calf pairs, smaller groups, and groups with calves appear to be more responsive to close vessel approaches (Hall 1982, Bauer 1986, Bauer and Herman 1986, Clapham and Mattila 1993, Williamson, Kavanagh et al. 2016). Cetaceans may become sensitized or habituated to vessels as the result of multiple approaches (Constantine 2001), which could increase or decrease stress levels associated with additional approaches and or research activities following an approach. Reactions to vessel noise by bowhead and gray whales have been observed when engines are started at distances of 3,000 feet (Malme, Miles et al. 1983, Richardson, Greene et al. 1985), suggesting that some level of disturbance may result even if the vessel does not closely approach. It should be noted that human observations of a whale’s behavioral response may not reflect a whale’s actual experience; thus our use of behavioral observations as indicators of a whale’s response to research may or may not be correct (Clapham and Mattila 1993).

Despite the varied observed responses to vessel approaches documented in the literature, and the multitude of factors that may affect an individual whale’s response, we expect effects from close vessel approaches that would be authorized under Permit No. 21485 to be minimal for several reasons. First, Dr. Robbins has years of experience approaching cetaceans in a way that is designed to minimize disturbance and associated responses. Second, the source levels of sounds that would be generated by research vessels are below that which could cause physical injury or temporary hearing threshold shifts, and they are unlikely to mask cetaceans ability to hear mates and other conspecifics for any significant amount of time (Hildebrand 2009, NOAA 2016). Finally, no long-term effects on behavior or fitness from disturbances caused by close vessel approaches for research have been documented, by Dr. Robbins and more generally in the literature. Thus, we expect the proposed close approaches may produce short- to mid-term behavioral and stress responses, but would not significantly disrupt the normal behavioral patterns of whales to an extent that they would create the likelihood of injury or impact fitness. As a result, we do not expect close approaches to have fitness consequences for individual whales. Therefore, we conclude that the effects on ESA-listed cetaceans (i.e., blue, bowhead, fin, sei, and sperm whales) that may result from this stressor (close approaches for research activities other than biopsies) are insignificant, and thus these approaches may affect but are not likely to adversely affect these species, and we will not discuss them further in this opinion.

10.1.2.2 Photography, Photogrammetry, and Videography

As noted above, photography and photogrammetry that occurs from the vessel would not present any additional stressors to whales outside of those associated with a close vessel approach.

Underwater videography will be accomplished by placing polecams within one body length of whales, a distance that may be closer than those associated with close vessel approaches. Therefore, we anticipate the very close approaches associated with underwater videography may elicit a greater proportion of the more extreme responses noted above, such as momentary changes in swimming speed and orientation, diving, surface and foraging behavior, and respiratory patterns. However, these polecams will only be operated by trained staff from onboard the research vessel.

10.1.2.3 Biological Sampling

Under Permit No. 21485, Dr. Robbins would be authorized to collect a variety of biological samples. The only stressors associated with fecal and sloughed skin sampling would be those associated with a potential close vessel approach as described above. Exhaled breath sampling may produce stressors associated with approaching animals closer (within 10 meters) than would typically be done for other activities except for biopsy sampling and underwater videography. In addition, breath sampling may result in direct physical contact with the animal via the sample collection pole. As a result, as with underwater videography, we anticipate the very close approaches and possible physical contact associated with vessel-based exhaled breath sampling may elicit a greater proportion of the more extreme responses noted above, such as momentary changes in swimming speed and orientation, diving, surface and foraging behavior, and respiratory patterns.

Biopsy sampling presents the stressors of a minor puncture wound and tissue collection, and also requires a very close approach. In general, it is difficult to distinguish between animals' reactions to these different stressors without explicit studies designed to isolate the response to individual stressors, which to our knowledge have not be conducted. As such, below we describe the range of responses, both physiological and behavioral, to the overall procedure of biopsy sampling, and where data are available, indicate possible responses to specific stressors.

Physiological responses of cetaceans to biopsy sampling may include the biopsy site wound and associated healing, a stress response, serious injury, or even death (reviewed in Noren and Mocklin 2012). Responses vary by species, biopsy tip dimensions, the draw weight of the sampling method, and the distance from which animals are sampled (Noren and Mocklin 2012). However, generally speaking wounds from biopsy sampling heal quickly, often within a month or less, and show no signs of infection (Noren and Mocklin 2012). In fact, for at least some large whale species (e.g., southern right whales [*Eubalaena australis*]) immediately after sampling takes place, biopsy sites are hardly noticeable (Reeb and Best 2006). This is perhaps not surprising given that cetaceans have high rates of cell proliferation that enable them to heal from large shark inflicted wounds within months (Corkeron, Morris et al. 1987, Lockyer and Morris 1990, Dwyer and Visser 2011).

Beyond the wound itself, biopsy sampling could cause a physiological stress response similar to that described above in the beginning of this section, even if the biopsy dart does not successfully penetrate the animal's tissue. Such a response may involve the release of stress hormones, short-term weight loss, susceptibility to gastrointestinal parasitism, the liberation of glucose into the blood stream, impairment of the immune and nervous systems, an elevated heart rate, body temperature, blood pressure, and alertness, muscle damage, and death. However, given the small size of wounds created by biopsy sampling and the short duration in which the sampling occurs, stress responses to remote biopsy sampling are likely minimal.

Finally, biopsy sampling could result in serious injury or death. However, in over 40 years of researchers collecting biopsy samples from cetaceans, we are aware of only one example of such an event: a common dolphin death following biopsy sampling in 2000 (Bearzi 2000). Several possibly explanations exist for why this particular animal died including a dart stopper malfunction, the location of the biopsy wound, the thinness of the animal's blubber, the handling of the animal, and possibly this animal having a predisposition to catatonia and death during stressful events (Bearzi 2000). It is important to note that due to this animal's unusually thin blubber layer, the biopsy tip penetrated the animal's muscle, which is not the intent of most researchers' biopsy sampling efforts.

While the above discussion indicates a range of physiological responses to biopsy sampling, only minor wounds and low-level stress responses are anticipated as the result of biopsy sampling that would be conducted under Permit No. 21485. This is because all biopsy dart tips that Dr. Robbins would use would 1) be thoroughly sterilized before sampling, thus minimizing any chances of infection, and 2) only penetrate the animal's blubber layer, not muscle, and thus result in no serious injury or death.

Cetaceans also exhibit a wide range of behavioral responses to biopsy sampling (reviewed in Noren and Mocklin 2012). Most researchers report either no behavioral response or minor behavioral responses including changes in dive behavior, heading, or speed, and startle responses and tail flicks (Noren and Mocklin 2012). On occasion, researchers report similar low-level responses from animals nearby those being biopsied and to darts entering the water, suggesting that some observed responses are a general startle response and not necessarily due to being contacted by the biopsy dart (Gorgone, Haase et al. 2008, Noren and Mocklin 2012). On rare occasions (zero to six percent of animals biopsied), researchers have reported more severe behavioral responses such as a flight response, breaching, multiple tail slaps, and/or numerous trumpet blows (Noren and Mocklin 2012). These more severe responses appear to coincide with instances where biopsy tips struck an unintended body part (e.g., dorsal fin) or when tips remain lodged in the animal (Weinrich, Lambertsen et al. 1991, Weinrich, Lambertson et al. 1992, Gauthier and Sears 1999, Berrow, Mchugh et al. 2002). This being said, when darts remain in animals it does not appear to result in mortality, infection, or lasting behavioral changes (Clapham and Mattila 1993, Barrett-Lennard, Smith et al. 1996, Parsons, Durban et al. 2003). For all of these responses, it is important to keep in mind that in many cases it is hard to distinguish the behavioral response to biopsy sampling from the response to the close vessel approach (Pitman 2003). Regardless, in most instances animals return to pre-biopsying/close approach behavior quickly, usually within 30 seconds to three minutes (Noren and Mocklin

2012). In fact, biopsied individuals do not appear to avoid vessels during subsequent biopsy attempts (within one week to five months), and in many cases show the same or a lesser response to the second biopsying event (Noren and Mocklin 2012, although see Best et al. 2005).

