NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title: Biological Opinion on the Issuance of Permit No. 20951 to Ann Zoidis, Cetos Research Organization, for Research on Cetaceans in the Gulf of Maine

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

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

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Approved: Donna S Wieting

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Director, Office of Protected Resources

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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 the 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 ESA-listed species or destroy or adversely modify critical habitat, NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures 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 Division). The Permits Division proposes to issue a scientific research permit (Permit No. 20951, Appendix A) pursuant to section 10(a)(1)(A) of the ESA and section 104 of the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 USC 1361 et seq.) to Ann Zoidis, Cetos Research Organization, 11 Des Isle Avenue, Bar Harbor, Maine 04609. The purpose of the proposed permit is to allow an exception to the moratoria and prohibition on takes established under the ESA and MMPA in order to allow the applicant to conduct scientific research on cetaceans (both ESA-listed and non-ESA-listed) in the Gulf of Maine.

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 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." NMFS does not have a regulatory definition of "harass." We rely on our interim guidance, which interprets harass as to "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, harassment is defined under the MMPA as any act of 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 perfectly equate to 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 the MMPA and ESA, our and the Permit Division's ESA analysis may result in slightly different outcomes compared to the Permit Division's MMPA analysis, depending on the action. Given that the MMPA definition of harass involves two different levels, neither of which is completely synonymous with our interpretation of harass under the ESA, there may be circumstances in which an act is considered harassment, and thus take, under one statute but not the other. NMFS intends to further explore the similarities and differences between harassment under the MMPA and ESA to determine whether additional steps should be taken relative to the interpretation of the two statutes when taking actions regarding ESA-listed marine mammals.

This consultation, biological opinion (opinion), and incidental take statement, were completed by NMFS Office of Protected Resources Endangered Species Act Interagency Cooperation Division (hereafter referred to as "we") 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.

This document represents NMFS opinion on the effects of the proposed issuance of Permit No. 20951 on blue whales (*Balaenoptera musculus*), fin whales (*Balaenoptera physalus*), North Atlantic right whales (*Eubalaena glacialis*), sei whales (*Balaena borealis*), sperm whales (*Physeter macrocephalus*), green turtles (*Chelonia mydas*, North Atlantic Distinct Population Segment [DPS]), hawksbill turtles (*Eretmochelys imbricata*), Kemp's ridley turtles (*Lepidochelys kempii*), leatherback turtles (*Dermochelys coriacea*), and loggerhead turtles (*Caretta caretta*, Northwest Atlantic DPS). A complete record of this consultation is on file at NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

Ms. Zoidis has been conducting research on cetaceans with the Cetos Research Organization since 1992 and has previously held at least three NMFS scientific research permits authorizing research on cetaceans in the Pacific Ocean (Permit Nos. 1039-1699, 14353, and 19257, which is still active). While the proposed permit would be her first permit in the Atlantic Ocean, specifically the Gulf of Maine, the College of the Atlantic, a major collaborator on the proposed research, previously held NMFS Permit No. 526-1523 in the Gulf of Maine, which the proposed research would continue. The past permits issued to Ms. Zoidis and the College of the Atlantic authorized a variety of research activities including most of the activities proposed under Permit No. 20951 such as vessel surveys, close approaches, documentation, and biopsy sampling. Previous consultations considering the issuance of these permits all resulted in biological opinions concluding that their issuance was not likely to jeopardize the continued existence of ESA-listed species, nor adversely modify designated critical habitat (NMFS 2000; NMFS 2016b). The only proposed activity that Ms. Zoidis and/or the College of the Atlantic has not been previously authorized to conduct is unmanned aerial surveys. However, we have previously consulted on numerous research permits involving the use of unmanned aerial surveys and all resulting biological opinions concluded that this activity was not likely to jeopardize the continued existence of ESA-listed species, nor adversely modify designated critical habitat (NMFS 2017c). In this consultation, we build upon on our long-term evaluation of Ms. Zoidis and the College of the Atlantic's research activities from previous consultations, consider their previous permits as part of the environmental baseline (Section 7), and evaluate the effects of authorizing Ms. Zoidis to conduct the proposed research under Permit No. 20951.

1.2 Consultation History

This opinion is based on information provided in the permit application (NMFS 2017e), correspondence and discussions with the Permits Division and the applicant, previous biological opinions for research permits issued to Ms. Zoidis, the College of the Atlantic, and other researchers for similar activities (NMFS 2000; NMFS 2016b; NMFS 2016c; NMFS 2017c; NMFs 2017d), and the best scientific and commercial data available from the literature. Our communication with the Permits Division regarding this consultation is summarized as follows:

- On February 2, 2017, the Permits Division provided us a copy of the initial permit application and asked for our review.
- On February 22, 2017, we provided our review of the initial permit application and requested additional information and clarification from the applicant and the Permits Division.
- On April 3, 2017, the Permits Division sent us an updated application that addressed our questions and request for additional information.
- On April 4, 2017, the Permits Division sent us an initiation package and memorandum requesting initiation of formal consultation on the issuance of Permit No. 20951.
- On April 10, 2017, we informed the Permits Division that we completed our review of the initiation package and determined it to be complete.
- On April 13, 2017, we sent the Permits Division a memorandum informing them formal consultation on the issuance of Permit No. 20951 was initiated on April 10, 2017. In this memorandum, we acknowledged the Permit Division's request to have consultation completed on or before July 15, 2017, which we would try meet, but noted that by statute, we have until August 16, 2017, to complete consultation.
- On June 6, 2017, we spoke with the Permits Division about the July 15, 2017, target date and the possibility of extending this timeline given other ongoing, high priority consultations. The Permits Division agreed to discuss a potential change of date for the issuance of the permit with the applicant. The following day, the applicant confirmed that she did not need the permit until September 15, 2017, at the earliest, as she had no plans for research in the Gulf of Maine prior to this date. As such, we suggested a target date for completion of consultation of September 1, 2017.
- On June 20, 2017, the Permits Division suggested a target date for the completion of consultation of August 15, 2017. We requested clarification from the Permits Division on the need to meet this earlier deadline, given the response the applicant provided. Upon further consideration, on June 29, 2017, the Permits Division agreed to our proposed extended timeline, with a target date for completion of consultation of September 1, 2017.
- On July 27, 2017, the Permits Division provided us a copy of a public comment they received regarding the issuance of Permit No. 20951, in which the commenter requested the Permits Division deny the proposed permit. Along with the public comment, the Permits Division provided a draft of their response.
- On July 28, 2017, we informed the Permits Division that we had reviewed the public comment and agreed with their draft response. We notified them that we did not foresee this comment having an impact on the consultation.

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), *Interrelated and Interdependent Actions* (Section 4), and *Action Area* (Section 5)*:* We describe the proposed action, identify any interrelated and interdependent actions, and describe the spatial extent of the action area.

Status of Endangered Species Act Protected Resources (Section 6): 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 and habitat. In this Section, we also identify any species and designated critical habitat not likely to be adversely affected (Section 6.1).

Environmental Baseline (Section 7): 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 8): We identify the stressors that are likely to result from the proposed action, any measures that will be taken to mitigate or minimize exposure of ESA-listed resources to the stressors, the number (and age or life stage, and gender, if possible) of ESA-listed individuals that are likely to be exposed to the stressors and the populations or subpopulations 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 9): 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 10): In this section, we integrate the preceding analyses to summarize the consequences to ESA-listed species and designated critical habitat under NMFS' jurisdiction.

Conclusion (Section 11); 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 a 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 12) 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 (Section 13) that may be implemented by the action agency. 50 C.F.R. §402.14 (j). Finally, we identify the circumstances in which reinitiation of consultation is required (Section 14). 50 C.F.R. §402.16.

To comply with our obligation to use the best scientific and commercial data available, we collected information through searches of *Google Scholar*, *Web of Science*, 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 Division and the applicant

- Government reports (including NMFS biological opinions and stock assessment reports)
- National Oceanic and Atmospheric Administration (NOAA) technical memoranda
- 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 Division's issuance of a scientific research permit pursuant to the ESA and MMPA. The research permit would allow an exception to the moratoria and prohibition on takes established under the ESA and MMPA in order to allow Ms. Zoidis to conduct scientific research on ESA-listed and non-ESA-listed cetaceans. The purpose of Ms. Zoidis's research is to better understand the seasonal migration, foraging habits, and behaviors of balaenopterid species within the northern Gulf of Maine, as well as any changes in these traits since data were last systematically collected on these species within the area by the College of the Atlantic in 2006.

Permit No. 20951 would authorize Ms. Zoidis to take ESA-listed blue, fin, North Atlantic right, sei, and sperm whales, as well as several other non-ESA-listed cetacean species during directed research activities. Table 1 below displays the annual takes of ESA-listed species that would be authorized under Permit No. 20951. For research permits, the Permits Division counts one take per cetacean per day including all approaches[1] and procedure attempts, regardless of whether a behavioral response to the permitted activity is observed.

[1] 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 sperm and baleen whales (excluding minke whales) and 50 yards for all other cetaceans.

Table 1: Proposed annual takes of Endangered Species Act listed species that would be authorized under Permit No. 20951.

Species	Stock/ Listing Unit	Life stage	No. of Takes[2]	Takes Per Animal	Take Action	Procedures	Details
Whale, blue	Range-wide (NMFS Endangered)	All	50	1	Harass	Count/survey; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial; photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
		Adult/ Juvenile	30	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial; photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to six adult or juvenile blue whales may be resampled annually.
Whale, fin	Western North Atlantic Stock (NMFS Endangered)	All	400	1	Harass	Count/survey; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial; photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
		Adult/ Juvenile	100	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial; photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to 20 adult or juvenile fin whales may be resampled annually.
		Calf	10	2		Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial; photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Only calves at least six months old and one third the length of companion whale will be sampled. Up to two fin whale calves may be resampled annually.

[2] 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.

Species	Stock/ Listing Unit	Life stage	No. of Takes[2]	Takes Per Animal	Take Action	Procedures	Details
Whale, right, North Atlantic	Range-wide (NMFS Endangered)	All	50	1	Harass	Count/survey; Incidental harassment; Observations, monitoring and behavioral; Photograph/video; Remote vehicle, aerial; photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
Whale, sei	Range-wide (NMFS Endangered)	All	100	1	Harass	Count/survey; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial; photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
		Adult/ Juvenile	30	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial; photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to six adult sei whales may be resampled annually.
Whale, sperm	North Atlantic Stock (NMFS Endangered)		50			Count/survey; Incidental harassment; Observations, monitoring and behavioral; Photograph/video; Remote vehicle, aerial; photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling

The proposed research would encompass a variety of activities including vessel surveys, close approaches, documentation (e.g., photography, videography, observation, etc.), unmanned aerial surveys, and biopsy sampling. During these activities non-target cetaceans that are in association with target cetaceans may be incidentally harassed. These activities are individually described in more detail below. Further information can be found in the permit application (NMFS 2017e).

Ms. Zoidis would also be authorized to import and export marine mammal parts, samples, and specimens collected either from biopsy sampling under Permit No. 20951, as further described below, or from legal sample collection performed by other researchers. However, since these activities would have no effects on ESA-listed species outside of the sample collection, the act of exporting and importing is not discussed further in this opinion.

3.1 Vessel Surveys, Close Approaches, and Documentation

Vessel surveys are the primary means by which cetacean researchers collect data as they provide a platform to collect a wealth of information on cetacean biology. The Permits Division proposes to authorize Ms. Zoidis to take all age and sex classes of ESA-listed cetaceans in Table 1 by means of harassment as the result of close approaches and documentation during vessel surveys. Here we describe the proposed vessel surveys and associated close approaches and documentation (e.g., photography, observation, etc.) more generally and then detail the additional research activities (unmanned aerial surveys and biopsy sampling) that would sometimes occur during vessel surveys in each section below.

During vessel surveys, a small vessel (five to 15 meters in length) would traverse pre-determined track-lines within the action area at speeds of approximately 15 knots while three to four researchers aboard the vessel search for cetaceans. Once a cetacean or group of cetaceans is sighted, researchers would observer the animal(s) from a distance of greater than 100 meters for a minimum of 10 minutes in order to acquaint themselves with the group and record associations and behaviors. Following this, the vessel would approach the animal(s) at a speed of 10 knots or less on a converging course (e.g., 45-degree angle, not directly from behind or head on) to within no less than 15 meters. During this approach, researchers would take photographs of the animal's dorsal fin, flukes, dorsal surface, and other body parts for the purposes of individual identification (Hammond et al. 1990). Researchers would then assess whether conditions are suitable to attempt additional research activities such as focal observations and continued photography, unmanned aerial surveys, and/or biopsy sampling. Focal observations would consist of researchers observing cetaceans with the naked eye and/or binoculars, while continuously recording behavioral and environmental data and taking photographs of the animals. Throughout focal observations, if conditions allow, researchers would also attempt to conduct unmanned aerial surveys and/or collect biopsy samples as further discussed below.

The total time researchers would spend with any given individual or group of individuals (including time spent if unmanned aerial surveys and/or biopsy sampling were conducted) would be between 15 minutes and two hours. On occasion, researchers would approach an animal or group of animals more than once a day (up to a maximum of five times) if needed for additional data collection. However, at all times researchers would monitor the animals' behavior in order to minimize impacts that may result from the vessel's presence, and if a disruption of behavior is observed (e.g., avoidance, changes in diving or surface behavior, cessation of feeding, etc.), researchers would cease data collection and leave the animals.

3.2 Unmanned Aerial Surveys

With recent advances in unmanned aircraft systems (UAS), researchers are now conducting unmanned aerial surveys to collect data on the occurrence, abundance, and habitat use of cetaceans, as well as collect photographic and health information. The Permits Division proposes to authorize Ms. Zoidis to take all ESA-listed cetaceans in Table 1 (any age and sex class) by means of harassment during unmanned aerial surveys. The primary goal for these activities is to collect photographs and video to be used in health assessments and photo-identification.

The UAS that would be used during unmanned aerial surveys would be a DJI Phantom 4, a short endurance, vertical takeoff and landing quadcopter equipped with a camera system (Figure 1). Flights would be conducted from the vessels described above, while traveling alongside cetaceans at a distance of approximately 30 meters and speeds of a maximum of 10 knots. The UAS would always be within visual range of the pilot, and be flown at altitudes between 35 and 90 meters. Flight durations would be 23 minutes or less (typically 15 minutes) as limited by the battery life of the UAS, with the UAS making up to a maximum of five, one to three minute passes over a cetacean when it surfaces. All UAS operations would be conducted by a U.S. Federal Aviation Administration certified pilot and in compliance with existing their regulations and the terms and conditions specified in the proposed permit.

Figure 1: DJI Phantom 4 quadcopter that would be used during unmanned aerial surveys.

3.3 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. At least 42 species of cetaceans have been biopsy sampled (33 odontocetes and nine mysticetes) since the method was initially developed in 1973 (Noren and Mocklin 2012). The Permits Division proposes to authorize Ms. Zoidis to biopsy sample blue, fin, and sei whales as specified in Table 1 for the purposes of studying cetacean foraging ecology. No biopsy sampling is proposed for North Atlantic right whales or sperm whales. Biopsy sampling would be authorized for both sexes. Adults and juveniles of blue, sei, and fin whales would be biopsy sampled. Additionally, fin whale calves of at least six months of age or older would be biopsy sampled as this is the only species for which Ms. Zoidis anticipates observing calves within the action area. Researchers would keep detailed photographic records of all biopsied individuals in order to avoid unintentional repeat biopsies. Up to 20 percent of the individuals biopsy sampled would be intentionally re-biopsied within the same year, for a maximum of two biopsies per year, in order to estimate variance in samples or capture temporal forage variances. In all cases, these individuals would not be resampled within one week at minimum.