A variety of factors influence how cetaceans behaviorally respond to biopsy sampling including the species, age and sex, behavioral context, location, methods and or equipment used, type and size of the boat, size of the biopsy dart, season, water depth, and sea state (Noren and Mocklin 2012). For example, a higher proportion of odontocetes respond to biopsy sampling compared to mysticetes (Noren and Mocklin 2012). In some cases (Best, Reeb et al. 2005), but not others (Weinrich, Lambertsen et al. 1991), mothers and calves appear to be more sensitive to biopsy sampling than other age groups. Migrating humpback whales appear to be less responsive than those on the feeding grounds (Weinrich, Lambertsen et al. 1991, Clapham and Mattila 1993), but on the feeding grounds, foraging whales are less likely to respond than resting whales (Weinrich, Lambertson et al. 1992).

Given the above overview of possible behavioral responses of cetaceans to biopsy sampling, and the mitigation measures proposed by the Permits Division and the applicant (

Appendix and Section 3.5), we expect ESA-listed cetaceans to behaviorally respond to biopsy sampling by exhibiting short-term, minor to moderate changes in behavior, which we do not expect to impact any individual's fitness.

In summary, of the large number of cetaceans that have been biopsy sampled in recent decades (probably in the tens of thousands), there has been only one documented case of an immediate fitness consequence associated with biopsy sampling (Bearzi 2000). While studies on the delayed, long-term impacts of biopsy sampling are lacking, the available data suggests no effects to fitness (Best, Reeb et al. 2005, Noren and Mocklin 2012). As such, we expect biopsy sampling to result in minor wounds, low-level stress responses, and temporary behavior changes, but we do not expect any individuals to experience reductions in fitness.

10.2 Risk Analysis

In this section, we assess the consequences of the responses of the individuals that have been exposed to the stressors we have identified as adversely impacting ESA-listed cetaceans, the populations those individuals represent, and the species those populations comprise. Whereas the *Response Analysis* (Section 10.1.2) identified the potential responses of ESA-listed species to the proposed action, this section summarized our analysis of the expected risk to individuals, populations, and species given the expected exposure to the stressors (as described in Section 10.1.1) and the expected responses to those stressors (as described in Section 10.1.2).

We measure risk to individuals of endangered or threatened species based upon effects on the individual's "fitness," which may be indicated by changes to the individual's growth, survival, annual reproductive fitness, and lifetime reproductive success. When we do not expect ESA-listed animals exposed to an action's effects to experience reductions in fitness, we will not expect the action to have adverse consequences on the viability of the populations those individual represent or the species those populations comprise. As a result, if we conclude that ESA-listed animals are not likely to experience reductions in their fitness, we will conclude our assessment. If, however, we conclude that individual animals are likely to experience reductions in fitness, we will assess the consequences of those fitness reductions on the population(s) those individuals belong to.

As noted in the *Response Analysis*, none of the research activities and associated mitigation measures to minimize exposure and associated responses as proposed, are expected to reduce the fitness of any individual ESA-listed cetacean. As such, the issuance of Permit No. 21485 is not expected to present any risk to individuals, populations, DPSs, or species listed under the ESA.

11 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 C.F.R. §402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

This section attempts to identify the likely future environmental changes and their impact on ESA-listed and their critical habitat in the action areas. This section is not meant to be a comprehensive socio-economic evaluation, but a brief outlook on future changes in the environment. Projections are based upon recognized organizations producing best-available information and reasonable rough-trend estimates of change stemming from these data. However, all changes are based upon projections that are subject to error and alteration by complex economic and social interactions.

During this consultation, we searched for information on future state, tribal, local, or private (non-Federal) actions reasonably certain to occur in the action areas. We conducted electronic searches of Google and other electronic search engines for other potential future state or private activities that are likely to occur in the action area. We are not aware of any non-Federal actions that are likely to occur in the action areas during the foreseeable future that were not considered in the *Environmental Baseline* (Section 9) of this opinion. Anthropogenic effects include climate change, oceanic temperature regimes, whaling, vessel strikes, whale watching, sound producing activities, military activities, fisheries, aquaculture, aquatic nuisance species, pollution, and scientific research, although some of these activities would involve a federal nexus and thus be subject to future ESA section 7 consultation. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time. The best scientific and commercial data available provide little specific information on any long-term effects of these potential sources of disturbance on ESA-listed cetacean populations. Therefore, NMFS expects that the levels of interactions between human activities and marine mammals described in the environmental baseline will continue at similar levels into the foreseeable future. Movements towards the reduction of vessel strikes and fisheries interactions or greater protections of ESA-listed cetaceans from these anthropogenic effects may aid in abating the downward trajectory of some populations and lead to recovery of other populations.

12 Integration and Synthesis

The *Integration and Synthesis* section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the *Effects of the Action* (Section 10) to the *Environmental Baseline* (Section 9) and the *Cumulative Effects* (Section 11) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a ESA-listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the *Status of the Species and Critical Habitat Likely to be Adversely Affected* (Section 8). For this consultation, we determined that the effects were not likely to adversely affect designated critical habitat; therefore only the risk to ESA-listed cetaceans (i.e., blue, bowhead, fin, sei, and sperm whales) are analyzed in this section. On an annual basis for the duration of the permit, individual ESA-listed cetaceans of these species within the action area would be exposed to vessel activities (close approaches), documentation (photo-identification, underwater videography), and non-invasive (sloughed skin, fecal, and breath mucosa) and invasive (biopsy) biological sampling.

The following discussions separately summarize the probable risks the proposed action poses to endangered species that are likely to be exposed to the stressors associated with the research activities under Permit No. 21485. These summaries integrate the exposure profiles presented previously with the results of our response analyses for each of the actions considered in this opinion.

12.1 Blue Whale

No reduction in the distribution of blue whales from the Atlantic Ocean is expected because of the research activities proposed for authorization under Permit No. 21485.

The blue whale is endangered as a result of past commercial whaling. In the North Atlantic Ocean, at least 11,000 blue whales were taken from the late 19th to mid-20th centuries. In the North Pacific Ocean, at least 9,500 whales were killed between 1910 and 1965. Commercial whaling no longer occurs, but blue whales are affected by anthropogenic noise, threatened by ship strikes, entanglement in fishing gear, pollution, harassment due to whale watching, and reduced prey abundance and habitat degradation due to climate change. There are three stocks of blue whales designated in United States waters: the Eastern North Pacific Ocean (approximately 1,647 individuals [minimum number of individuals N_{min}=1,551]), the Central North Pacific Ocean (approximately 133 individuals [N_{min}=63]), and Western North Atlantic Ocean (N_{min}=440). Current estimates indicate a growth rate of just under three percent per year for the Eastern North Pacific stock. An overall population growth rate for the species or growth rates for the two other individual United States stocks are not available at this time. Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats; however, the species has not recovered to pre-exploitation levels.

The Final Recovery Plan for the blue whale lists recovery objectives for the species. The following recovery objectives are relevant to the impacts of the proposed actions:

- Determine stock structure of blue whale populations occurring in United States waters and elsewhere.
- Estimate the size and monitor trends in abundance of blue whale populations.
- Identify and protected habitat essential to the survival and recovery of blue whale populations.
- Reduce or eliminate human-caused injury and mortality of blue whales.
- Minimize detrimental effects of directed vessel interactions with blue whales.

- Maximize efforts to acquire scientific information from dead stranded, and entangled blue whales.
- Coordinate state, federal, and international efforts to implement recovery actions for blue whales.

We do not expect any mortalities of blue whales from the proposed action. Although the effects analysis was done by separating the activities into distinct stressors, many of which alone are not likely to adversely affect individual blue whales, the stressors often occur together (e.g., a whale cannot be biopsied without being approached by a vessel). Considering the totality of the research activities, individual whales may experience stress, minor injury from the taking of a biopsy, or alter its behavior in some way. Under Permit No. 21485, 40 blue whales (not necessarily individuals) would be subject to research each year. Effects to individual blue whales are expected to be short term (generally hours or days). Any injury from biopsy is expected to heal within weeks. None of the research activities are expected to result in any fitness consequence for individual blue whales. As such, we do not anticipate the proposed research activities will impede the recovery objectives for blue whales. In conclusion, we believe the effects associated with the proposed actions are not expected to cause a reduction in the likelihood of survival and recovery of blue whales in the wild.

12.2 Bowhead Whale

No reduction in the distribution of bowhead whales from the Atlantic Ocean is expected because of the research activities proposed for authorization under Permit No. 21485.

The bowhead whale is endangered as a result of past commercial whaling. Prior to commercial whaling, thousands of bowhead whales existed. Global abundance declined to 3,000 by the 1920s. Bowhead whales may be killed under "aboriginal subsistence whaling" provisions of the International Whaling Commission. Additional threats include ship strikes, fisheries interactions (including entanglement), contaminants, and noise. The species' large population size and increasing trends indicate that it is resilient to current threats.

There are currently four or five recognized stocks of bowheads, the Western Arctic (or Bering-Chukchi-Beaufort) stock, the Okhotsk Sea stock, the Davis Strait and Hudson Bay stock (sometimes considered separate stocks), and the Spitsbergen stock (Rugh and Shelden 2009). The only stock thought to be found within U.S. waters is the Western Arctic stock. The 2011 ice-based abundance estimate puts this stock, the largest remnant stock, at over 16,892 (N_{min}= 16,091) individuals. Prior to commercial whaling, there may have been 10,000 to 23,000 whales in this stock (Rugh and Shelden 2009). Historically the Davis Strait-Hudson Bay stock may have contained over 11,000 individuals, but now it is thought to number around 7,000 bowheads (Cosens et al. 2006). In the Okhotsk Sea, there were originally more than 3,000 bowheads, but now there are only about 300 to 400. The Spitsbergen stock originally had about 24,000 bowheads and supported a huge European fishery, but today is thought to only contain tens of whales (Shelden and Rugh 1995).

Current estimates indicate approximately 16,892 bowhead whales in the Western Arctic stock, with an annual growth rate of 3.7 percent (Givens et al. 2013). While no quantitative estimates exist, the Davis Strait and Hudson Bay stock is also thought to be increasing (COSEWIC 2009). We could find no information on population trends for the Okhotsk Sea stock. Likewise, no information is available on the population trend for the Spitsbergen stock, but it is thought to be nearly extinct.

There is currently no recovery plan for the bowhead whale.

We do not expect any mortalities of bowhead whales from the proposed action. Although the effects analysis was done by separating the activities into distinct stressors, many of which alone are not likely to adversely affect individual bowhead whales, the stressors often occur together (e.g., a whale cannot be biopsied without being approached by a vessel). Considering the totality of the research activities, individual whales may experience stress, minor injury from the taking of a biopsy, or alter its behavior in some way. Under Permit No. 21485, 10 bowhead whales (not necessarily individuals) would be subject to research each year. Effects to individual bowhead whales are expected to be short term (generally hours or days). Any injury from biopsy is expected to heal within weeks. None of the research activities are expected to result in any fitness consequence for individual bowhead whales. As such, we do not anticipate the proposed research activities will impede the recovery objectives for bowhead whales. In conclusion, we believe the effects associated with the proposed actions are not expected to cause a reduction in the likelihood of survival and recovery of bowhead whales in the wild.

12.3 Fin Whale

No reduction in the distribution of fin whales from the Atlantic Ocean is expected because of the research activities authorized under Permit No. 21485.

Of the three to seven stocks in the North Atlantic Ocean (approximately 50,000 individuals), one occurs in U.S. waters, where the best estimate of abundance is 1,618 individuals (minimum number of individuals [N_{min}]=1,234); however, this may be an underrepresentation as the entire range of stock was not surveyed (Palka 2012). There are three stocks in U.S. Pacific Ocean waters: Northeast Pacific [minimum 1,368 individuals], Hawaii (approximately 58 individuals [N_{min}=27]) and California/Oregon/Washington (approximately 9,029 [N_{min}=8,127] individuals) (Nadeem, Moore et al. 2016). The International Whaling Commission also recognizes the China Sea stock of fin whales, found in the Northwest Pacific Ocean, which currently lacks an abundance estimate (Reilly, Bannister et al. 2013). Abundance data for the Southern Hemisphere stock are limited; however, there were assumed to be somewhat more than 15,000 in 1983 (Thomas, Reeves et al. 2016).

Current estimates indicate approximately 10,000 fin whales in U.S. Pacific Ocean waters, with an annual growth rate of 4.8 percent in the Northeast Pacific stock and a stable population abundance in the California/Oregon/Washington stock (Nadeem, Moore et al. 2016). Overall population growth rates and total abundance estimates for the Hawaii stock, China Sea stock, western North Atlantic stock, and Southern Hemisphere fin whales are not available at this time.

The 2010 Final Recovery Plan for the fin whale lists recovery objectives for the species. The following recovery objectives are relevant to the impacts of the proposed actions:

- Achieve sufficient and viable population in all ocean basins.
- Ensure significant threats are addressed.

We do not expect any mortalities of fin whales from the proposed action. Although the effects analysis was done by separating the activities into distinct stressors, many of which alone are not likely to adversely affect individual fin whales, the stressors often occur together (e.g., a whale cannot be biopsied without being approached by a vessel). Considering the totality of the research activities, individual whales may experience stress, minor injury from the taking of a biopsy, or alter its behavior in some way. Under Permit No. 21485, 370 fin whales (not necessarily individuals) would be subject to research each year. Effects to individual fin whales are expected to be short term (generally hours or days). Any injury from biopsy is expected to heal within weeks. None of the research activities are expected to result in any fitness consequence for individual fin whales. As such, we do not anticipate the proposed research activities will impede the recovery objectives for fin whales. In conclusion, we believe the effects associated with the proposed actions are not expected to cause a reduction in the likelihood of survival and recovery of fin whales in the wild.