Biopsy sampling would take place during focal observations following the close approach and documentation described above for vessel surveys. Biopsy samples would be collecting using a Barnett crossbow with stainless steel Ceta-Dart bolts measuring 40 millimeters in length by eight millimeters in diameter or smaller (Figure 2). Prior to and in between sampling (e.g., after missed attempts), biopsy dart tips would be cleaned with detergent and flame sterilized and then stored in two percent hydrogen peroxide. Researchers would aim to sample dermal skin and blubber (i.e., darts would not penetrate below the blubber layer) from the dorsal region of the animal, just below the dorsal fin (Figure 2). No biopsy samples would be taken forward of the pectoral fin in an effort to avoid sensitive areas (e.g., eyes, blowhole, etc.). Once the biopsy dart hits the animal, it would recoil, fall into the water, and float for retrieval by boat.

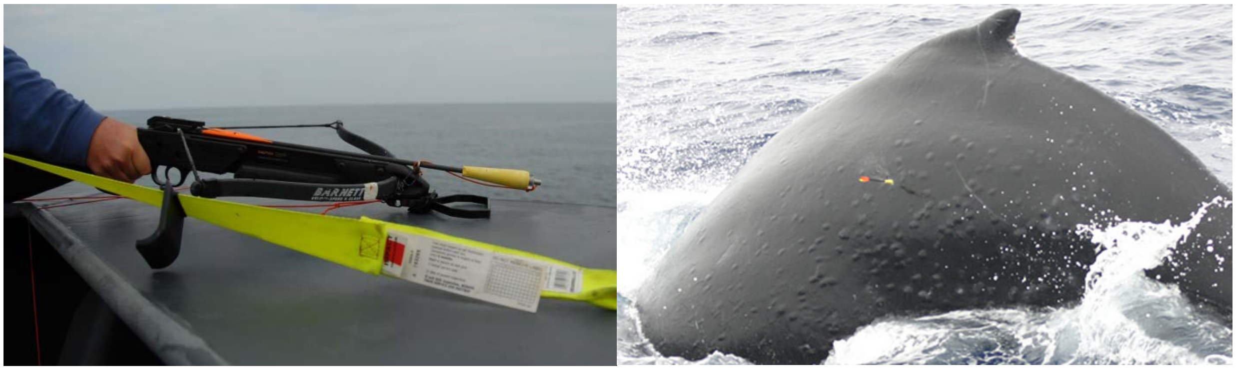

Figure 2: Loaded biopsy crossbow (left) and biopsy dart sampling of a humpback whale (*Megaptera novaeangliae*) (right). Photos taken from https://teacheratsea.wordpress.com/tag/biopsy-dart/ and http://oceanwidescience.org/splash/ respectively.

Researchers would be authorized to attempt to biopsy an individual up to three times per day, but would be required to discontinue attempts if an animal exhibits repetitive, strong, adverse responses. To aid in monitoring animals' responses, the researcher firing the crossbow would wear a head-mounted video camera to record animal behavior during all biopsy sampling.

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 this vessel transit on ESA-listed species and so include all waters traversed during such transits as part of the action area.

5 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 action area for Permit No. 20951 can be seen below in Figure 3. It includes an area of approximately 30,000 square kilometers in the northern Gulf of Maine off the coast of Bar Harbor, Maine, roughly centered around Mount Desert Rock Marine Research Station (43° 58' North, 68° 08' West). While research within this area would potentially occur any time throughout the year over the five-year duration of the permit, most research would likely be performed between the months of June and October annually.

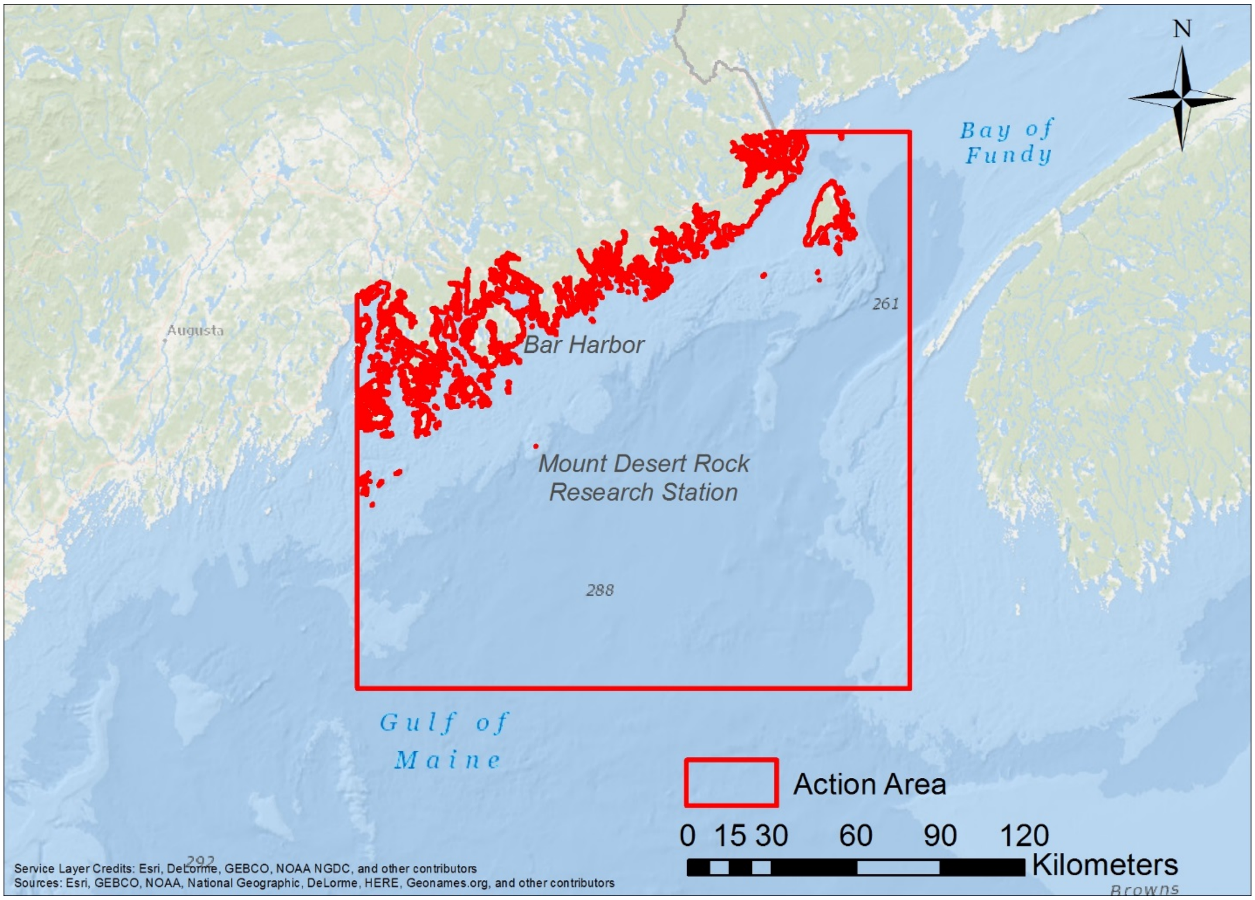

Figure 3: Action Area for Permit No. 20951 in the Gulf of Maine.

6 STATUS OF ENDANGERED SPECIES ACT PROTECTED RESOURCES

This section identifies the ESA-listed species that potentially occur within the action area (Figure 3) that may be affected by the issuance of Permit No. 20951. It then identifies those species not likely to be adversely affected by the proposed action because the effects of the proposed action are deemed insignificant, discountable, or beneficial. Finally, summarizes the biology and ecology of those species that may be adversely affected by the proposed action and details information on their life histories in the action area if known. The ESA-listed species potentially occurring within the action area that may be affected by the proposed action are given in Table 2, along with their regulatory status.

Table 2: Endangered Species Act-listed species that may be affected by the proposed action.

Species	ESA Status	Recovery Plan
Blue Whale (*Balaenoptera musculus)*	E – 35 FR 18319	07/1998
Fin Whale (*Balaenoptera physalus)*	E – 35 FR 18319	75 FR 47538
North Atlantic Right Whale (*Eubalaena glacialis*)	E – 73 FR 12024	70 FR 32293
Sei Whale (*Balaenoptera borealis*)	E – 35 FR 18319	12/2011
Sperm Whale (*Physeter macrocephalus*)	E – 35 FR 18319	75 FR 81584

Species	ESA Status	Recovery Plan
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 FR 20057	10/1991
Hawksbill Turtle (*Eretmochelys imbricata)*	E – 35 FR 8491	63 FR 28359 and 57 FR 38818
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	9/2011
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	63 FR 28359 and 10/1991
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	74 FR 2995

6.1 Species Not Likely to be Adversely Affected

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 2 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. That means the ESA-listed species may be expected to be affected, but not harmed or harassed.

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.

6.1.1 Cetaceans

The proposed action spatially overlaps with and may affect North Atlantic right and sperm whales. The Permits Division has determined that the issuance of Permit No. 20951 is likely to adversely affect these species and proposes to issue take in the form of harassment that may result from vessel surveys, close approaches, and documentation. North Atlantic right and sperm whales will not be targeted for biopsy sampling. Vessel surveys and close approaches could result in disturbance and vessel strikes.

Vessel surveys, close approaches, documentation, and unmanned aerial surveys may cause visual or auditory disturbances to cetaceans and more generally disrupt their behavior. Cetacean's responses to these activities are discussed in greater detail in Section 8.4.1 and 8.4.2 but summarized for North Atlantic and sperm whales here. North Atlantic right and sperm whales are known to exhibit a variety of behavioral responses to vessel surveys, close approaches, and documentation ranging from no response to short-term changes in activity state (e.g., ceasing resting or foraging), diving, surface behavior, respiration, swimming speed, orientation, and vocalizations (Baumgartner and Mate 2003; Isojunno and Miller 2015; Miller et al. 2008; NMFS 2016c; NMFS 2017b; NMFS 2017f; Richter et al. 2006; Richter et al. 2003). In response to unmanned aerial surveys, North Atlantic right and sperm whales appear to exhibit no response (Marine Mammal Commission 2016; Smith et al. 2016). Regardless of the particular response, individuals appear to resume species' typical behavior within minutes of researchers leaving the area (Baumgartner and Mate 2003; Isojunno and Miller 2015; NMFS 2016c; NMFS 2017f). Under Permit No. 20951, at most researchers would be with an individual for two hours and at any time during the encounter they could potentially disturb the animal. However, in her application, Ms. Zoidis states that if their research vessel appears to disturb a whale, researchers would leave the area immediately. Given the experience of Ms. Zoidis in conducting cetacean research, we expect that determinations of levels of disturbance requiring the survey vessel leave the area would be rapid and accurate. As a result, we expect that any disturbance caused by vessel surveys, close approaches, and documentation would be extremely short-term. Given the short duration of this potential disturbance and the expected mild behavioral responses to these activities, we do not anticipate that vessel surveys, close approaches, and documentation as proposed under Permit No. 20951 would significantly disrupt North Atlantic right and sperm whales' normal behavioral patterns to an extent that would create the likelihood of injury or impact fitness. Thus, even though the Permits Division proposes to authorize take of North Atlantic right and sperm whales under the MMPA as a result of harassment that may occur during vessel surveys, close approaches, and documentation, we have determined that the effects of vessel surveys, close approaches, and documentation to North Atlantic right and sperm whales are insignificant and do not constitute harassment under the ESA.

Any vessel transiting waters inhabited by whales has a 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 (Conn and Silber 2013; Jensen and Silber 2004; Laist et al. 2001; Vanderlaan and Taggart 2007). 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. Both events involved vessels striking North Atlantic right whales in the Gulf of Maine, although both were outside of the action area and neither involved Ms. Zoidis or the College of the Atlantic. Full details of these events can be found in Wiley et al. (2016), but below we provide a brief summary of each.

The first event occurred on April 9, 2009, in Massachusetts Bay when the NOAA research vessel the *Auk* struck a North Atlantic right whale (Wiley et al. 2016). A captain and mate, each of whom had logged many hours of ship time during marine mammal research activities, were operating the vessel. The vessel was traveling at 19.7 knots, which, while not required for a vessel of its size (15 meters), is well above the 10 knot restrictions that were active at the time within the area for larger vessels (greater than 19.8 meters). Winds were 20 to 23 knots out of the northeast, and wave heights were approximately 1.3 meters, not ideal conditions for spotting marine mammals. Six marine mammal observers were on the lookout when the mate spotted a whale approximately nine meters in front of the vessel, which was subsequently seen by an observer when the whale's fluke was directly in front of the vessel. There was no time to notify the captain, nor adjust course and speed; the whale was struck. The whale exhibited minor bleeding from seven to eight lacerations on the tip of its left tail fluke, which follow up photographs show eventually healed with the tip of the fluke falling off. After assessing the whale's condition, the research vessel departed approximately one hour following the initial strike, since at this point the animal appeared to be behaving normally. Since the event, the whale has been seen at least 46 times, with the injury being fully healed by day 719 after the strike and the whale appears to be healthy.

The second event occurred on April 9, 2014, in Cape Cod Bay when the Center for Coastal Studies' research vessel the *Shearwater* struck a North Atlantic right whale (Wiley et al. 2016). Researchers aboard the vessel were performing North Atlantic right whale prey mapping and sampling along pre-determined track lines. The vessel was traveling at nine knots, below regulatory limits within the area even though these limits don't apply to the *Shearwater* given its size. While aerial observers in the area had spotted sub-surface feeding groups of whales, the two dedicated vessel observers saw no indication of whales in the immediate vicinity of the vessel until the whale was struck. All observations of the event indicate the whale was struck on the left mid or lower flank. Despite significant aerial and vessel effort to photograph, relocate, and follow animal immediately after the strike, researchers were unable to confirm the individual's identity. However, since the injury appeared to be non-lethal based on its location, depth, width, size, and the number of cuts, and no carcass with wounds consistent with the strike was found, the individual is assumed to have survived (Wiley et al. 2016).

The two events described above represent extremely rare occurrences, being the only two researched-related cetacean vessel strikes that we are aware of in over 40 years of permitted cetacean research activities. Given this, the small vessel sizes that would be used (five to 15 meters), the extensive experience Ms. Zoidis and her research team have in spotting cetaceans at sea, and the slow speeds at which Ms. Zoidis would operate the survey vessel when near whales (10 knots or less), we believe the likelihood of a vessel strike from research vessel transits is extremely unlikely, and thus discountable.

In summary, we conclude that the issuance of Permit No. 20951 is not likely to adversely affect North Atlantic right and sperm whales, and we will not discuss these species further.

6.1.2 Sea Turtles

The proposed action spatially overlaps with several ESA-listed sea turtle species and/or DPSs including green turtles (North Atlantic DPS), hawksbill turtles, Kemp's ridley turtles, leatherback turtles, and loggerhead turtles (Northwest Atlantic DPS). The Permits Division has determined that the issuance of Permit No. 20951 may affect, but is not likely to adversely affect these ESA-listed sea turtles. As for North Atlantic right and sperm whales, interactions with sea turtles could potentially involve disturbance and vessel strikes, but the possibility of these interactions is considered remote due to the directed nature of the research activities.

If occurring within the vicinity of sea turtles, general vessel operations, including unmanned aerial surveys, have the potential to disturb sea turtles. However, researchers 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 et al. 2002), well before the animals would be expected to respond (approximiately 10 meters, Hazel et al. 2007). In addition, sea turtles appear to exhibit no response to UAS (Bevan et al. 2015). If a sea turtle were spotted, as required by their permit, researchers would not approach the sea turtle, and would change course in order to avoid coming into close proximity. Because researchers would reasonably be expected to spot sea turtles, and thus avoid approaching and disturbing them, we find that disturbance of sea turtles is extremely unlikely to occur, and thus discountable.

As for North Atlantic right and sperm whales, vessel strikes of sea turtles are expected to be extremely unlikely. Research vessels would travel at speeds of 10 knots or less and have numerous observers on lookout, which would allow researchers to spot and avoid sea turtles well in advance of any potential collision. In addition, we are not aware of any case of a cetacean research vessel striking a sea turtle in over 40 years of research activities permitted by the Permits Division. For these reasons, we find it is extremely unlikely that a research vessel will strike a sea turtle, and thus such effects are discountable.

In summary, we concur with the Permits Division that the issuance of Permit No. 20951 is not likely to adversely affect green (North Atlantic DPS), hawksbill, Kemp's ridley, leatherback, and loggerhead turtles (Northwest Atlantic DPS), and we will not discuss these species further.

6.2 Species Likely to be Adversely Affected

This opinion examines the status of each species that would be affected by the proposed action. The status is determined by the 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" 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 NMFS Web site: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm.

Below we describe the status of the species that are likely to be adversely affected by the proposed action. We also describe that status of the species specifically within the action area.

6.2.1 Blue Whale

The blue whale is a widely distributed baleen whale found in all major oceans (Figure 4).

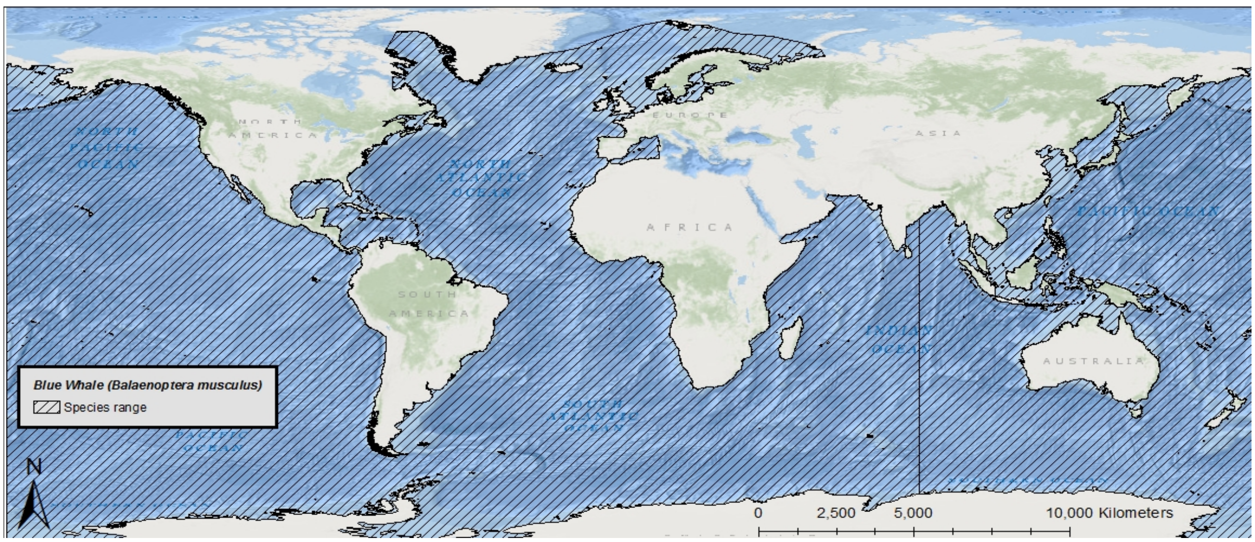

Figure 4: Map identifying the range of the blue whale.

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, a proportionally smaller dorsal fin, and a mottled gray coloration that appears light blue when seen through the water (Figure 5). Most experts recognize at least three subspecies of blue whale, *B. m. musculus*, which occurs in the Northern Hemisphere, *B. m. intermedia* or Antarctic blue whales, 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 (Table 3).

Figure 5: Blue whale. Photo: National Oceanic and Atmospheric Administration.

Table 3: Blue whale status summary and information links.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Balaenoptera musculus	Blue whale	None	Endangered	None	35 FR 18319	1998 Intent to update (77 FR 22760)	None Designated

Information available from the recovery plan (NMFS 1998), recent stock assessment reports (Carretta et al. 2017; Hayes et al. 2017; Muto et al. 2017), and the status review (COSEWIC 2002) were used to summarize the life history, population dynamics and status of the species as follows.

6.2.1.1 Life History

The average life span of blue whales is 80 to 90 years. They have a gestation period of 10 to 12 months, and calves nurse for six to seven months. Blue whales reach sexual maturity between five and 15 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.

6.2.1.2 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, North Pacific, and Southern Hemisphere. There are three stocks of blue whales designated in U.S. waters: the Eastern North Pacific [current best estimate N = 1,647, N_{min} = 1,551; (Mann 1999)] Central North Pacific (N = 81 N_{min} = 38), and Western North Atlantic (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 1,160-4,500) (Branch 2007). While no range-wide estimate for pygmy blue whales exists (Thomas 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 acoustics (McCauley and Jenner 2010), or 712 to 1,754 individuals based on photographic mark-recapture (Jenner et al. 2008).

Current estimates indicate a growth rate of just under three percent per year for the eastern North Pacific stock (Calambokidis et al. 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 1.6–14.8 percent) (Branch 2007).

Little genetic data exist on blue whales globally. Data from Australia indicates that 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 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 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 500 individuals or less may be at a greater risk of extinction due to genetic risks resulting from inbreeding. Stock populations 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, blue whale 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 4). In the North Atlantic Ocean, the blue whale range extends from the subtropics to the Greenland Sea. They are most frequently sighted in waters off 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*) seem to be segregated. The subspecies *B. m. intermedia* occurs in relatively high latitudes south of the "Antarctic Convergence" (located between 48° South and 61° South latitude) and close to the ice edge. The subspecies *B. m. brevicauda* is typically distributed north of the Antarctic Convergence.

6.2.1.3 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 vessel 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.

Status of Species within the Action Area

There are thought to be two populations of blue whales within the North Atlantic, one in the west and one in the east. The Western North Atlantic stock, which is the only population that would occur in the action area, ranges from the subtropics to the Greenland Sea. These whales are most frequently sighted in waters off eastern Canada with a majority of sightings taking place in the Gulf of St. Lawrence and western North Atlantic. The blue whale is considered only an occasional visitor to U.S. waters in the Atlantic, which may represent the southern limit of its foraging range. Nonetheless, it has been sighted in waters of Cape Cod, Massachusetts. Like other large baleen whales, blue whales within the action area forage at higher latitudes during spring and summer and migrate to lower latitudes in winter to breed. As such, adults, juveniles, and non-neonate blue whales may be present within the action area of Permit No. 20951. In general, little is known about the population size of blue whales within the North Atlantic, but the best available data give a minimum estimate of 440 individuals. Currently no data are available to estimate population trends or mortality and reproduction rates for this stock (Hayes et al. 2017).

6.2.1.4 Critical Habitat

No critical habitat has been designated for the blue whale.

6.2.1.5 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.

6.2.2 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. patachonica* (a pygmy form) in the Southern Hemisphere (Figure 6).

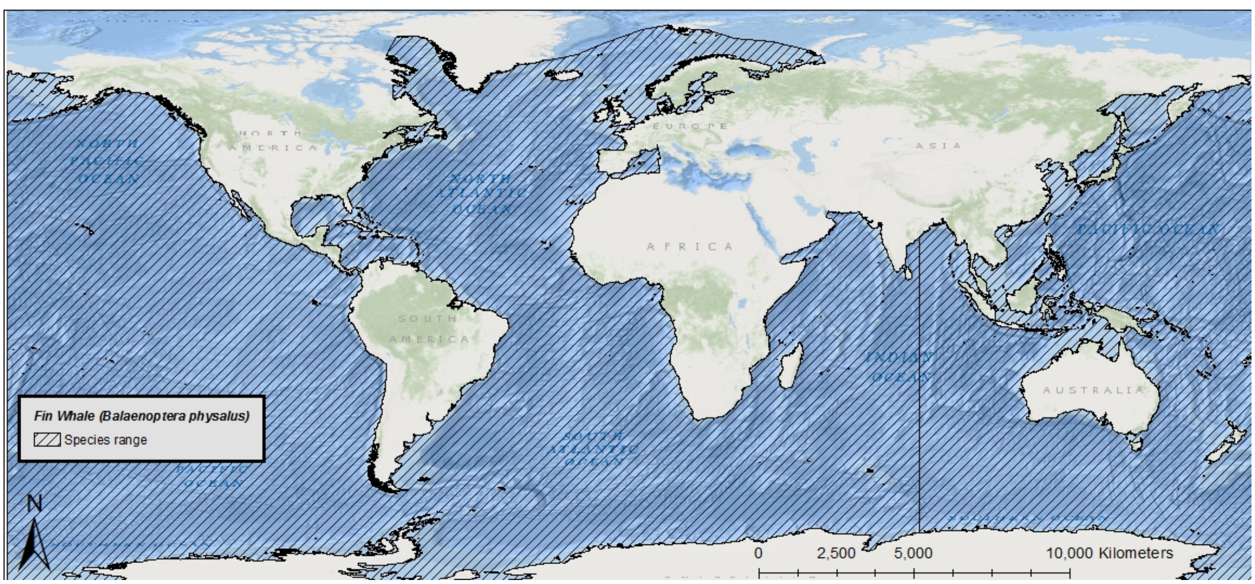

Figure 6: Map identifying the range of the fin whale.

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 (Figure 7). The fin whale was originally listed as endangered on December 2, 1970 (Table 4).

Figure 7: Fin whale. Photo: National Oceanic and Atmospheric Administration.

Table 4: Fin whale status summary and information links.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Balaenoptera physalus	Fin whale	None	Endangered	2011	35 FR 18319	2010	None Designated

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

6.2.2.1 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 10 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.

6.2.2.2 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 fin whale.

The pre-exploitation estimate for the fin whale population in the North Pacific was 42,000 to 45,000 (Ohsumi and Wada 1974). In the North Pacific, at least 74,000 whales were killed between 1910 and 1975. In the North Atlantic, at least 55,000 fin whales were killed between 1910 and 1989. Approximately 704,000 whales were killed in the Southern Hemisphere from 1904 to 1975. Of the three to seven stocks in the North Atlantic (approximately 50,000 individuals), one occurs in U.S. 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 U.S. Pacific 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 et al. 2016). The International Whaling Commission (IWC) also recognizes the China Sea stock of fin whales, found in the Northwest Pacific, which currently lacks and abundance estimate (Reilly 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 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 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 et al. (2013) recently examined the genetic structure and diversity of fin whales globally. Full sequencing of mitochondrial DNA genome for 154 fin whales sampled in the North Atlantic, North Pacific, 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 fin whales appear to be more closely related to the Southern Hemisphere population, as compared to fin whales in the North Pacific, which may indicate a revision of the subspecies delineations is warranted. Generally speaking, haplotype diversity was found to be high both within ocean basins, and across. Such high genetic diversity and lack of differentiation within ocean basins may indicate that despite some population's 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, North Pacific, and Southern Hemisphere (Figure 7), where they appear to be reproductively isolated. The availability of prey, sand lice in particular, is thought to have a strong influence on the distribution and movements of fin whales.

6.2.2.3 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 IWC ban on commercial whaling. Additional threats include vessel 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.

Status of the Species within the Action Area
Several subpopulations of fin whales are thought to exist within the North Atlantic, although some studies have found substantial gene flow between these populations and little genetic divergence suggesting there may only be one functional population (excluding the Mediterranean). The stock found within the action area, and the only one within U.S. waters, is the Western North Atlantic Stock. As mentioned previously, this stock is estimated to comprise 1,618 individuals (N_{min}=1,234), although this is likely an underestimate (Hayes et al. 2017). Within the action area, fin whales are the most abundant large cetacean during all seasons. Like many other baleen whales, fin whales exhibit strong site fidelity and whales of the Western North Atlantic stock are no exception. Waters off New England represent an important feeding area for this stock and calving is thought to occur to the south, along the U.S. mid-Atlantic, although the exact location of breeding remains unknown. Thus, the life stages that would be present within the action area of Permit No. 20951 include adults, juveniles, and non-neonate calves. At this time, not enough data are available to estimate population trends, including mortality and reproductive rates for the Western North Atlantic stock.

6.2.2.4 Critical Habitat

No critical habitat has been designated for the fin whale.

6.2.2.5 Recovery Goals

See the 2010 Final Recovery Plan for the fin whale for complete down listing/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.

6.2.3 Sei Whale

The sei whale is a widely distributed baleen whale found in all major oceans (Figure 8).

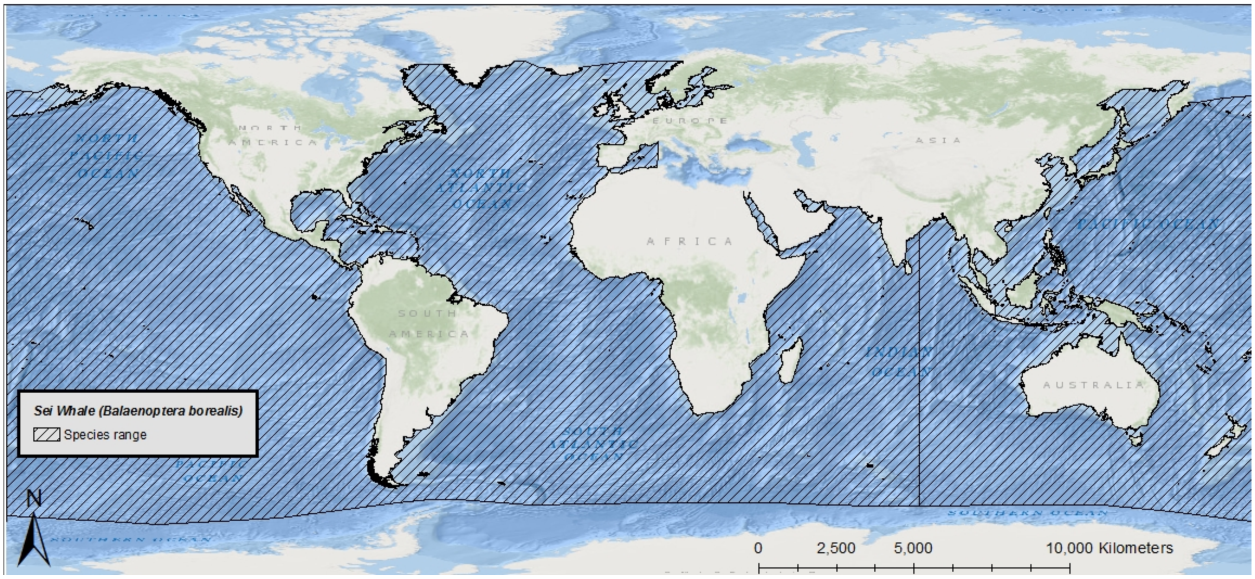

Figure 8: Map showing the range of the sei whale.

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 (Figure 9). The sei whale was originally listed as endangered on December 2, 1970 (Table 5). Information available from the recovery plan (NMFS 2011b), recent stock assessment reports (Carretta et al. 2017; Hayes et al. 2017; Muto et al. 2017), and status review (NMFS 2012) were used to summarize the status of the species as follows.

Figure 9: Sei whale. Photo: National Oceanic and Atmospheric Administration.

Table 5: Sei whale status summary and information links.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Balaenoptera borealis	Sei whale	None	Endangered	2012	35 FR 18319	2011	None Designated

6.2.3.1 Life History

Sei whales can live, on average, between 50 to 70 years. They have a gestation period of 10 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 zooplankton (copepods and krill), small schooling fishes, and cephalopods.

6.2.3.2 Population Dynamics

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

Two subspecies 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 sei whales in the North Atlantic. Models indicate that total abundance declined from 42,000 to 8,600 between 1963 and 1974 in the North Pacific. More recently, the North Pacific population was estimated to be 29,632 (95 percent confidence intervals 18,576 to 47,267) between 2010 and 2012 (IWC 2016; Thomas et al. 2016). In the Southern Hemisphere, pre-exploitation abundance is estimated at 65,000 whales, with recent abundance estimated ranging from 9,800 to 12,000. 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.