12.4 Sei Whale

No reduction in the distribution of sei whales from the Atlantic Ocean is expected because of the research activities authorized under Permit No. 21485.

The sei whale is endangered as a result of past commercial whaling. Now, only a few individuals are taken each year by Japan; however, Iceland has expressed an interest in targeting sei whales. Current threats include ship strikes, fisheries interactions (including entanglement), climate change (habitat loss and reduced prey availability), and noise. The species' large population size may provide some resilience to current threats, but trends are largely unknown. There are currently no estimates of pre-exploitation abundance or population growth rates in the North Atlantic.

The Final Recovery Plan for the sei whale lists recovery objectives for the species. The following recovery objectives are relevant to the impacts of the proposed actions:

- Achieve sufficient and viable populations in all ocean basins.
- Ensure significant threats are addressed.

We do not expect any mortalities of sei whales from the proposed action. Although the effects analysis was done by separating the activities into distinct stressors, many of which alone are not likely to adversely affect individual sei whales, the stressors often occur together (e.g., a whale cannot be biopsied without being approached by a vessel). Considering the totality of the research activities, individual whales may experience stress, minor injury from the taking of a biopsy, or alter its behavior in some way. Under Permit No. 21485, 60 sei whales (not necessarily individuals) would be subject to research each year. Effects to individual sei whales are expected to be short term (generally hours or days). Any injury from biopsy is expected to heal within weeks. None of the research activities are expected to result in any fitness consequence for individual sei whales. As such, we do not anticipate the proposed research activities will impede the recovery objectives for sei whales. In conclusion, we believe the effects associated with the proposed actions are not expected to cause a reduction in the likelihood of survival and recovery of sei whales in the wild.

12.5 Sperm Whale

No reduction in the distribution of sperm whales from the Atlantic Ocean is expected because of the research activities authorized under Permit No. 21485.

The sperm whale is endangered as a result of past commercial whaling. Although the aggregate abundance worldwide is probably at least several hundred thousand individuals, the extent of depletion and degree of recovery of populations are uncertain. Commercial whaling is no longer allowed, however, illegal hunting may occur at biologically unsustainable levels. Continued threats to sperm whale populations include ship strikes, entanglement in fishing gear, competition for resources due to overfishing, pollution, loss of prey and habitat due to climate change, and noise. The species' large population size shows that it is somewhat resilient to current threats.

The Final Recovery Plan for the sperm whale lists recovery objectives for the species. The following recovery objectives are relevant to the impacts of the proposed actions:

- Achieve sufficient and viable populations in all ocean basins.
- Ensure significant threats are addressed.

We do not expect any mortalities of sperm whales from the proposed action. Although the effects analysis was done by separating the activities into distinct stressors, many of which alone are not likely to adversely affect individual sperm whales, the stressors often occur together (e.g., a whale cannot be biopsied without being approached by a vessel). Considering the totality of the research activities, individual whales may experience stress, minor injury from the taking of a biopsy, or alter its behavior in some way. Under Permit No. 21485, 10 sperm whales (not necessarily individuals) would be subject to research each year. Effects to individual sperm whales are expected to be short term (generally hours or days). Any injury from biopsy is expected to heal within weeks. None of the research activities are expected to result in any fitness consequence for individual sperm whales. As such, we do not anticipate the proposed research activities will impede the recovery objectives for sperm whales. In conclusion, we believe the effects associated with the proposed actions are not expected to cause a reduction in the likelihood of survival and recovery of sperm whales in the wild.

13 Conclusion

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence or recovery of blue whales, bowhead whales, fin whales, sei whales, and sperm whales. We find that the proposed action is not likely to adversely affect North Atlantic right whales, green turtles (North Atlantic DPS), hawksbill turtles, Kemp's ridley turtles, leatherback turtles, loggerhead turtles (Northwest Atlantic Ocean DPS), and olive ridley turtles (All Other Areas); thus, it is also not likely to jeopardize the continued existence or recovery of these species.

We find that the proposed action is not likely to adversely affect designated critical habitat for for North Atlantic right whales, green turtles (North Atlantic DPS), hawksbill turtles, leatherback turtles, and loggerhead turtles (Northwest Atlantic Ocean DPS); thus, no destruction or adverse modification of the designated critical habitat for these species is anticipated. No critical habitat has been designated for blue whales, bowhead whales, fin whales, sei whales, sperm whales, Kemp's ridley turtles, or olive ridley turtles (All Other Areas); therefore, no critical habitat will be affected for these species.

14 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a 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 (16 U.S.C. §1532(19)). "Harm" is further defined by regulation to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 C.F.R. §222.102). "Harass" is further defined as an act that "creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering" (NMFSPD 02-110-19). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

All research activities associated with the issuance of Permit No. 21485 involve directed take for the purposes of scientific research. Therefore, NMFS does not expect the proposed action will incidentally take threatened or endangered species. However, we request that the Permits and

Conservation Division report to us whether the MMPA-authorized take specified in Table 1 and Table 2 actually occurs and the actual numbers of take in comparison to the permitted MMPA take numbers at the expiration of the permit, as well as any available information on the response animals exhibited to those takes. Such information will be used to inform the *Environmental Baseline* and *Effects of the Action* for future consultations for the Center for Coastal Studies, and other similar research activities permitted by the Permits and Conservation Division.

15 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 the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

1. **Aggregate Take Tracking**

   We recommend that the Permits and Conservation Division develop a system for tracking and evaluating the extent of take issued and that which is realized for any given population of ESA-listed species. The Permits and Conservation Division's current permit tracking allows tracking of individual permit takes but for the purpose of understanding the extent of research at broad scales (e.g., number of research permits in a particular region), it remains difficult to quantify the extent of take each individual population of ESA-listed species may be subject to across permits for any given period of time. Such aggregate take tracking would be better enable us to evaluate the impacts of multiple, simultaneous research efforts on ESA-listed species.

2. **Reporting**

   We recommend the Permits and Conservation Division tailor the required reporting for research permits to include information that would aid managers in protecting and conserving ESA-listed species. In requiring researchers to provide annual reports, the Permits and Conservation Division is positioned to collect unprecedented, nationwide data on ESA-listed species. We recommend that the Permits and Conservation Division continue to request information on the effects of research activities on ESA-listed cetaceans, and where possible, require applicants to provide quantitative data regarding the impacts of their research on species. We also recommend that the Permits and Conservation Division require at least basic behavioral response reports from all relatively new procedures that would be permitted. For the purposes of this consultation, this would include exhaled breath sampling because little information is available about how cetaceans respond to this procedure and the use of unmanned aircraft systems.

3. **Data Sharing**

We recommend the Permits and Conservation Division work to establish protocols for data sharing among all permit holders. While many researchers in the community collaborate, having a national standard for data sharing among all researchers permitted by the NMFS will reduce impacts to trusted resources by minimizing duplicative research efforts. We recommend basic reporting information be required from each researcher including the species, location, number of individuals, and age, sex, and identity (if known) at the expiration of each permit. This information would further inform the tracking of impacts of multiple research activities on ESA-listed cetaceans.

4. Coordination Meetings

The Permits Division should continue to work with the NMFS' Regional Offices to conduct meetings among regional species coordinators, permit holders conducting research within a region, and future applicants to ensure that the results of all research programs or other studies on specific threatened or endangered species are coordinated among the different investigators. Such meetings may be a venue to discuss the details outlined in our second conservation recommendation.

In order for the ESA Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their proposed or designated critical habitat, the Permits and Conservation Division should notify the ESA Interagency Cooperation Division of any conservation recommendations they implement in their final action.

16 Reinitiation Notice

This concludes formal consultation for the Permits and Conservation Division's proposed action to issue Permit No. 21485. As 50 C.F.R. §402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

(1) The amount or extent of taking specified in the incidental take statement is exceeded.
(2) New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered.
(3) The identified action is subsequently modified in a manner that causes an effect to ESA-listed species or designated critical habitat that was not considered in this opinion.
(4) A new species is listed or critical habitat designated under the ESA that may be affected by the action.

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18 APPENDIX – PERMIT TERMS AND CONDITIONS

Section 10(a)(1) of the ESA requires the prescription of terms and conditions as part of the scientific research permit. The Permits Division proposes to include the following terms and conditions in Permit No. 21485. The text below was taken directly from the proposed permit provided to us in the consultation initiation package from the Permits and Conservation Division. The final permit may have minor changes that will not affect this opinion.

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

A. Duration of Permit

1. Personnel listed in Condition C.1 of this permit (hereinafter "Researchers") may conduct activities authorized by this permit through October 1, 2023. This permit may be extended by the Director, National Marine Fisheries Service (NMFS) Office of Protected Resources or the Chief, Permits and Conservation Division (hereinafter Permits Division), pursuant to applicable regulations and the requirements of the MMPA and ESA.

2. Researchers must immediately stop permitted activities and the Permit Holder or Principal Investigator must contact the Chief, NMFS Permits and Conservation Division (hereinafter "Permits Division") for written permission to resume:

   a. If serious injury or mortality[1] of protected species occurs.

   b. If authorized take[2] is exceeded in any of the following ways:

[1] This permit does not allow for unintentional serious injury and mortality caused by the presence or actions of researchers. This includes, but is not limited to: deaths of dependent young by starvation following research-related death of a lactating female; deaths resulting from infections related to sampling procedures; and deaths or injuries sustained while attempting to avoid researchers. Note that for marine mammals, a serious injury is defined by regulation as any injury that will likely result in mortality.

[2] By regulation, a take under the MMPA means to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. This includes, without limitation, any of the following: The collection of dead animals, or parts thereof; the restraint or detention of a marine mammal, no matter how temporary; tagging a marine mammal; the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal; and feeding or attempting to feed a marine mammal in the wild. Under the ESA, a take means to harass, harm, pursue, hunt, shoot, wound, kill, trap,

i. More animals are taken than allowed in Tables 1-3 of Appendix 1.
ii. Animals are taken in a manner not authorized by this permit.
iii. Protected species other than those authorized by this permit are taken.

c. Following incident reporting requirements at Condition E.2.

3. The Permit Holder may continue to possess biological samples[3] acquired[4] under this permit after permit expiration without additional written authorization provided a copy of this permit is kept with the samples and they are maintained as specified in this permit.

B. Number and Kinds of Protected Species, Locations and Manner of Taking

1. The tables in Appendix 1 outline the authorized species and stock or distinct population segment (DPS) authorized; number of animals to be taken and the manner of take, locations, and time period.

2. Researchers working under this permit may collect images (e.g., photographs, video) and audio recordings in addition to the photo-identification or behavioral photo-documentation authorized in Appendix 1 as needed to document the permitted activities, provided the collection of such images or recordings does not result in takes.

3. The Permit Holder may use visual images and audio recordings collected under this permit, including those authorized in Tables 1-3 of Appendix 1, in printed materials (including commercial or scientific publications) and presentations provided the images and recordings are accompanied by a statement indicating that the activity was conducted pursuant to NMFS ESA/MMPA Permit No. 21485. This statement must accompany the images and recordings in all subsequent uses or sales.

capture, or collect, or attempt to do any of the preceding.

[3] Biological samples include, but are not limited to: carcasses (whole or parts); and any tissues, fluids, or other specimens from live or dead protected species; except feces, urine, and spew collected from the water or ground.

[4] Authorized methods of sample acquisition are specified in Appendix 1.

4. The Chief, Permits Division may grant written approval for personnel performing activities not essential to achieving the research objectives (e.g., a documentary film crew) to be present, provided:

   a. The Permit Holder submits a request to the Permits Division specifying the purpose and nature of the activity, location, approximate dates, and number and roles of individuals for which permission is sought.

   b. Non-essential personnel/activities will not influence the conduct of permitted activities or result in takes of protected species.

   c. Persons authorized to accompany the Researchers for the purpose of such non-essential activities will not be allowed to participate in the permitted activities.

   d. The Permit Holder and Researchers do not require compensation from the individuals in return for allowing them to accompany Researchers.

5. Researchers must comply with the following conditions related to the manner of taking:

<u>Counting and Reporting Takes</u>

a. Count and report a take of a cetacean regardless of whether you observe a behavioral response to the permitted activity.

b. For all approaches[5] in water and attempts to remotely biopsy, count and report 1 take per cetacean per day.

   i. If all of your Level A biopsy attempts on a single day are unsuccessful but <u>do not make contact</u> with the animal, count the take against your Level B harassment take row.

[5] An "approach" is defined as a continuous sequence of maneuvers involving a vessel, including drifting, directed toward a cetacean or group of cetaceans closer than 100 yards for baleen and sperm whales and 50 yards for all other cetaceans.

ii. If any of your Level A attempts on a single day are unsuccessful but make contact with the animal, count the take for the day against your sampling take row.

General

c. Researchers must approach animals cautiously and retreat if behaviors indicate the approach may interfere with reproduction, feeding, or other vital functions.

d. Where females with calves are authorized to be taken, Researchers:

i. Must immediately terminate efforts if there is any evidence that the activity may be interfering with pair-bonding or other vital functions;

ii. Must not position the research vessel between the mother and calf;

iii. Must approach mothers and calves gradually to minimize or avoid any startle response;

iv. Must discontinue an approach if a calf is actively nursing; and

v. Must, if possible, sample the calf first to minimize the mother's reaction when sampling mother/calf pairs.

e. For underwater filming/photography: Research Assistants may conduct underwater activities only if they are trained photographers, videographers, or safety divers.

Remote Biopsy, Breath Collection

f. Researchers may attempt (discharge/fire) each procedure (biopsy, breath sample,) on an animal 3 times a day.

g. A biopsy or breath sampling attempt must be discontinued if an animal exhibits repetitive, strong, adverse reactions to the activity or vessel.

h. Researchers must use sterile[6] biopsy tips following protocol provided in Appendix 3.

i. If the biopsy tip becomes contaminated and is no longer sterile (e.g., missed attempt, contacts seawater, physical contact) prior to use, a new sterile biopsy tip should be used.

ii. If a new, sterile biopsy tip is not available, Researches must clean and disinfect[7] the contaminated tip following the provided protocol for high-level disinfection in Appendix 3.

i. Off Puerto Rico, Researchers may biopsy sample up to 10 non-neonate humpback whale calves per year. Elsewhere, calves greater than approximately 3 months old may be biopsy sampled

j. Before attempting to biopsy/tag/sample an individual, Researchers must take reasonable measures (e.g., compare photo-identifications) to avoid unintentional repeated sampling of any individual.

k. Researchers must not attempt to biopsy or tag a cetacean anywhere forward of the pectoral fin.