While some genetic data exist sei whales, current samples sizes are small limiting our confidence in their estimates of genetic diversity (NMFS 2011b). 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 500 individuals or less may be at a greater risk of extinction due to genetic risks resulting from inbreeding. Stock populations 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. All stocks of sei whales within U.S. waters are estimated to be below 500 individuals indicating they may be at risk of extinction due to inbreeding.

Sei whales are distributed worldwide, occurring in the North Atlantic, North Pacific, and Southern Hemisphere (Figure 8).

6.2.3.3 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 vessel 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 resilience to current threats. However, trends are largely unknown, especially for individual stocks, many of which have relatively low abundance estimates.

Status of Species within the Action Area

The IWC recognizes seven stocks of sei whales within the North Atlantic. Of these, the Nova Scotia stock is the only one found in U.S. waters and the only stock that would be found within the action area. Consistent with many other baleen whales, sei whales of this stock spend spring and summer foraging in higher latitudes, including the Gulf of Maine, although sei whales are typically found in deeper waters compared to many other baleen whales. While the stock is suspected to migrate south for breeding, little is known about sei whale movement patterns and migration compared to other, better-studied baleen whales. Thus, as for blue and fin whales, adults, juveniles, and non-neonate calves are likely to be found within the action area. This stock is estimated to be small at only 357 individuals (N_{min}=236) and data are currently insufficient to estimate population trends, including mortality and reproductive rates (Hayes et al. 2017).

6.2.3.4 Critical Habitat

No critical habitat has been designated for the sei whale.

6.2.3.5 Recovery Goals

See the 2011 Final Recovery Plan for the sei whale for complete down listing/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.

7 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.

7.1 Climate Change

There is mounting evidence that our climate is changing. The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 0.85 ºCelsius over the period 1880 to 2012 (IPCC 2014). Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850 (IPCC 2014). Burning fossil fuels has increased atmospheric carbon dioxide concentrations by 35 percent with respect to pre-industrial levels, with consequent climatic disruptions that include a higher rate of global warming than occurred at the last global-scale state shift (the last glacial-interglacial transition, approximately 12,000 years ago) (Barnosky et al. 2012). Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90 percent of the energy accumulated between 1971 and 2010 (IPCC 2014). It is virtually certain that the upper ocean (zero to 700 meters) warmed from 1971 to 2010 and it likely warmed between the 1870s and 1971 (IPCC 2014). On a global scale, ocean warming is largest near the surface, and the upper 75 meters warmed by 0.11 degrees Celsius per decade over the period 1971 to 2010 (IPCC 2014). In fact, a recent analysis utilizing improved methods for assessing ocean heat content indicates that the ocean has been steadily warming since the 1980s and warming is increasingly being seen at greater depths (Cheng et al. 2017). There is high confidence, based on substantial evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. Higher carbon dioxide concentrations have also caused the ocean rapidly to become more acidic, evident as a decrease in pH by 0.05 in the past two decades (Doney 2010).

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine ecosystems in the near future. It is most likely to have the most pronounced effects on species whose populations are already in tenuous positions (Isaac 2008). Furthermore, species most threatened by climate change appear to face a greater number of other, non-climatic anthropogenic threats compared to species less threatened by climate change (Fortini and Dye 2017). As such, we expect the extinction risk of ESA-listed species to rise with climate change. Primary effects of climate change on individual species include habitat loss or alteration, distribution changes, altered and/or reduced distribution and abundance of prey, changes in the abundance of competitors and/or predators, shifts in the timing of seasonal activities of species and prey, and geographic isolation or extirpation of populations that are unable to adapt. Secondary effects include increased stress, disease susceptibility, and predation. Cetaceans with restricted distributions linked to water temperature may be particularly exposed to range restriction (Issac 2009; Learmonth et al. 2006). MacLeod (2009) estimated that, based on expected shifts in water temperature, the ranges of 88 percent of cetaceans would be affected, 47 percent would be negatively affected, and 21 percent would be put at risk of extinction. Blue and fin whales have a relatively global, cosmopolitan distribution, and so are not predicted to suffer significant range alterations. No prediction is available for sei whales. However, even if species ranges are not expected to shift, changes in other aspects of their ecology such as the arrival at and departure from feeding grounds and diet may still occur (Ramp et al. 2015).

The Atlantic Ocean appears to be warming faster than all other ocean basins except perhaps the southern oceans (Cheng et al. 2017). In the western North Atlantic, surface temperatures have been unusually warm in recent years (Blunden and Arndt 2016). A study by Polyakov et al. (2009), suggests that the North Atlantic overall has been experiencing a general warming trend over the last 80 years of 0.031 ± 0.006 ºCelsius per decade in the upper 2,000 meters of the ocean. These sea surface temperatures are closely related to the North Atlantic Oscillation, which results from variability in pressure differences between a low pressure system that lies over Iceland and a high pressure system that lies over the Azores Islands. The North Atlantic Oscillation Index, which is positive when both systems are strong and negative when both systems are weak, varies from year to year. In years when the North Atlantic Oscillation Index is positive, sea surface temperature generally increases, which is thought to produced favorable conditions for *C. finmarchicus*, the principal prey of North Atlantic right whales (Conversi et al. 2001). As a result, during these years North Atlantic right whale calving rates generally increase, although there may be some lag in timing (Greene et al. 2003). In years when the index is negative, sea surface temperatures are generally lower, and as a result, so is the abundance of *C. finmarchicus* and consequently, North Atlantic right whale calving rates in subsequent years decrease (Drinkwater et al. 2003; Greene et al. 2003; Pershing et al. 2010). In recent years, the oscillation has been mostly positive, leading to increases in copepod abundance and North Atlantic right whale calving rates (Meyer-Gutbrod and Greene 2014). However, climate change models suggest that increases in ocean temperature may produce more severe fluctuations in the North Atlantic Oscillation, which may cause dramatic shifts in the reproductive rate of North Atlantic right whales (Drinkwater et al. 2003; Greene et al. 2003). Furthermore, evaluation of changes in *C. finmarchicus* abundance under multiple climate change scenarios indicate *C. finmarchicus* density is likely to decrease in the North Atlantic, in some cases by as much as 50 percent by 2081-2100. Thus, regardless of the North Atlantic Oscillation, North Atlantic right whales are likely to experience a significant decline in their primary prey (Grieve et al. 2017). While the relationship between changes in sea surface temperature, prey, and the reproduction of blue, fin, and sei whales is unknown, this information regarding North Atlantic right whales demonstrates how all three whale species may be affected by future climate changes.

7.2 Whaling

It is not known how many whales were taken by aboriginal hunting and early commercial whaling, though 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). In 1982, the IWC issued a moratorium on commercial whaling to begin in 1985. There is currently no legal commercial whaling by IWC Member Nations party to the moratorium; however, whales are still killed commercially by countries that filed objections to the moratorium (Iceland and Norway). 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. Finally, whales in a few areas of the world are also still killed for subsistence purposes. Blue, fin, and sei whale mortalities since 1985 resulting from these activities can be seen below in Table 6 (IWC 2017a; IWC 2017b; IWC 2017c).

Table 6: Endangered Species Act-listed whale mortalities as the result of whaling since 1985.

Species	Commercial Whaling	Scientific Research	Subsistence
Blue whales			
Fin whales	706	310	368
Sei whales		1,339	3

While current whaling activities occur outside of the action area, it is possible that the whales killed as part of these activities are part of the populations that inhabit the action area for this consultation. Whaling for commercial purposes still occurs off the coasts of Norway and Iceland in the Eastern North Atlantic, and while unlikely, it is possible some of these whales may be exposed to the research activities that would be authorized under Permit No. 20951. 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 in the action area ceased.

7.3 Vessel Strikes

Vessel strikes are considered a serious and widespread threat to ESA-listed whales. This threat is increasing as commercial shipping lanes cross important breeding and feeding habitats and as whale populations recover and populate new areas or areas from which they were previously extirpated (Swingle et al. 1993; Wiley et al. 1995). As vessels continue to become faster and more widespread, an increase in vessel interactions with cetaceans is to be expected. The vast majority of commercial vessel strike mortalities of cetaceans are likely undocumented, as most probably go unreported and most whales killed by vessel strike probably sink rather than washing up on shore. Kraus et al. (2005) estimated that 17 percent of vessel strikes are actually detected. Of the 11 cetacean species known to be threatened by vessel strikes, fin whales are the mostly commonly struck species (Laist et al. 2001; Vanderlaan and Taggart 2007). While any vessel has the potential to hit whales, in most cases, lethal or severe injuries are caused by vessels 80 meters or longer, travelling 14 knots or faster (Laist et al. 2001).

Vessel traffic within the action area can come from both private (e.g., commercial, recreational) and federal vessels (e.g., military, research), but traffic that is most likely to result in vessel strikes comes from commercial shipping. The North Atlantic is one of the most traveled areas in the world for marine shipping. While the Port of Boston, the only major port near the action area, is by no means the busiest of U.S. ports (U.S. Maritime Administration 2016), it experiences high vessel traffic (Table 7), posing a substantial risk of ship strike to blue, fin, and sei whales.

Table 7: Number of port calls for the Port of Boston from 2013 to 2017 by month. NA indicates not available. Data from https://www.massport.com/port-of-boston/about-port-of-boston/port-statistics/.

Month	2013	2014	2015	2016	2017
January	2,588	6,203	5,990	4,978	3,227
February	4,554	5,038	2,907	3,230	2,038
March	5,103	4,016	4,954	4,335	4,624
April	4,252	4,751	3,653	4,923	3,157
May	4,051	3,918	5,526	5,302	4,330
June	3,405	5,678	4,048	4,055	5,855
July	3,159	5,341	7,181	5,093	NA
August	5,886	4,319	4,695	5,018	NA
September	2,506	4,737	4,408	4,465	NA

Month	2013	2014	2015	2016	2017
October	5,916	4,996	5,276	2,647	NA
November	5,966	4,852	5,957	6,156	NA
December	4,625	6,199	5,400	3,652	NA
Total	**52,011**	**60,048**	**59,995**	**53,854**	**27,806**

The potential population consequences of lethal vessel strikes are particularly profound on species with low abundance. Given their relatively high global abundance, this does not likely include fin, sei, or blue whales. 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 blue, fin, and sei whale stocks within U.S. waters likely to be found in the action area are given in Table 8 below (Henry et al. 2016). 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 8: Five-year mortalities and serious injuries related to vessel strikes for blue, fin, and sei whale stocks within the action area.

Species	Date Range	Ship Strikes	Annual Average
Blue whales	2010-2014	0	0
Fin whales	2010-2014	16	3.2
Sei whales	2010-2014	4	0.8

7.4 Whale Watching

There are numerous whale watching operations within the action area (O'Connor et al. 2009). Whale watching is a rapidly-growing business with more than 3,300 operators worldwide, serving 13 million participants in 119 countries and territories (O'Connor et al. 2009). Although considered by many to be a non-consumptive use of cetaceans with economic, recreational, educational and scientific benefits (García-Cegarra and Pacheco 2017), whale watching has the potential to impact whales in a variety of ways (reviewed in Parsons 2012). In some cases, whale watching vessels have a high frequency of collision with whales (Parsons 2012). Whale watching vessels can also contribute to underwater noise that may affect whales (Parsons 2012). Harassment from whale watching vessels has been known to cause whales to alter surfacing, acoustic, and swimming behavior and can lead to changes in direction, group size, and coordination (Lesage et al. 2017; Parsons 2012; Senigaglia et al. 2016). In addition, preferred habitats may be abandoned if disturbance levels are too high (Parsons 2012). The particular response observed appears to be dependent on factors such as vessel proximity, speed, and direction, as well as the number of vessels in the vicinity. While numerous short-term behavioral responses to whale watching vessels are well documented, much less is known about long-term negative effects. However, in a recent study of humpback whales (*Megaptera novaeangliae*) off the coast of New England, Weinrich and Corbelli (2009) found no detectable impacts on calf production or survival. Nonetheless, as longitudinal research on these species continues, we will soon have a better understanding of the population-level, long-term impacts of whale watching (New et al. 2015; Senigaglia et al. 2016).

With the high density of whales found in the action area, there are numerous whale watching operations that may impact blue, fin, and sei whales here (Wiley et al. 2008). While a voluntary conservation program aimed at protecting whales from the impacts of whale watching was implemented in the northeastern U.S. in 1998, there is little compliance with the program, making whales in this region subject to many of the threats that can result from whale watching (Wiley et al. 2008).

7.5 Sound

Cetaceans generate and rely on sound to navigate, hunt, and communicate with other individuals and anthropogenic sound can interfere with these important activities (Nowacek et al. 2007). Anthropogenic sound in the action area may be generated by commercial and recreational vessels, sonar, aircraft, military activity (discussed in Section 7.6), seismic exploration, in-water construction activities, wind farms, and other human activities. These activities occur to varying degrees throughout the year and may lead to behavioral disturbance or even physical injury, both of which have the potential to negatively impact individual fitness. Behavioral disturbances may include changes in surfacing, diving, orientation, and vocalizations (Gomez et al. 2016; Nowacek et al. 2007). Physiological responses can include stress-related changes such as increases in heart rate, respiratory rates, stress hormones, and temporary or permanent hearing threshold shifts (Kunc et al. 2016; Nowacek et al. 2007).

Commercial shipping traffic is a major source of low frequency anthropogenic sound globally (NRC 2003). Large vessels emit predominantly low frequency sound which overlaps with many mysticetes predicted hearing ranges [seven hertz (Hz) to 35 kilohertz (kHz), (NOAA 2016)] and may mask their vocalizations and cause stress (Rolland et al. 2012). Other commercial vessels (e.g., whale watching, fisheries, etc.) and recreational vessels also operate within the action area and may produce similar sounds, although to a lesser extent given their much smaller size. Nonetheless, even sound from small whale watching vessels can cause auditory masking, behavioral responses, and temporary threshold shifts in cetaceans (Nowacek et al. 2007). Anthropogenic sound from vessel traffic may be particularly prevalent in shallower waters (13 to 19 meters). At greater foraging depths of 100 to 200 meters (Croll et al. 2001; Goldbogen et al. 2011), less but still substantial vessel traffic sound can be heard. Modelled anthropogenic noise from commercial vessel traffic within the action area can be seen in Figure 10 below.