6. The Permit Holder must comply with the following conditions and the regulations at 50 CFR 216.37, for biological samples acquired or possessed under authority of this permit.

a. The Permit Holder is ultimately responsible for compliance with this permit and applicable regulations related to the samples unless the samples are permanently transferred according to NMFS regulations governing the taking and importing of marine mammals (50 CFR 216.37) and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR 222.308).

[6] Sterilization = destroys or eliminates all forms of microbial life and is carried out by physical or chemical methods (CDC 2008). These methods should follow the IACUC-approved protocol for sterilization (e.g., gas).

[7] Disinfection = eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects usually by liquid chemicals (CDC 2008).

b. Samples must be maintained according to accepted curatorial standards and must be labeled with a unique identifier (e.g., alphanumeric code) that is connected to on-site records with information identifying the following:

   i. Species and, where known, age and sex;
   ii. Date of collection, acquisition, or import;
   iii. Type of sample (e.g., blood, skin, bone);
   iv. Origin (i.e., where collected or imported from); and
   v. Legal authorization for original sample collection or import.

c. Biological samples belong to the Permit Holder and may be temporarily transferred to Authorized Recipients identified in Appendix 2 without additional written authorization, for analysis or curation related to the objectives of this permit. The Permit Holder remains responsible for the samples, including any reporting requirements.

d. The Permit Holder may request approval of additional Authorized Recipients for analysis and curation of samples related to the permit objectives by submitting a written request to the Permits Division specifying the following:

   i. Name and affiliation of the recipient;
   ii. Address of the recipient;
   iii. Types of samples to be sent (species, tissue type); and
   iv. Type of analysis or whether samples will be curated.

e. Sample recipients must have authorization pursuant to 50 CFR 216.37 prior to permanent transfer of samples and transfers for purposes not related to the objectives of this permit.

f. Samples cannot be bought or sold, including parts transferred pursuant to 50 CFR 216.37.

g. After meeting the permitted objectives, the Permit Holder may continue to possess and use samples acquired under this permit, without additional written authorization, provided the samples are maintained as specified in the permit and findings are discussed in the annual reports (See Condition E. 3).

C. <u>Qualifications, Responsibilities, and Designation of Personnel</u>

1. At the discretion of the Permit Holder, the following Researchers may participate in the conduct of the permitted activities in accordance with their qualifications and the limitations specified herein:

   a. Principal Investigator – Jooke Robbins, Ph.D.

   b. Co-Investigators – See Appendix 2 for list of names and corresponding activities.

   c. Research Assistants – personnel identified by the Permit Holder or Principal Investigator and qualified to act pursuant to Conditions C.2, C.3, and C.4 of this permit.

2. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities. The roles and responsibilities of personnel operating under this permit are as follows:

   a. The Permit Holder is ultimately responsible for activities of individuals operating under the authority of this permit. Where the Permit Holder is an institution/facility, the Responsible Party is the person at the institution/facility who is responsible for the supervision of the Principal Investigator.

   b. The Principal Investigator (PI) is the individual primarily responsible for the taking, import, export and related activities conducted under the permit. This includes coordination of field activities of all personnel working under the permit. The PI must be on site during activities conducted under this permit unless a Co-Investigator named in Condition C.1 is present to act in place of the PI.

   c. Co-Investigators (CIs) are individuals who are qualified to conduct activities authorized by the permit, for the objectives described in the application, without the on-site supervision of the PI. CIs assume the role and responsibility of the PI in the PI's absence.

d. Research Assistants (RAs) are individuals who work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI.

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

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

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

   c. Individuals included for training purposes.

4. Persons who require state or Federal licenses or authorizations (e.g., pilots) to conduct activities under the permit must be duly licensed/authorized and follow all applicable requirements when undertaking such activities.

5. Permitted activities may be conducted aboard vessels or aircraft, or in cooperation with individuals or organizations, engaged in commercial activities, provided the commercial activities are not conducted simultaneously with the permitted activities.

6. The Permit Holder cannot require or receive direct or indirect compensation from a person approved to act as PI, CI, or RA under this permit in return for requesting such approval from the Permits Division.

7. The Permit Holder may add CIs by submitting a request to the Chief, Permits Division that includes a description of the individual's qualifications to conduct and oversee the activities authorized under this permit. If a CI will only be responsible for a subset of permitted activities, the request must also specify the activities for which they would provide oversight.

8. Where the Permit Holder is an institution/facility, the Responsible Party may request a change of PI by submitting a request to the Chief, Permits Division that includes a description of the individual's qualifications to conduct and oversee the activities authorized under this permit.

9. Submit requests to add CIs or change the PI by one of the following:

   a. The online system at https://apps.nmfs.noaa.gov;

   b. An email attachment to the permit analyst for this permit; or

   c. A hard copy mailed or faxed to the Chief, Permits Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910; phone (301)427-8401; fax (301)713-0376.

D. Possession of Permit

1. This permit cannot be transferred or assigned to any other person.

2. The Permit Holder and persons operating under the authority of this permit must possess a copy of this permit when engaged in a permitted activity.

3. A duplicate copy of this permit must accompany or be attached to the container, package, enclosure, or other means of containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

E. Reporting

1. The Permit Holder must submit incident, annual, and final reports containing the information and in the format specified by the Permits Division.

   a. Reports must be submitted to the Permits Division by one of the following:

      i. The online system at https://apps.nmfs.noaa.gov;
      ii. An email attachment to the permit analyst for this permit; or
      iii. A hard copy mailed or faxed to the Chief, Permits Division.

b. You must contact your permit analyst for a reporting form if you do not submit reports through the online system.

2. Incident Reporting

a. If a serious injury or mortality occurs or authorized takes have been exceeded as specified in Condition A.2, the Permit Holder must:
    i. Contact the Permits Division by phone (301-427-8401) as soon as possible, but no later than 2 business days of the incident;
    ii. Submit a written report within 2 weeks of the incident as specified below; and
    iii. Receive approval from the Permits Division before resuming work. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.

b. The incident report must include 1) a complete description of the events, and 2) identification of steps that will be taken to reduce the potential for additional serious injury and research-related mortality or exceeding authorized take.

3. Annual reports describing activities conducted during the previous permit year must:

a. Be submitted by a specified date each year for which the permit is valid, and

b. Include a tabular accounting of takes and a narrative description of activities and their effects.

4. A joint annual/final report including a discussion of whether the objectives were achieved must be submitted by a specified date, or, if the research concludes prior to permit expiration, within 90 days of completion of the research.

5. Research results must be published or otherwise made available to the scientific community in a reasonable period of time. Copies of technical reports, conference abstracts, papers, or publications resulting from permitted research must be submitted the Permits Division upon request.

F. <u>Notification and Coordination</u>

1. NMFS Regional Offices are responsible for ensuring coordination of the timing and location of all research activities in their areas to minimize unnecessary duplication, harassment, or other adverse impacts from multiple researchers.