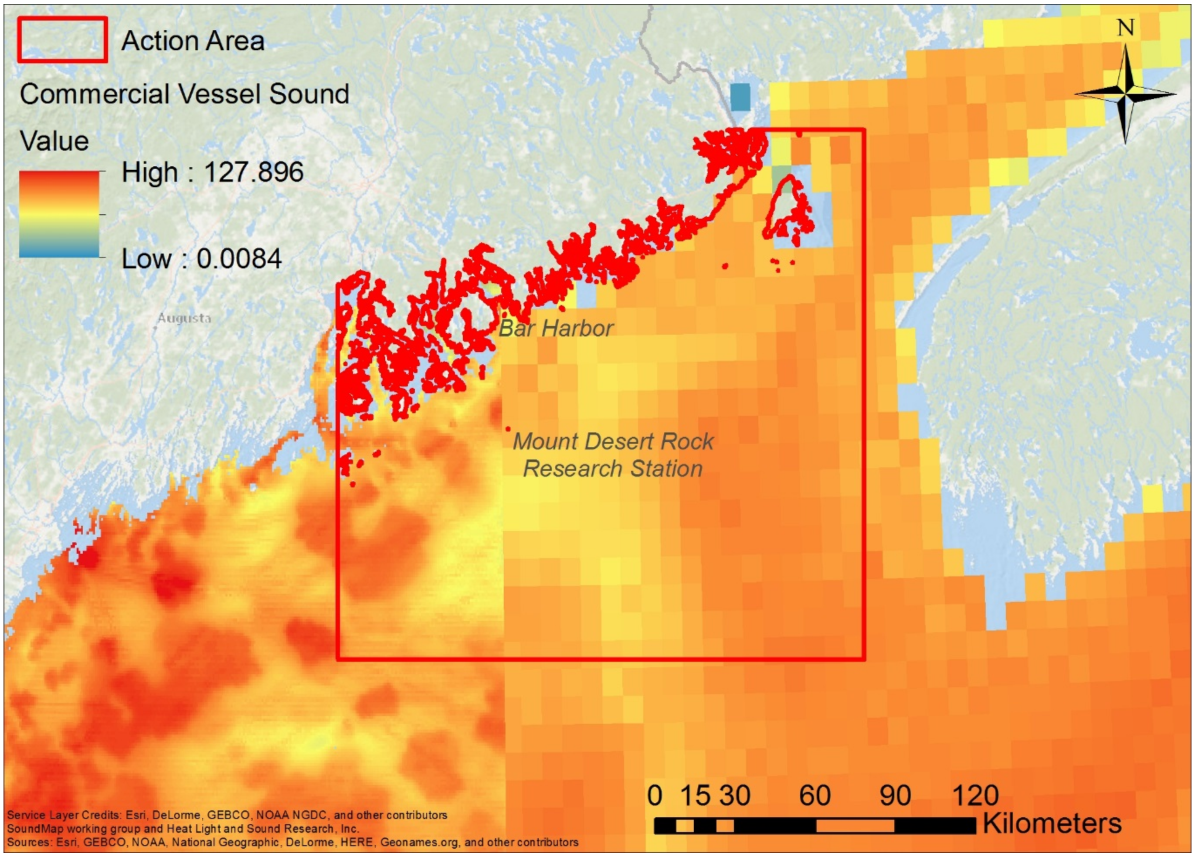

Figure 10: Commercial vessel traffic sound in decibels, one-third-octave centered at 100 hertz at 30 meters, within the action area. Data from http://cetsound.noaa.gov/.

Sonar systems are used on recreational, commercial, 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 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 et al. 2016). For further discussion of military sound on the ESA-listed species considered in this opinion see Section 7.6.

Aircraft within the action area may consist of small commercial or recreational airplanes or helicopters, or large commercial airliners. These aircraft produce a variety of sounds that could potentially enter the water and impact cetaceans. 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 et al. 2007).

While the North Atlantic Ocean has been subject to drilling for oil and gas in the past, there are currently no planned or active lease sales in the North Atlantic (BOEM 2017). However, seismic surveys involving airguns for oil and gas exploration, as well as for scientific research and/or geological purposes, have and may occur in the action area (82 FR 26244). Seismic airguns generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of 10 to 20 seconds for extended periods (NRC 2003). Most of the energy from the guns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235 to 240 decibels at dominant frequencies of five to 300 Hz (NRC 2003). Most of the sound energy is at frequencies below 500 Hz, which is within the hearing range of baleen whales (Nowacek et al. 2007). In the United States, seismic surveys involving the use of airguns with the potential to take marine mammals are covered by incidental harassment authorizations under the MMPA, and if they involve ESA-listed species, undergo formal ESA section 7 consultation. The Bureau of Ocean Energy Management authorizes oil and gas activities in U.S. 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 oil and gas activities on ESA-listed species can be found in recent biological opinions on the Bureau of Ocean Energy Management activities (e.g., NMFS 2013)

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 and is often associated with wind farms. Currently there is one operational offshore windfarms off the east coast of the U.S., the Block Island Wind Farm, but more are likely to become operational in the near future (DOE and DOI 2016). The Block Island Wind Farm is just outside the action area, located off Block Island, Rhode Island, and became operational in December 2016. Near the action area, there are three wind farm projects (75 FR 81637; 78 FR 33897; 79 FR 70545) consisting of five active leases, and another area where leasing may occur (77 FR 75187). Construction on these projects has not begun, but it may during the 5-year extent of Permit No. 20951. While the full extent of impacts from wind farms to whales is unknown, there are likely much greater impacts during construction than during operation (Madsen et al. 2006).

7.6 Military Activities

The U.S. Navy has a major submarine facility (Portsmouth Naval Shipyard) and conducts military readiness activities within the action area (Atlantic Fleet Training and Testing [AFTT], Figure 11). Military readiness activities can be categorized as either training or testing exercises. 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. In addition to these testing and training activities, the Navy operates Surveillance Towed

Array Sensor System Low Frequency Active sonar (SURTASS LFA) within the action area. SURTASS LFA utilizes low frequency sounds to detect and monitor submarines.

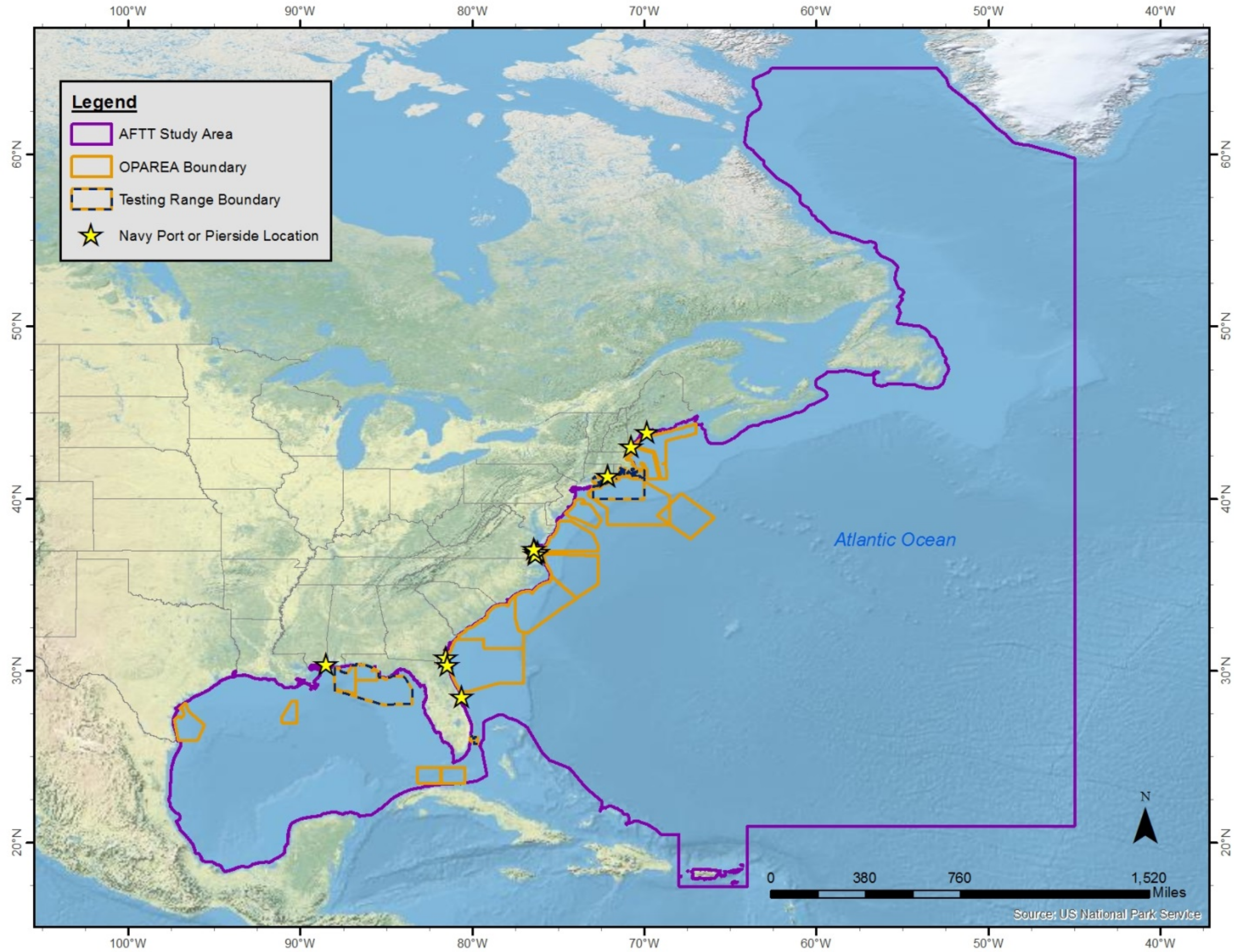

Figure 11: Navy Atlantic fleet training and testing area. OPAREA stands for at-sea Operating Area and is where training exercise and system qualification tests are routinely conducted.

U.S. Navy activities are likely to produce sound and visual disturbance to cetaceans and may result in vessel strikes and/or other physical injury. Take of ESA-listed cetaceans within the action area for these Navy activities has been authorized and previously consulted on (NMFS 2015; NMFS 2016a). Our previous biological opinions considering the effects of Navy activities within the action area resulted in incidental take statements because we concluded that the Navy's actions were not likely to jeopardize the continued existence of ESA-listed species, nor adversely modify designated critical habitat. Effects of Navy's activities on ESA-listed cetaceans include behavioral disturbance, temporary or permanent hearing threshold shifts, injury, and mortality. More details regarding the effects of Navy activities on ESA-listed cetaceans can be found in recent biological opinions considering the U.S. Navy's actions (NMFS 2015; NMFS 2016a).

7.7 Fisheries

Entrapment and entanglement in fishing gear is a frequently documented source of human-caused mortality in cetaceans (see Dietrich 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 (van der Hoop et al. 2017b), which may have significant sub-lethal energetic impacts and subsequent effects on reproduction (van der Hoop et al. 2017a). 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 fishing-related mortalities. Cetaceans also 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 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 et al. 2016). Given their relatively high global abundance, this does not likely include fin, sei, or blue whales. Nevertheless, all species of cetaceans may face threats from derelict fishing gear.

The latest five-year average mortalities and serious injuries related to fisheries interactions for blue, fin, and sei whale stocks within U.S. waters likely to be found in the action area are given in Table 9 below (Henry et al. 2016). 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 9: Five-year mortalities and serious injuries related to fisheries interactions for blue, fin, and sei whale stocks within the action area.

Species	Date Range	Entanglements	Annual Average
Blue whales	2010-2014	0	0
Fin whales	2010-2014	16	3.2
Sei whales	2010-2014	4	0.8

In addition to these direct impacts, cetaceans may also be subject to indirect impacts from fisheries. Many cetacean species are known to feed on species of fish that are harvested by humans (Ruzicka et al. 2013). 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 populations. Even species that do not directly compete with human fisheries could be indirectly affected by fishing activities through changes in ecosystem dynamics (DeMaster et al. 2001; Gavrilchuk et al. 2014). In general, the effects of fisheries on whales through changes in prey abundance remain unknown.

7.8 Pollution

Contaminants can cause adverse health effects in cetaceans. Contaminants may be introduced by rivers, coastal runoff, wind, ocean dumping, dumping of raw sewage by boats, and various industrial activities, including offshore oil and gas or mineral exploitation (Garrett 2004; Grant and Ross 2002; 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 such as cetaceans, including immune system abnormalities, endocrine disruption, and reproductive effects (Krahn 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 in waters have declined, although the more persistent chemicals are still detected and are expected to endure for years (Law 2014) with the potential for health consequences in marine mammal populations.

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

Cetaceans are also impacted by marine debris, which includes: plastics, glass, metal, polystyrene foam, rubber, and derelict fishing gear (Baulch and Perry 2014; Li et al. 2016). Marine debris is introduced into the marine environment through ocean dumping, littering, or hydrologic transport of these materials from land-based sources. Even natural phenomena, such as tsunamis and continental flooding, can cause large amounts of debris to enter the ocean environment. 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).

Nuisance species are aquatic and terrestrial organisms, introduced into new habitats throughout the United States and other areas of the world that produce harmful impacts on aquatic ecosystems and native species (http://www.anstaskforce.gov). They are also referred to as invasive, alien, or nonindigenous species. Introduction of these species is cited as a major threat to biodiversity, second only to habitat loss (Wilcove et al. 1998). They have been implicated in the endangerment of 48 percent of ESA-listed species (Czech and Krausman 1997) and are likely a leading cause of animal extinctions (Clavero and Garcia-Berthou 2005). In the marine environment, invasive species are widespread primarily as a result of international shipping and aquaculture with only 16 percent or less of marine ecoregions having no reported marine invasives (Molnar et al. 2008). While invasive species are not considered a major threat to cetaceans, they are likely to alter the ecosystem dynamics upon which cetaceans depend and may act as vectors for disease (Bax et al. 2003).

7.9 Scientific Research

Scientific research similar to that which would be conducted under Permit No. 20951 has and will continue to impact blue, fin, and sei whales that may be found in action area. Currently, there are seven active research permits that may affect the blue, fin, and sei whale populations considered in this opinion (Permit Nos. 16239, 16325, 17355, 19091, 19315, 19674, and 20605). The primary objective of these permitted studies is to monitor populations or gather data for behavioral and ecological studies. These currently permitted activities may directly or incidentally result in harassment, stress, and injury. No mortalities are authorized for any animal of any age under these existing permits and no mortalities have been reported as a result of activities carried out under these permits. It is important to note that the research activities that would be conducted under Permit No. 20951 would be in addition to those conducted under these other research permits. Seven active research permits, with Permit No. 20951 representing the eighth, represent substantial research on blue, fin, and sei whales within a relatively small geographic region. As such, many individuals would be subject to more than one activity within a given year, and in some cases could be subject to the same activity multiple times within a single year.

However, all permits contain conditions requiring the permit holders to coordinate their activities with the NMFS' regional offices and other permit holders and, to the extent possible, share data to avoid unnecessary duplication of research and associated impacts to cetaceans. In addition, research activities under many of the existing permits occur over the entire range of the species rather than being conducted only within the limits of the action area for Permit No. 20951. The current permits have undergone ESA section 7 consultation and for each permit, we concluded that the research activities were not likely to jeopardize the continued existence of ESA-listed species, nor adversely modify designated critical habitat.

As detailed further below in our response analysis (Section 8.4), cetaceans may respond to research activities in a variety of ways including no obvious response, minor behavioral disturbances, avoidance and stress-related response, temporary abandonment of important behaviors such as feeding and breeding. In rare cases whales may become injured, infected, and possibly even die when biological samples are taken or implantable tags are used (NMFS 2017a; NMFS 2017b). The fact that multiple permitted "takes" of ESA-listed cetaceans is already permitted in the action area and is expected to continue to be permitted in the future means that research has the ability to contribute to or even exacerbate the stress response of cetaceans to other threats occurring in the action area.

8 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 potential stressors associated with the proposed action, 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 of 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.

8.1 Stressors Associated with the Proposed Action

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. 20951 would authorize several research activities that may expose ESA-listed cetaceans 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 at non-ESA listed cetaceans are not expected to present any stressors to ESA-listed cetaceans, and so these activities are not considered further.

Vessel surveys and close approaches would present a range of stressors including vessel traffic, discharge, and visual and auditory disturbances. Given the non-invasive nature of documentation, it is not expected to produce any stressors aside from those associated with vessel surveys and close approaches. As such, the effects of documentation will not be discussed further. Unmanned aerial surveys would expose cetaceans to noise and visual disturbance depending on the UAS altitude. Biopsy sampling carries the stressor of a minor puncture wound and tissue collection.

8.2 Mitigation to Minimize or Avoid Exposure

Several aspects of the proposed action are designed to minimize ESA-listed species' exposure to the potential stressors associated with the research activities. These include the experience and measures taken by the researchers and conditions specified in the permit, as proposed by the Permits Division.