2. The Permit Holder must ensure written notification of planned field work for each project is provided to the NMFS Regional Offices listed below at least two weeks prior to initiation of each field trip/season.

   a. Notification must include the following:

      i. Locations of the intended field study and/or survey routes;

      ii. Estimated dates of activities; and

      iii. Number and roles of participants (for example: PI, CI, boat driver, Research Assistant "in training").

   b. Notification must be sent to the following Assistant Regional Administrators for Protected Resources as applicable to the location of your activity:

      For activities in NC, SC, GA, FL, AL, MS, LA, TX, PR, and USVI:

      Southeast Region, NMFS, 263 13th Ave South, St. Petersburg, FL 33701; phone (727)824-5312; fax (727)824-5309

      Email (*preferred*): nmfs.ser.research.notification@noaa.gov; and

      For activities in ME, VT, NH, MA, NY, CT, NJ, DE, RI, MD, and VA: Greater Atlantic Region, NMFS, 55 Great Republic Drive, Gloucester, MA 01930; phone (978)281-9328; fax (978)281-9394

      Email (*preferred*): NMFS.GAR.permit.notification@noaa.gov

3. Researchers must coordinate their activities with other permitted researchers to avoid unnecessary disturbance of animals or duplication of efforts. Contact the applicable Regional Offices listed above for information about coordinating with other Permit Holders.

G. Observers and Inspections

1. NMFS may review activities conducted under this permit. At the request of NMFS, the Permit Holder must cooperate with any such review by:

   a. Allowing an employee of NOAA or other person designated by the Director, NMFS Office of Protected Resources to observe and document permitted activities; and

   b. Providing all documents or other information relating to the permitted activities.

H. Modification, Suspension, and Revocation

1. Permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR Part 904.

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

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

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

   c. In response to a written request[8] from the Permit Holder;

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

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

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

3. Issuance of this permit does not guarantee or imply that NMFS will issue or approve subsequent permits or amendments for the same or similar activities requested by the Permit Holder, including those of a continuing nature.

I. Penalties and Permit Sanctions

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

2. The NMFS Office of Protected Resources shall be the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in this permit.

a. The Permit Holder must contact the Permits Division for verification before conducting the activity if they are unsure whether an activity is within the scope of the permit.

b. Failure to verify, where the NMFS Office of Protected Resources subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the MMPA, the ESA, and applicable regulations in any enforcement actions.

Appendix 1: Tables Specifying the Kind(s) of Protected Species, Location(s), and Manner of Taking

Table 1. Authorized annual takes in the Gulf of Maine (MA, NH, ME, RI and NY) during vessel surveys.							
Line	Species	Stock/ Listing Unit	Life stage	Number of Takes*	Takes Per Animal	Procedures	Details
1	Dolphin, Atlantic white-sided	Western North Atlantic Stock	All	500	1	Incidental harassment	
2	Dolphin, bottlenose	Range-wide	All	50	1	Incidental harassment	
3	Dolphin, common, short-beaked	Western North Atlantic Stock	All	70	1	Incidental harassment	
4	Dolphin, Risso's	Western North Atlantic Stock	All	50	1	Incidental harassment	
5	Dolphin, white-beaked	Western North Atlantic Stock	All	50	1	Incidental harassment	
6	Porpoise, harbor	Gulf of Maine/Bay of Fundy Stock	All	20	1	Incidental harassment	

Table 1. Authorized annual takes in the Gulf of Maine (MA, NH, ME, RI and NY) during vessel surveys.							
Line	Species	Stock/ Listing Unit	Life stage	Number of Takes*	Takes Per Animal	Procedures	Details
7	Seal, gray	Western North Atlantic Stock	All	50	1	Incidental disturbance	
8	Seal, harbor	Western North Atlantic Stock	All	20	1	Incidental disturbance	
9	Whale, blue	Western North Atlantic Stock (NMFS Endangered)	Adult/ Juvenile	30	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy	
10	Whale, blue	Western North Atlantic Stock (NMFS Endangered)	Calf	10	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy	calves > 3 months old

Table 1. Authorized annual takes in the Gulf of Maine (MA, NH, ME, RI and NY) during vessel surveys.

Line	Species	Stock/ Listing Unit	Life stage	Number of Takes*	Takes Per Animal	Procedures	Details
11	Whale, bowhead	Range-wide (NMFS Endangered)	Adult/ Juvenile	5	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	
12	Whale, fin	Western North Atlantic Stock (NMFS Endangered)	All	200	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Underwater photo/videography	
13	Whale, fin	Western North Atlantic Stock (NMFS Endangered)	Calf	15	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	calves > 3 months old

Table 1. Authorized annual takes in the Gulf of Maine (MA, NH, ME, RI and NY) during vessel surveys.							
Line	Species	Stock/ Listing Unit	Life stage	Number of Takes*	Takes Per Animal	Procedures	Details
14	Whale, fin	Western North Atlantic Stock (NMFS Endangered)	Adult/ Juvenile	30	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	
15	Whale, humpback	West Indies DPS	All	900	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Underwater photo/videography	
16	Whale, humpback	West Indies DPS	Adult/ Juvenile	60	3	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	Endocrinology studies. Biopsy samples from individuals of known traits, no more than 3 times per year

Table 1. Authorized annual takes in the Gulf of Maine (MA, NH, ME, RI and NY) during vessel surveys.							
Line	Species	Stock/ Listing Unit	Life stage	Number of Takes*	Takes Per Animal	Procedures	Details
17	Whale, humpback	West Indies DPS	Calf	50	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	calves > 3 months old
18	Whale, humpback	West Indies DPS	Adult/ Juvenile	50	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	Biopsy samples to be obtained from individuals that have not previously been sampled.
19	Whale, humpback	West Indies DPS	Adult/ Juvenile	40	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy	Aging, microbiome, toxicology, isotopes and other studies, Biopsy samples from individuals of known traits, only 1 sample per year

Table 1. Authorized annual takes in the Gulf of Maine (MA, NH, ME, RI and NY) during vessel surveys.							
Line	Species	Stock/ Listing Unit	Life stage	Number of Takes*	Takes Per Animal	Procedures	Details
20	Whale, killer	Western North Atlantic Stock	Adult/ Juvenile	30	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy	
21	Whale, minke	Canadian East Coastal Stock	All	30	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy	
22	Whale, minke	Canadian East Coastal Stock	Calf	10	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy	calves > 3 months old
23	Whale, right, North Atlantic	Western Atlantic Stock (NMFS Endangered)	All	5	1	Incidental harassment	

Table 1. Authorized annual takes in the Gulf of Maine (MA, NH, ME, RI and NY) during vessel surveys.							
Line	Species	Stock/ Listing Unit	Life stage	Number of Takes*	Takes Per Animal	Procedures	Details
24	Whale, sei	Nova Scotia Stock (NMFS Endangered)	All	30	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, exhaled air; Sample, fecal ; Sample, skin and blubber biopsy	
25	Whale, sei	Nova Scotia Stock (NMFS Endangered)	Calf	10	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy	calves > 3 months old
26	Whale, sperm	North Atlantic Stock (NMFS Endangered)	Adult/ Juvenile	10	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy	

*Takes = the **maximum** number of animals, not necessarily individuals, that may be targeted for research annually for the suite of procedures in each row of the table.