Ms. Zoidis and her collaborators at the College of the Atlantic have extensive experience conducting research on cetaceans. As noted in Section 1.1, all previous permits for Ms. Zoidis and the College of the Atlantic underwent section 7 consultation and resulted in biological opinions concluding that the research was not likely to jeopardize the continued existence of ESA-listed species, nor destroy or adversely modify designated critical habitat. In addition, in her permit application, Ms. Zoidis outlines the following mitigation measures designed to minimize exposure to cetaceans:

> "As in previous studies and our previous permitted activities, we will minimize the potential impacts of both direct and indirect impacts from close approach, photo-ID, and biopsy efforts, by utilizing the following steps:
>
> *Behavioral and photo-identification*
>
> Our photographic approaches will be as short in duration as possible and will not exceed effort time limits for any one focal individual or group (15 minutes to not more than two hours). We will approach the animals at slow speed (less than 10 knots), and obliquely (at a 45 degree angle, rather than direct movement towards them) so as to both allow them to continue their activities, and to not overtake or disturb them (with the exception of humpback whales, which for fluke photos, a direct but posterior approach is needed). These approach methods are based on our decades of direct research experience with the target species and the other species listed for photo ID takes in this permit application. We estimate that the number of approaches will be no more than five on any individual, per day.
>
> The closest point of approach during photo-ID from a vessel will be 15 meters for any species or age class. Every effort will be made not to separate animal(s) from their group or divide them by vessel maneuvering. The use of telephoto lenses and binoculars will ensure quality photographs or video from a distance that does not impact the animals.
>
> We will cease approach after we have obtained suitable identification photographs, which will be easily assessed through the use of digital photography. We will avoid multiple repeat approaches of the same groups of whales at separate times on a given day. We will

not work any mother-calf group that exhibits extreme avoidance (constantly moving away from the vessel, does not settle, rest, linger, etc.) or shows signs of stress (change in respiration rates, increase in surface activity, change in direction, change in speed of travel, etc.) as a result of our approach. If with our collective expertise we determine the short-term changes in the above behaviors to be as a result of our actions, we will abandon the effort. The Principal Investigator and all Co-Investigators have decades of experience of working with Gulf of Maine species and are well acquainted with the typical behaviors, and therefore can identify easily any changes or indications of harassment (i.e., avoidance, change in direction, sudden dives, change in respiration rates, etc.). We will suspend any photo-ID effort if we determine that our activities result in any disruption of normal whale activities (i.e., feeding, rest, milling, or slow or fast travel).

While assessing and generally while working, we will not travel in front of or too close to (less than 25 meters), or block any intended path for pairs or small groups of whales that are attempting to stay together. We will not interfere with any travel or contact between whales. We will be especially prudent and cautious when approaching any groups or pairs with a calf and will assess the behavior prior to close approach. We will station observers who are responsible for documenting and reporting in real time any indication of take (i.e., changes in respiration rates, sudden onset of surface activity, bubble blasts, change in directions specifically away from the vessel, etc.). We will avoid separating or coming between a mother-calf pair.

Finally, following any photo-ID approaches, we will move off to a distance of minimum 200 meters from the group but continue to observe for 15 minutes minimum or until any reaction behaviors cease in order to monitor and evaluate effects of our activities and/or to ensure changes in animal behavior are not long lasting.

Both the Allied Whale and the Cetos team scientists have long standing collaborations and interactions with all research and management groups in New England and that may occur in the study area. Such groups include but are not limited to; The Provincetown Center for Coastal Studies, the former Whale Center of New England, the New England Aquarium, the Northeast Regional Fisheries Science Center (NOAA), NOAA's Office of Law Enforcement, the Department of Marine Resources (including Maine's Marine Patrol), the Gulf of Maine Research Institute, the University of Maine, and the Woods Hole Oceanographic Institute. We already have an existing system of coordination for interacting with other research groups when they come to our area to work in the Gulf of Maine. We will continue to communicate via email, conference call, and in-person meetings prior to, during, and following each study field season in order to effectively collaborate and coordinate research efforts. This will ensure that we do not work in the same "sub-areas" within the Gulf of Maine on any given day or week. If the Allied Whale/Cetos team has worked in the local area within the timeline of the visiting researchers, we will inform them prior to their work start of all the locations and species worked in order to minimize impacts. Data on locations, species, activities, and any permitted activities will be shared in order to minimize disturbance.

UAS

Use of UAS inherently may reduce effects such as those from larger aircraft or large vessels when used in surveys; the latter can lead to a behavioral change and increased dispersion of groups of marine mammals altering the observed behavior during the collection of useful survey data in the use of abundance estimates (Koski et al. 2009). There are currently no documented impacts to marine mammals for UAS flights at altitudes of 40 and 60 meters. Use of equipment such as the device we plan to use (the DJI Phantom 4) will provide minimal effects. This model allows for greater control in moderate wind situations (20 knots or less), automated survey tracks integrated with a Global Positioning System and higher lens resolution, which combine to allow for a much greater breadth of research and survey capability with quality results. No effects are expected.

Biopsy

Every effort will be made to reduce the impact of biopsy sampling on individuals approached. During biopsy operations we will reduce the numbers of approaches and interaction time as much as possible. Animals will be monitored at all times and if an animal or animals appear to be in distress, the operation will be halted. We will use the same biopsy tips and darts and sterilization protocols used during our previous permitted work that was shown to have minimal effects on the animals.

The closest point of approach during biopsy sampling will be as follows: for large whales we will approach to within 20 to 30 meters when using the crossbow (no small species biopsy requested). We will approach at oblique angles with a goal of getting the sample from the left or right flank near the dorsal, not near the head or tail, and will never approach head on.

We will not travel in front of or too close to (less than 25 meters), or block any intended path for pairs or small groups of whales that are attempting to stay together. We will not interfere with any travel or contact between whales. The only exception to the close travel (less than 25 meters) would be during biopsy approaches, and these have been accounted for in take requests in the previous text.

Additionally, the age of calves for any biopsy would be minimum six months and they must be at least one-third the length of the companion individual. Juveniles are considered to be between 12 months (post weaning) to sexual maturity, which is largely determined by animal size and behavior (often indicated also by conspecific size in the group, i.e., juveniles tend to hang out with animals of the same age range), and these are generally considered one to six years old for both baleen and toothed whales. Mothers with non-neonate calves may be biopsy sampled.

Impacts from biopsy will be reduced and mitigated whenever possible through the following procedures:

- We will use small vessels for biopsy approaches and for post-biopsy follows.
- We will limit the number of biopsy attempts to no more than three on any individual, in the case of missed biopsies. We estimate five approaches will be the maximum approaches for a successful biopsy.
- We will not follow an animal for biopsy purposes more than two hours total. The number of close approaches (less than 25 meters) to a single individual or group will be limited to no more than five and total time in active pursuit will not exceed one hour. Mathews (1986) suggest that repeated approaches tend to increase the likelihood that an individual will experience disturbance from the vessel itself. This agrees with other observations of baleen whale responses to repeated close approaches by vessels (Richardson et al. 2013; Richardson and Wursig 1997).
- We will biopsy what is known as the least reactive part of the body (near the dorsal, high up on the body) and will limit the impact to each individual animal.

We will have both short- and long-term post-biopsy procedure monitoring to evaluate the effects of our activities and to ensure animals have recovered, as follows:

- Animals will be monitored at all times. We will terminate a biopsy approach if an animal or animals appear to be in distress through boat maneuvering or other operations prior to biopsy sampling. The operation will be halted if we see any signs of avoidance such as evasive maneuvering at the surface or subsurface (when visible), premature termination of a surfacing series, or surface behaviors indicative of disturbance (such as a 'tail swish' or 'peduncle lob').
- We will assess our photographs and field notes, and focus our field observations to identify groups and animals that have been approached previously and will assess effects on any resighted animals.
- We will not work small "resident" local groups that sometimes occur for any length of time and all take limits will be observed daily.
- All biopsy efforts will be captured by high definition video for later debriefing when possible.
- We will minimize cumulative impacts by keeping appraised of other research activities in the area through our ongoing collaboration with other researchers and local whale watch boats.
- Allied Whale has time tested protocols and mechanisms for staying in frequent communication with all vessels in the areas. These protocols are well established.
- We will collaborate with colleagues on projects, coordinate timing and activities, and will share information and identification photographs.
- We will coordinate with the National Marine Fisheries Service staff and researchers.

Sterilization and/or disinfection protocols for biopsy darts:

Biopsy dart tips will be cleaned with detergent and flame sterilized between use and stored in two percent hydrogen peroxide until required for tissue collection. College of the Atlantic, the governing body for Allied Whale, has not applied for an Institutional Animal Care and Use Committee protocol since our procedures do not represent any change, significant or otherwise from any significant changes in previously approved techniques widely utilized in marine mammal biopsy and which we used in our previous permit without any effect. All biopsy protocols proposed and documented in this application are standard for the marine mammal research industry, prevent any risk of infection, and err on the side of caution. Funding will not be from federal sources and will remain in the private sector.

Our PI and CIs' range of experience is extensive and all leads involved are experienced at how to minimize impacts via experienced field–boat driving skills. We have protocols in place for minimal animal interaction time and for minimizing disturbances both via approach techniques, limited our days on the water, and only working animals that do not avoid our vessels."

In addition to these mitigation measures taken by Ms. Zoidis and her colleagues, the Permits Division proposed to include terms and conditions in the proposed permit, which include several mitigation measures to minimize exposure and impacts to ESA-listed species (see Appendix A, Section III of Draft Permit). As part of these terms and conditions, the Permits Division would require individuals conducting the research activities to possess qualifications commensurate with their roles and responsibilities. In accordance, the only personnel authorized to conduct the research would be Ms. Zoidis, listed Co-Investigators, and research assistants. We anticipate that requiring that the research be conducted by experienced personnel would further minimize impacts to the ESA-listed cetaceans that may be exposed to the stressors, as these individuals should be able to recognize adverse responses and cease or modify their research activities accordingly.

8.3 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 specifies the applicant's and the Permits Division's proposed exposure of ESA-listed species to research activities associated with vessel surveys, close approaches, documentation, unmanned aerial surveys, and biopsy sampling. In accordance with our regulations (50 C.F.R. §402), here we evaluate whether or not these proposed levels of exposure are reasonably certain to occur.

In her application, Ms. Zoidis states the follow as justification for the proposed takes in Table 1:

"The [take] numbers were selected on the basis of take requests approved in our previous permit. Further, those approved take requests [for biopsy sampling] were based on statistical analyses that utilized the then known variance in stable isotope signals to estimate the sample size needed (plus a small approximately 10 percent buffer) to create a statistical power of 80 to 90 percent. Activity conducted under our previous permit, and data collected therein, confirm these estimates. Thus, our take request has been minimized to sufficiently represent summer-resident populations in the Northern Gulf of Maine.

A very few individuals may be taken more than once annually for biopsy sampling as described above, however the frequency and type of take activity per individual per year (per field season if less than one year) will still be restricted to the numbers listed [in the] Take Table. Care will be taken not to approach the same animal more times than necessary in one day (estimated no more than five times) for a successful biopsy sample. For the small subset of animals that may have repeat biopsy, sampling will be separated by a minimum of one week. If the biopsy effort does not result in a successful sampling, biopsy attempts will not be taken on one animal more than three times in one day. The resample rate based on a 20 percent estimate per above would result in: six blue whales; 20 adult fin whales and two fin whale calves; 20 adult humpbacks and two humpback calves; six minke whales and six sei whales potentially being resampled in one year. These are maximum potential takes and as such likely would be much less and not across the board for the aforementioned species.

A whale calf is considered zero to 11 months in age. Calves can be distinguished by size in relation to the mother and proximity to mother as well as by behavior. Juveniles are considered to be between 12 months (post weaning) to sexual maturity, which is again largely determined by animal size and behavior (often indicated by conspecific size in the a group; i.e., juveniles tend to hang out with animals of the same age range), and these are generally considered one to six years old for both baleen and toothed whales. Adults would be animals in the general adult large size range for that species which is well known and we are familiar with.

An estimate of the sampling rate over the five year life of the permit would be would a maximum of five times, but that would be rather rare and for 95 percent of the individuals we encounter we estimate one biopsy per the permit lifetime. For those other individuals that we resample, we estimate that would only take place for fewer than five percent of individuals studied. It is possible however that a very small subset of individuals that we recognize would have a maximum of five biopsies to allow for the analysis in the isotope study. There is a low residency rate in the Gulf of Maine in general, though we do get recurrence of individual humpbacks and less often, fin whales. Allied Whale maintains the photo ID catalogue for fin whales and humpbacks, so we can keep track of which animals have been biopsied before and restrict resampling to max one per individual per year

Note that calf biopsy takes are only requested for humpbacks and fin whales. Our decades-long study of the Gulf of Maine shows there are no other species with calves that

> occur during the summer months when our research occurs. Calves are estimated to be at least six months of age and one third the length of the female. Mothers of non-neonate calves may be biopsy sampled. Calves on the Gulf of Maine feeding grounds would be at least three to six months old in this portion of their habitat. The calves of any of our target species are not born in the Gulf of Maine and the animals travel from birthing grounds to feed here. The minimum age of any calf accompanying a mother would be three months and more likely six months based on typical ages found in the Gulf of Maine.
>
> The Photo-ID research [i.e., all non-biopsy sampling takes] involves a larger list of species known to occur in the Gulf of Maine. Any other species not on the above list would be considered incidentals or rare species and would not be approached within the legally restricted distance limits. There will be no import or export activity for target or non-target species."

With this explanation of the requested take number estimates, our own evaluation of these take numbers in comparison to other researchers' annual reports for similar species and activities within a similar area (NMFS 2010a; NMFS 2010b; NMFS 2014; NMFS 2016d), and the conservative assumption that all take that the Permits Division authorized under Permit 20951 *could* occur, we adopt the exposure of ESA-listed species specified in Table 1. This exposure could occur year-round, with the duration of each exposure ranging from 15 minutes to two hours as described in Section 3.

Having estimated or adopted the applicant's and Permit Division's exposure of ESA-listed cetaceans to research activities that would be authorized under Permit No. 20951, we now further consider the meaning of the numbers specified in Table 1. Despite their names, the column titled *No. Takes* and *Takes Per Animal* in Table 1 do not necessarily reflect the number of animals that would be exposed or their repeat exposure, respectively (as further detailed below). Instead, *No. Takes* represent the maximum number of *takes* that would be authorized and *Takes Per Animal* represents the maximum number of intentional repeat *takes* of the same individual, as further detailed below.

Given the Permits Division's issuance and counting of takes[3] and the fact that researchers may often not be able to identify individual animals in the field, the number specified in *No. Takes* in Table 1 does not necessarily reflect the number of animals that would be exposed to the research activities under Permit No. 20951. For example, if researchers take an animal on one day it would count as one individual taken. If the same individual were taken on another day that same year without researchers realizing it had already been sampled, it would be counted as a different individual taken. This would result in the total annual number of individuals taken being less than in Table 1. This scenario also illustrates that researchers may unintentionally take the same

[3] The Permits Division directs researchers to count and report one take per cetacean per day including all approaches and procedure attempts, regardless of whether a behavioral response to the permitted activity is observed.

individual more than once in a single year, and thus may not be able to adhere to the number specified in the *Takes Per Animal* column. However, given the nature of fieldwork (unpredictability, reliance on equipment and personnel availability, and good weather for operations, etc.) and the vast ranges of ESA-listed cetaceans considered in this opinion, it is likely that many, if not all animals, would only be taken once or at most two to three times.

Given researchers inability to identify each individual animal in the field, the *No. Takes* presented in Table 1 represents the maximum number of individuals that could be exposed annually, and it is possible that individuals could be exposed more than the number of times specified in *Takes Per Animal* in a given year. This annual exposure from directed research represents a relatively small percentage (36 percent of the population or less based on Table 1 and population abundance estimates given in Section 6.2) of the individuals from the populations of blue, fin, and sei whales that may be found in the action area. Furthermore, most of this exposure would only be to vessel surveys (and associated close approaches, documentation, and unmanned aerial surveys), with a much smaller percentage of each population (eight percent or less) being exposed to biopsy sampling.

8.4 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 would be authorized under Permit No. 20951. These include stressors associated with vessel surveys, close approaches, unmanned aerial surveys, and biopsy sampling. As discussed in Section 8.1, documentation itself is not expected to produce any stressors, and as such, no response to documentation is expected beyond the response to the associated vessel surveys and close approaches. 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 (Beale and Monaghan 2004; Frid 2003; Frid and Dill 2002; Gill et al. 2001; Harrington and Veitch 1992; Lima 1998; 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 (Frid and Dill 2002; Romero 2004; Sapolsky et al. 2000; Walker et al. 2005). Further, these responses have been associated with abandonment of sites (Sutherland and Crockford 1993), reduced reproductive success (Giese 1996; Mullner et al. 2004), and the death of individual animals (Bearzi 2000; Daan 1996; Feare 1976).

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 (Busch and Hayward 2009; Gulland et al. 1999; St. Aubin and Geraci 1988; St. Aubin et al. 1996; Thomson and Geraci 1986). 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 (Busch and Hayward 2009; Cattet et al. 2003; Dickens et al. 2010; Dierauf and Gulland 2001a; Dierauf and Gulland 2001b; Elftman et al. 2007; Fonfara et al. 2007; Kaufman and Kaufman 1994; Mancia et al. 2008; Noda et al. 2007; Thomson and Geraci 1986). 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; Cowan and Curry 2008; Herraez et al. 2007). 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 2001b). Mammalian stress levels can vary by age, sex, season, and health status (Hunt et al. 2006; Keay et al. 2006; Peters 1983). In addition, smaller mammals tend to react more strongly to stress than larger mammals (Hunt et al. 2006; Keay et al. 2006; Peters 1983).

In sum, the common underlying stressor of human disturbance caused by the research activities that would occur under Permit No. 209591 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.

8.4.1 Vessel Surveys and Close Approaches, and Documentation

Vessel surveys and close approaches would expose blue, fin, and sei whales within the action area to vessel traffic, discharge, and visual and auditory disturbances. Responses to each of these stressors are described below.

Vessel surveys necessarily involve transit within the marine environment, and the transit of any vessel in waters inhabited by whales carries the risk of a vessel strike. As noted in Section 6.1.1, responses to vessel strike include death, serious injury, and/or minor, non-lethal injuries, with the associated response depending on the size and speed of the vessel, among other factor. Vessels traveling at speeds greater than approximately 10 knots, especially large vessels (80 meters or greater), are more likely to cause serious injury or death (Conn and Silber 2013; Jensen and Silber 2004; Laist et al. 2001; Vanderlaan and Taggart 2007). To our knowledge, there are only two instances of a cetacean research vessel striking a whale in over 40 years of NMFS permitting cetacean research activities. Both events involved North Atlantic right whales, not blue, fin, or sei whales, and appeared to be non-lethal (Wiley et al. 2016). As such the chances of a research vessel striking a blue, fin, or sei whale are remote. Furthermore, as noted in Section 6.1.1, Ms. Zoidis would use small vessels (seven to 15 meters) traveling at slow speeds (10 knots or less) that would be easily maneuvered away from oncoming whales. In addition, she and her team have extensive experience spotting cetaceans at sea. For these reasons, we believe the likelihood of one of her research vessel striking a whale is extremely low. As such, we find effects from this stressor to be discountable, 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 researchers experience operating and maintaining small vessels, it is unlikely that spills or discharges would occur. If discharge does occur, the amounts of leakage would be small given the proposed size of the research vessels that will be used and the related amounts of fuel oil and other chemicals onboard the vessels and would not be expected to affect whales directly, or pose measurable hazards to their food sources. Therefore, we conclude that effects from this stressor are discountable, 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, (Au and Green. 2000; Baker et al. 1983; Baumgartner and Mate 2003; Hall 1982; Isojunno and Miller 2015; Jahoda et al. 2003; Koehler 2006; Malme et al. 1983; Richardson et al. 1985; Scheidat et al. 2006; Watkins et al. 1981). Changes in cetacean behavior can correspond to vessel speed, size, and distance from the whale, as well as the number and frequency of vessel approaches (Baker 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 et al. 1988; Gauthier and Sears 1999; Hooker et al. 2001; Koehler 2006; Lusseau 2004; Richter et al. 2006; Weilgart 2007; Wursig et al. 1998). Observations of large whales indicate that cow-calf pairs, smaller groups, and groups with calves appear to be more responsive to close vessel approaches (Bauer 1986; Bauer and Herman 1986; Clapham and Mattila 1993; Hall 1982; Williamson 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 (*Balaena mysticetus*) and gray whales (*Eschrichtius robustus*) have been observed when engines are started at distances of 3,000 feet (Malme et al. 1983; Richardson 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. 20951 to blue, fin, and sei whales to be minimal for several reasons. First, Ms. Zoidis and her team have years of experience approaching cetaceans in a way designed to minimize disturbance and associated responses. Furthermore, in her application Ms. Zoidis notes that if her team observes any avoidance behaviors, research on that animal would be terminated. 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 Ms. Zoidis or more generally in the literature. In her application, Ms. Zoidis notes that previously observed responses to close vessel approaches "may include temporarily affecting animal(s) behaviors or foraging, causing minor changes in respiration rates or dive rates. Based on our decades of photo-ID research experience and the qualifications of the Principal Investigator and Co-Investigators, no long term or adverse impacts are expected. Any effects would be extremely short term and minimal and of no biological significance and no effects on the populations would occur." Thus, based on accounts from Ms. Zoidis's past research, responses documented in the literature, and the proposed method for closely approaching whales by vessel, we expect the proposed close approaches may produce short-term (several minutes) behavioral and stress responses, but would not significantly disrupt the normal behavioral patterns of whales to an extent that would create the likelihood of injury or impact fitness. Thus, even though the Permits Division proposes to authorize take of blue, fin, and sei whales under the MMPA as a result of harassment that may occur during vessel surveys and close approaches, we have determined that the effects of vessel surveys and close approaches are insignificant and do not constitute harassment under the ESA.

In summary, we find the effects of vessel strikes and discharge discountable since both events are extremely unlikely to occur. While we anticipate some ESA-listed cetaceans will exhibit mild, short-term behavioral responses to the presence of the research vessel and close approaches, we have determined that these responses would be insignificant. As such, we will not discuss the effect of vessel surveys and close approaches further.

8.4.2 Unmanned Aerial Surveys

Unmanned aerial surveys may cause visual or auditory disturbances to ESA-listed cetaceans. While the use of UAS to study cetaceans is in its infancy, current data indicate that cetaceans exhibit no behavioral response to UAS. For example Acevedo-Whitehouse et al. (2010) used a UAS at an elevation of 13 meters over blue, gray (*Eschrichtius robustus*), humpback, and sperm whales and observed no avoidance behaviors. Koski et al. (2015) used UAS over bowhead whales at a flying elevation of 120 meters with no behavioral responses noted. NMFS' Southwest Fisheries Science Center used UAS over killer whales (*Orcinus orca*) and found that at 35 meters flying elevation, there were no behavioral reactions (Durban et al. 2015). Three recent reviews covering the potential impacts of UAS on marine mammals found no data to indicate that ESA-listed cetaceans behaviorally respond to UAS (Christie et al. 2016; Marine Mammal Commission 2016; Smith et al. 2016). However, in a recent report submitted to NMFS for Permit No. 18636, researchers documented behavioral responses by southern right (*Eubalaena australis*) and humpback whales when UAS were flown at a height of approximately 12 feet (NMFS 2017g) above the animals. These responses consisted of mild, short-term change in behavior such as whales rolling over to view the UAS, or "bucking" before returning to pre-exposure behavior. Given the available information, we anticipate that in most cases, there would be no response to unmanned aerial surveys, but in some cases, mild short-term behavioral responses could occur. Given the nature of these responses, we do not expect they would significantly disrupt the normal behavioral patterns of whales to an extent that they would create the likelihood of injury or impact fitness. Thus, even though the Permits Division proposes to authorize take of blue, fin, and sei whales under the MMPA as the result of harassment that may occur during unmanned aerial surveys, we have determined that the effects of unmanned aerial surveys are insignificant and do not constitute harassment under the ESA. As such, we will not discuss the effects of unmanned aerial surveys further.

8.4.3 Biopsy Sampling

Under Permit No. 20951, Ms. Zoidis and her colleagues would be authorized to biopsy sample blue, fin, and sei whales. Biopsy sampling presents the stressor of a minor puncture wound for tissue collection. In general, it is difficult to distinguish between animals' reactions to the different stressors such as biopsy sampling 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) 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 trauma such as large shark-inflicted wounds within months (Corkeron et al. 1987; Dwyer and Visser 2011; Lockyer and Morris 1990).

Beyond the wound itself, biopsy sampling could cause a physiological stress response similar to that described 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 level, and muscle damage. However, given the small size of wounds created by biopsy sampling and the short duration over which the sampling occurs, stress responses to remote biopsy sampling are likely to be 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 mortality: 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 a result of biopsy sampling that would be conducted under Permit No. 20951. This is because all biopsy dart tips that Ms. Zoidis would use would 1) be thoroughly sterilized before sampling, thus minimizing any chances of infection, 2) sample the animal's dorsal region just below the dorsal fin, away from vital organs and sensitive areas, and 3) only penetrate the animal's blubber layer, not muscle, and thus result in no serious injury, death, or impacts to fitness.

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 et al. 2008; Noren and Mocklin 2012). In her application, Ms. Zoidis notes that in her past research she has "observed brief, momentary tail flicks or rapid dives, with a resumption of normal activities (feeding, travel, milling) on both humpbacks and fin whales within the same surfacing interval or by the next surfacing." 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 (Berrow et al. 2002; Gauthier and Sears 1999; Weinrich et al. 1991; Weinrich et al. 1992). This being said, when darts remain in animals it does not appear to result in mortality, infection, or lasting behavioral changes (Barrett-Lennard et al. 1996; Clapham and Mattila 1993; Parsons 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 normal behavior quickly, usually within 30 seconds to three minutes following biopsy/close approach (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 respond behaviorally 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 et al. 2005), but not others (Weinrich 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 their feeding grounds (Clapham and Mattila 1993; Weinrich et al. 1991), but on the feeding grounds, foraging whales are less likely to respond than resting whales (Weinrich 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 applicants (Section 8.2), we expect ESA-listed cetaceans to behaviorally respond to biopsy sampling by exhibiting short-term, minor to moderate changes in behavior. However, we do not expect these responses would significantly disrupt their normal behavioral patterns to an extent that it would create the likelihood of injury or impact 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 of a common dolphin (Bearzi 2000). While studies on the delayed, long-term impacts of biopsy sampling are lacking, the available data suggests no effects to fitness (Best et al. 2005; Noren and Mocklin 2012) particularly given that researchers often resample the same individuals within one week or over a number of years during permitted activities. 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.

8.5 Risk Analysis

In this section we assess the consequences of the responses to the individuals that have been exposed, the populations those individuals represent, and the species those populations comprise. Whereas the *Response Analysis* (Section 8.4) identified the potential responses of ESA-listed species to the proposed action, this section summarizes our analysis of the expected risk to individuals, populations, and species given the expected exposure to those stressors (as described in Section 8.3) and the expected responses to those stressors (as described in Section 8.4).

We measure risks to individuals of endangered or threatened species using changes in the individuals' "fitness," which may be indicated by changes the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When we do not expect ESA-listed animals exposed to an action's effects to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise. As a result, if we conclude that ESA-listed animals are *not* likely to experience reductions in their fitness, we would conclude our assessment. If, however, we conclude that individual animals are likely to experience reductions in fitness, we would 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 as proposed with the mitigation measures to minimize exposure and associated responses are expected reduce the long-term fitness of any individual ESA-listed cetacean. As such, the issuance of Permit No. 20951 is not expected to present any risk to populations, DPSs, or species listed under the ESA.

9 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 changes and their impact on ESA-listed and their critical habitats in the action area. This section is not meant to be a comprehensive socio-economic evaluation, but a brief outlook on future changes on 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 area. We did not find any information about non-Federal actions other than what has already been described in the *Environmental Baseline* (Section 7), which we expect will continue in the future. Anthropogenic effects include climate change, whaling, vessel strikes, whale watching, sound, military activities, fisheries, 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 cetacean populations.

10 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 8) to the *Environmental Baseline* (Section 7) and the *Cumulative Effects* (Section 9) to formulate the agency's 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 Endangered Species Act Protected Resources* (Section 6).

The following discussions summarize the probable risks the proposed action poses to threatened and endangered species. This summary integrates the exposure profile presented previously with the results of our response analysis for the proposed action considered in this opinion.

As discussed in Section 6.1, several ESA-listed species occur within the action area and may be affected by the issuance of Permit No. 20951, but are not likely to be adversely affected because the effects of the proposed action are insignificant or discountable. These include North Atlantic right whales, sperm whales, green turtles (North Atlantic DPS), hawksbill turtles, Kemp's ridley turtles, leatherback turtles, and loggerhead turtles (Northwest Atlantic DPS).

The remaining ESA-listed species considered in this opinion may be affected and are likely to be adversely affected by the proposed action. On an annual basis over the five-year life of Permit No. 20951, a small percentage of the populations of blue, fin, and sei whales that may be found in the action area would be exposed to biopsy sampling, the only research activity for which the effects were not determined to be discountable or insignificant. Based on the best available data, behavioral responses to biopsy sampling range from no response, to mild behavioral responses that are not expected to create the likelihood of injury or impact fitness. Biopsy sampling may also result in minor wounds and low-level stress responses, but it is not expected to result in infection, long-term adverse health impacts, or effects on fitness.

The status of each species, as described in Section 6, varies greatly. Globally, blue whale populations vary in size with some larger populations showing signs of an increase. The population within the action area however, is estimated to be relatively small, at 440 individuals and no information is available on its population trend. Similarly, fin whale populations world-wide vary in size, with some being quite large and experiencing increases in abundance. The population within the action area is estimated to be relatively large (estimated at 1,618 individuals), although no information on its population trend is available. Little is known about sei whales, but existing estimates indicate most populations are small, as is the case for the population found within the action area (estimated at 357 individuals, no trend data available).

A variety of current and past anthropogenic threats impact these ESA-listed cetaceans within the action area including climate change, whaling, vessel strikes, whale watching, sound, military activities, fisheries, pollution, and scientific research. Perhaps the most significant direct anthropogenic threats these cetaceans currently face are vessel strikes and entanglement in fishing gear. Although other factors remain significant threats, the direct impact on ESA-listed cetaceans is more difficult to assess. All of these activities are expected to continue into the future, but the magnitude at which, and their future impacts on the survival and recovery of these ESA-listed whale species, is not reliably predictable.

Considering the activities to which ESA-listed cetaceans within the action area are likely to be exposed, their potential responses to these activities, the status of each species, and the baseline anthropogenic threats they face, we determined that the issuance of research Permit No. 20951 would result in minor behavioral and physiological responses, which are not likely to result in negative consequences to the fitness of any individual cetacean.

11 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 the NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence or recovery of blue whales, fin whales, and sei whales. In addition, we find that the proposed action is not likely to adversely affect North Atlantic right whales, sperm whales, green turtles (North Atlantic DPS), hawksbill turtles, Kemp's ridley turtles, leatherback turtles, and loggerhead turtles (Northwest Atlantic DPS).

12 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. 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. 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(b)(4) and 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 activities associated with the issuance of Permit No. 20951 involve directed take for the purposes of scientific research. Therefore, NMFS does not expect the proposed action would incidentally take threatened or endangered species. However, we request that the Permits Division report to us the take as specified in Table 1 that actually occurs at the expiration of the permit, as well as any information on the response animals exhibited to those takes. Such information will be used to inform the *Environmental Baseline* and *Effects of the Action* sections in future consultations for similar research activities to be performed by Ms. Zoidis or other researchers.