Table 2. Authorized annual takes on the East coast (NJ, MD, VA, NC, SC, GA, FL) during vessel surveys.

Line	Species	Stock/Listing Unit	Lifestage	Number of Takes*	Takes Per Animal	Procedures
1	Whale, humpback	West Indies DPS	All	75	5	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, fecal ; Underwater photo/videography
2	Whale, humpback	West Indies DPS	Adult/ Juvenile	50	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, fecal ; Sample, skin biopsy; Underwater photo/videography
3	Whale, fin	Western North Atlantic Stock (NMFS Endangered)	All	50	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal
4	Whale, fin	Western North Atlantic Stock (NMFS Endangered)	Adult/ Juvenile	30	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy

Table 2. Authorized annual takes on the East coast (NJ, MD, VA, NC, SC, GA, FL) during vessel surveys.

Line	Species	Stock/Listing Unit	Lifestage	Number of Takes*	Takes Per Animal	Procedures
5	Whale, sei	Nova Scotia Stock (NMFS Endangered)	Adult/ Juvenile	30	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy
6	Whale, minke	Canadian East Coastal Stock	Adult/ Juvenile	10	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy
7	Dolphin, bottlenose	Range-wide	All	100	1	Incidental harassment
8	Dolphin, pantropical spotted	Range-wide	All	100	1	Incidental harassment
9	Dolphin, striped	Range-wide	All	100	1	Incidental harassment
10	Dolphin, common, short-beaked	Western North Atlantic Stock	All	100	1	Incidental harassment

Table 2. Authorized annual takes on the East coast (NJ, MD, VA, NC, SC, GA, FL) during vessel surveys.						
Line	Species	Stock/Listing Unit	Lifestage	Number of Takes*	Takes Per Animal	Procedures
11	Dolphin, Risso's	Range-wide	All	100	1	Incidental harassment
12	Whale, pilot, long-finned	Range-wide	All	100	1	Incidental harassment
13	Whale, pilot, short-finned	Range-wide	All	100	1	Incidental harassment

*Takes = the **maximum** number of animals, not necessarily individuals, that may be targeted for research annually for the suite of procedures in each row of the table.

Table 3. Authorized annual takes in Puerto Rico during vessel surveys.							
Line	Species	Stock/ Listing Unit	Lifestage	Number of Takes*	Takes Per Animal	Procedures	Details
1	Whale, humpback	West Indies DPS	All	150	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, fecal ; Underwater photo/videography	

Table 3. Authorized annual takes in Puerto Rico during vessel surveys.							
Line	Species	Stock/ Listing Unit	Lifestage	Number of Takes*	Takes Per Animal	Procedures	Details
2	Whale, humpback	West Indies DPS	Adult/ Juvenile	50	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	
3	Whale, humpback	West Indies DPS	Non-neonate	10	1	Collect, sloughed skin; Count/survey; Import/export/receive, parts; Observation, monitoring; Observations, behavioral; Photo-id; Photogrammetry; Photograph/Video; Sample, fecal ; Sample, skin and blubber biopsy; Underwater photo/videography	calves < 3 months old, but not neonates
4	Dolphin, bottlenose	Range-wide	All	100	1	Incidental harassment	
5	Dolphin, spinner	Range-wide	All	100	1	Incidental harassment	

*Takes = the **maximum** number of animals, not necessarily individuals, that may be targeted for research annually for the suite of procedures in each row of the table.

Appendix 2: NMFS-Approved Personnel and Authorized Recipients for Permit No. 21485.

The following individuals are approved to act as Co-Investigators pursuant to the terms and conditions under Section C (Qualifications, Responsibilities, and Designation of Personnel) of this permit.

Name	Activities
Jooke Robbins (Principal Investigator)	All research activities
Susan Barco	All research activities authorized for the mid-Atlantic states/southeast US
Clay George	All research activities authorized for the mid-Atlantic states/southeast US
Katherine Jackson	All research activities authorized for the mid-Atlantic states/southeast US
Scott Landry	All research activities
Sarah Mallette	All research activities authorized for the mid-Atlantic states/southeast US
David Mattila	All Level B research activities
Charles Stormy Mayo	All Level B research activities
Thomas D. Pitchford	All research activities authorized for the mid-Atlantic states/southeast US
Grisel Rodriguez Ferrer	All research activities authorized off Puerto Rico

Biological samples authorized for collection or acquisition in Table(s) X of Appendix 1 may be transferred to the following Authorized Recipients for the specified disposition, consistent with Condition B.6 of the permit:

Authorized Recipient	Sample Type	Disposition
Lisa Abegglen, University of Utah, Salt Lake City, Utah.	Skin	Genomic and cell line research. Curate tissue.
Amy Apprill, Woods Hole Oceanographic Institution, Woods Hole, MA.	Skin, feces, breath mucosa	Bacterial analyses, samples consumed in analysis
Martine Bérubé, University of Groeningen, Groningen, Netherlands.	Skin	Genetic analyses. Curate tissue.
Ari Friedlaender, University of Santa Cruz, Santa Cruz, CA.	Blubber	Endocrinology. Tissue to be consumed in analysis.
Kathleen Hunt, Northern Arizona University, Flagstaff, Arizona.	Blubber, feces, breath mucosa	Endocrinology. Tissue to be consumed in analysis
Simon Jarman, Curtin University, Perth, Australia.	Skin	Epigenetic aging. Curate tissue.
Carlo Maley, Arizona State University, Tempe, Arizona.	Skin	Genomic and cell line research. Curate tissue.
Per Palsbøll, University of Groeningen, Groningen, Netherlands	Skin	Genetic analyses. Curate tissue.
Joshua Schiffman, University of Utah, Salt Lake City, Utah.	Skin	Genomic and cell line research. Curate tissue.
Sean Todd, College of the Atlantic, Bar Harbor, Maine	Skin	Stable isotope research. Tissue to be consumed in analysis.
Marc Tollis, Arizona State University, Tempe, Arizona.	Skin	Genomic and cell line research. Curate tissue.
Gina Ylitalo, Northwest Fisheries Science Center, Seattle, Washington.	Blubber	Toxicology. Tissue to be consumed in analysis.

Appendix 3: Requirements for Sterilization and Disinfection of Biopsy Tips

Biopsy tips must be sterile before each use. For sterilization, the biopsy tips must be cleaned with soap and water, soaked in a 10 percent bleach solution for at least 20 minutes, rinsed, and sterilized with gas or in an autoclave. Sterilized biopsy tips must be kept in individual sterilized packages until use, and any manipulation of the tips after the sterilization must be conducted wearing gloves.

In the rare event that a sterile biopsy tip is not available, high-level disinfected tips may be used. For high-level disinfection, the biopsy tips must be cleaned with soap and water, soaked in a 10 percent bleach solution for at least 20 minutes (or similar high-level disinfection solution e.g. 6 percent hydrogen peroxide, 2 percent glutaraldehyde), rinsed, allowed to air dry or dried with a sterile cloth, and then placed in sterile packaging until use. Disinfected biopsy tips must be kept in individual packages until use, and any manipulation of the tips must be conducted wearing gloves. High-level disinfection solutions should be changed weekly or per manufacturer directions.