13 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).

We make the following conservation recommendations, which would provide information for future consultations involving the issuance of permits that may affect ESA-listed whales as well as reduce harassment related to the authorized activities:

1. **Individual-Level and Aggregate Take Tracking**

   We recommend that the Permits Division improve their system for tracking the amount of take allowed under issued permits and realized for any given population of ESA-listed species during permitted activities. The Permits Division's current permit tracking system allows tracking of take (not necessarily number of individual animals) for an individual permit, and for understanding the extent of research at broad scales (e.g., number of research permits in a particular region). However, it remains difficult to quantify the number of animals taken and the extent of take each individual population of ESA-listed species may be subject to across permits. For example, the structure of Table 1 means that when reporting their actual take, researchers are not able to distinguish individuals that were subject to all of the procedures listed in the column "Procedures" from those that only received some of the procedures. Furthermore, there is currently no simple way to summarize the number of takes issued across permits for a given species within a given area, which is necessary for fully understanding the current level of authorized research in the environmental baseline for new research permits. In general, individual-level and aggregate take tracking would better enable the Permits Division and us to evaluate the impacts of multiple, simultaneous research efforts on ESA-listed individuals, populations, and species.

2. **Reporting**

   We recommend the Permits Division tailor the required reporting for research permits to go beyond that needed to demonstrate compliance in order to aid managers in collecting the information needed to better protect and conserve ESA-listed species. In requiring researchers provide annual reports, the Permit's Division is positioned to collect unprecedented, nationwide data on ESA-listed species, which in some cases may take years to become available in the peer-reviewed public literature. The Permits Division may consider discussing what data gaps exist with designated recovery coordinators and consultation biologists, working on specific reporting requirements that aid those managers in obtaining the necessary data, and making an annual report of these data available to managers and the public.

3. **Data Sharing**

   We recommend the Permits 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 applicable to all researchers permitted by NMFS will reduce impacts to trusted resources by minimizing duplicated research efforts. We recommend basic information reporting be required from each researcher at the expiration of each permit, including the species, location, number of individuals, and age, sex, and identity if known . This information could be further refined based on our second conservation recommendation above and then be made available to all other permit holders and/or applicants, and preferably the public. To help meet this need, data could be uploaded to one of several already established online repositories. For example, OBIS-SEAMAP allows researchers to upload spatial data regarding marine mega-vertebrate sightings (http://seamap.env.duke.edu/). Similarly, the IWC has a portal system (https://portal.iwc.int/) where researchers can contribute basic information on species sightings. In our experience, direct submission by researchers to the IWC portal is required by other countries (e.g., Australia) as a condition of research permits.

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 and with the resource managers. Such meetings may be a venue to discuss the details outlined in our second conservation recommendation.

In order for NMFS' Office of Protected Resources Endangered Species Act Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on or benefiting ESA-listed species or their critical habitat, the Permits Division should notify the Endangered Species Act Interagency Cooperation Division of any conservation recommendations they implement in their final action.

14 REINITIATION NOTICE

This concludes formal consultation for the Permits Division's proposal to issuance Permit No. 20951. 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.

15 References

Acevedo-Whitehouse, K., A. Rocha-Gosselin, and D. Gendron. 2010. A novel non-invasive tool for disease surveillance of free-ranging whales and its relevance to conservation programs. Animal Conservation 13(2):217-225.

Archer, F. I., and coauthors. 2013. Mitogenomic phylogenetics of fin whales (Balaenoptera physalus spp.): genetic evidence for revision of subspecies. PLoS One 8(5):e63396.

Attard, C. R. M., and coauthors. 2010. Genetic diversity and structure of blue whales (*Balaenoptera musculus*) in Australian feeding aggregations. Conservation Genetics 11(6):2437-2441.

Au, W. W. L., and M. Green. 2000. Acoustic interaction of humpback whales and whale-watching boats. Marine Environmental Research 49(5):469-481.

Baker, C. S., L. M. Herman, B. G. Bays, and G. B. Bauer. 1983. The impact of vessel traffic on the behavior of humpback whales in southeast Alaska: 1982 season. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, National Marine Mammal Laboratory.

Baker, C. S., A. Perry, and G. Vequist. 1988. Humpback whales of Glacier Bay, Alaska. Whalewatcher 22(3):13-17.

Barnosky, A. D., and coauthors. 2012. Approaching a state shift in Earth/'s biosphere. Nature 486(7401):52-58.

Barrett-Lennard, L. G., T. G. Smith, and G. M. Ellis. 1996. A cetacean biopsy system using lightweight pneumatic darts, and its effect on the behavior of killer whales. Marine Mammal Science 12(1):14-27.

Bauer, G. B. 1986. The behavior of humpback whales in Hawaii and modifications of behavior induced by human interventions. University of Hawaii.

Bauer, G. B., and L. M. Herman. 1986. Effects of vessel traffic on the behavior of humpback whales in Hawaii. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Honolulu, Hawaii.

Baulch, S., and C. Perry. 2014. Evaluating the impacts of marine debris on cetaceans. Mar Pollut Bull 80(1-2):210-21.

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

Bax, N., A. Williamson, M. Aguero, E. Gonzalez, and W. Geeves. 2003. Marine invasive alien species: a threat to global biodiversity. Marine Policy 27(4):313-323.

Beale, C. M., and P. Monaghan. 2004. Human disturbance: people as predation-free predators? Journal of Applied Ecology 41:335-343.

Bearzi, G. 2000. First report of a common dolphin (*Delphinus delphis*) death following penetration of a biopsy dart. Journal of Cetacean Research and Management 2(3):217-222.

Berrow, S. D., and coauthors. 2002. Organochlorine concentrations in resident bottlenose dolphins (*Tursiops truncatus*) in the Shannon estuary, Ireland. Marine Pollution Bulletin 44(11):1296-1303.

Best, P. B., and coauthors. 2005. Biopsying southern right whales: Their reactions and effects on reproduction. Journal of Wildlife Management 69(3):1171-1180.

Bevan, E., and coauthors. 2015. Unmanned Aerial Vehicles (UAVs) for Monitoring Sea Turtles in Near-Shore Waters. Marine Turtle Newsletter (145):19-22.

Blunden, J., and D. S. Arndt. 2016. State of the Climate in 2015. Bulletin of the American Meteorological Society 97(8).

BOEM. 2017. Record of Decision and Approval of the 2017-2022 Outer Continental Shelf Oil and Gas Leasing Program. Bureau of Ocean Energy Management, United States Department of the Interior, Washington, DC.

Branch, T. A. 2007. Abundance of Antarctic blue whales south of 60 S from three complete circumpolar sets of surveys.

Busch, D. S., and L. S. Hayward. 2009. Stress in a conservation context: A discussion of glucocorticoid actions and how levels change with conservation-relevant variables. Biological Conservation 142(12):2844-2853.

Calambokidis, J., E. Falcone, A. Douglas, L. Schlender, and J. Jessie Huggins. 2009. Photographic identification of humpback and blue whales off the US West Coast: Results and updated abundance estimates from 2008 field season. Cascadia Research, Olympia, Washington.

Carretta, J. V., and coauthors. 2017. U.S. Pacific marine mammal stock assessments: 2016, NOAA-TM-NMFS-SWFSC-577.

Cattet, M. R. L., K. Christison, N. A. Caulkett, and G. B. Stenhouse. 2003. Physiologic responses of grizzly bears to different methods of capture. Journal of Wildlife Diseases 39(3):649-654.

Cheng, L., and coauthors. 2017. Improved estimates of ocean heat content from 1960 to 2015. Science Advances 3(3):e1601545.

Christie, K. S., S. L. Gilbert, C. L. Brown, M. Hatfield, and L. Hanson. 2016. Unmanned aircraft systems in wildlife research: current and future applications of a transformative technology. Frontiers in Ecology and the Environment 14(5):241-251.

Clapham, P. J., and D. K. Mattila. 1993. Reactions of humpback whales to skin biopsy sampling on a West Indies breeding ground. Marine Mammal Science 9(4):382-391.

Clavero, M., and E. Garcia-Berthou. 2005. Invasive species are a leading cause of animal extinctions. Trends Ecol Evol 20(3):110.

Conn, P. B., and G. K. Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. Ecosphere 4(4):art43.

Constantine, R. 2001. Increased avoidance of swimmers by wild bottlenose dolphins (*Tursiops truncatus*) due to long-term exposure to swim-with-dolphin tourism. Marine Mammal Science 17(4):689-702.

Conversi, A., S. Piontkovski, and S. Hameed. 2001. Seasonal and interannual dynamics of *Calanus finmarchicus* in the Gulf of Maine (Northeastern US shelf) with reference to the North Atlantic Oscillation. Deep Sea Research Part II: Topical Studies in Oceanography 48(1-3):519-530.

Corkeron, P. J., R. J. Morris, and M. M. Bryden. 1987. Interactions between bottlenose dolphins and sharks in Moreton Bay, Queensland [Australia]. Aquatic Mammals 13(3):109-113.

COSEWIC. 2002. COSEWIC assessment and update status report on the blue whale *Balaenoptera musculus* (Atlantic population, Pacific population) in Canada.vi + 32.

Cowan, D. E., and B. E. Curry. 1998. Investigation of the potential influence of fishery-induced stress on dolphins in the eastern tropical pacific ocean: Research planning. National Marine Fisheries Service, Southwest Fisheries Science Center, NOAA-TM-NMFS-SWFSC-254.

Cowan, D. E., and B. E. Curry. 2002. Histopathological assessment of dolphins necropsied onboard vessels in the eastern tropical pacific tuna fishery. National Marine Fisheries Service, Southwest Fisheries Science Center, NMFS SWFSC administrative report LJ-02-24C.

Cowan, D. E., and B. E. Curry. 2008. Histopathology of the alarm reaction in small odontocetes. Journal of Comparative Pathology 139(1):24-33.

Croll, D. A., A. Acevedo-Gutiérrez, B. R. Tershy, and J. Urbán-Ramírez. 2001. The diving behavior of blue and fin whales: is dive duration shorter than expected based on oxygen stores? Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology 129(4):797-809.

Czech, B., and P. R. Krausman. 1997. Distribution and causation of species endangerment in the United States. Science 277(5329):1116-1117.

Daan, N. 1996. Multispecies assessment issues for the North Sea. Pages 126-133 *in* E.K.Pikitch, D.D.Huppert, and M.P.Sissenwine, editors. American Fisheries Society Symposium 20, Seattle, Washignton.

DeMaster, D. P., C. W. Fowler, S. L. Perry, and M. F. Richlen. 2001. Predation and Competition: The Impact of Fisheries on Marine-Mammal Populations over the Next One Hundred Years. Journal of Mammalogy 82(3):641-651.

Derraik, J. G. B. 2002. The pollution of the marine environment by plastic debris: a review. Marine Pollution Bulletin 44(9):842-852.

Dickens, M. J., D. J. Delehanty, and L. M. Romero. 2010. Stress: An inevitable component of animal translocation. Biological Conservation 143(6):1329-1341.

Dierauf, L., and M. Gulland. 2001a. Marine mammal unusual mortality events. Pages 69-81 *in* CRC Handbook of Marine Mammal Medicine. CRC Press.

Dierauf, L. A., and F. M. D. Gulland. 2001b. CRC Handbook of Marine Mammal Medicine, Second Edition edition. CRC Press, Boca Raton, Florida.

Dietrich, K. S., V. R. Cornish, K. S. Rivera, and T. A. Conant. 2007. Best practices for the collection of longline data to facilitate research and analysis to reduce bycatch of protected species. NOAA Technical Memorandum NMFS-OPR-35. 101p. Report of a workshop held at the International Fisheries Observer Conference Sydney, Australia, November 8,.

DOE and DOI. 2016. National Offshore Wind Strategy: Facilitating the Development of the Offshore Wind Industry in the United States. US. Department of Energy and U.S. Department of the Interior, DOE/GO-102016-4866.

Doney, S. C. 2010. The growing human footprint on coastal and open-ocean biogeochemistry. Science 328(5985):1512-1516.

Drinkwater, K. F., and coauthors. 2003. The response of marine ecosystems to climate variability associated with the North Atlantic oscillation. Geophysical Monograph 134:211-234.

Durban, J. W., H. Fearnbach, L. G. Barrett-Lennard, W. L. Perryman, and D. J. Leroi. 2015. Photogrammetry of killer whales using a small hexacopter launched at sea. Journal of Unmanned Vehicle Systems 3(3):131-135.

Dwyer, S. L., and I. N. Visser. 2011. Cookie cutter shark (*Isistius* sp.) bites on cetaceans, with particular reference to killer whales (orca) (*Orcinus orca*). Aquatic Mammals 37(2):111-138.

Elftman, M. D., C. C. Norbury, R. H. Bonneau, and M. E. Truckenmiller. 2007. Corticosterone impairs dendritic cell maturation and function. Immunology 122(2):279-290.

Epperly, S., and coauthors. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of southeast U.S. waters and the Gulf of Mexico. U.S. Department of Commerce NMFS-SEFSC-490.

Feare, C. J. 1976. Desertion and abnormal development in a colony of Sooty Terns infested by virus-infected ticks. Ibis 118:112-115.

Fonfara, S., U. Siebert, A. Prange, and F. Colijn. 2007. The impact of stress on cytokine and haptoglobin mRNA expression in blood samples from harbour porpoises (*Phocoena phocoena*). Journal of the Marine Biological Association of the United Kingdom 87(1):305-311.

Fortini, L. B., and K. Dye. 2017. At a global scale, do climate change threatened species also face a greater number of non-climatic threats? Global Ecology and Conservation 11:207-212.

Frid, A. 2003. Dall's sheep responses to overflights by helicopter and fixed-wing aircraft. Biological Conservation 110(3):387-399.

Frid, A., and L. Dill. 2002. Human-caused disturbance stimuli as a form of predation risk. Conservation Ecology 6(1).

Gambell, R. 1999. The International Whaling Commission and the contemporary whaling debate. Pages 179-198 *in* J. R. Twiss Jr., and R. R. Reeves, editors. Conservation and Management of Marine Mammals. Smithsonian Institution Press, Washington.

García-Cegarra, A. M., and A. S. Pacheco. 2017. Whale-watching trips in Peru lead to increases in tourist knowledge, pro-conservation intentions and tourist concern for the impacts of whale-watching on humpback whales. Aquatic Conservation: Marine and Freshwater Ecosystems.

Garrett, C. 2004. Priority Substances of Interest in the Georgia Basin - Profiles and background information on current toxics issues. Canadian Toxics Work Group Puget Sound/Georgia Basin International Task Force, GBAP Publication No. EC/GB/04/79.

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

Gavrilchuk, K., and coauthors. 2014. Trophic niche partitioning among sympatric baleen whale species following the collapse of groundfish stocks in the Northwest Atlantic. Marine Ecology Progress Series 497:285-301.

Geraci, J. R. 1990. Physiological and toxic effects on cetaceans.Pp. 167-197 *In:* Geraci, J.R. and D.J. St. Aubin (eds), Sea Mammals and Oil: Confronting the Risks. Academic Press, Inc.

Giese, M. 1996. Effects of human activity on Adelie penguin (Pygoscelis adeliae) breeding success. Biological Conservation 75:157-164.

Gill, J. A., K. Norris, and W. J. Sutherland. 2001. Why behavioural responses may not reflect the population consequences of human disturbance. Biological Conservation 97:265-268.

Goldbogen, J. A., and coauthors. 2011. Mechanics, hydrodynamics and energetics of blue whale lunge feeding: efficiency dependence on krill density. Journal of Experimental Biology 214(4):698-699.

Gomez, C., and coauthors. 2016. A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy. Canadian Journal of Zoology.

Gorgone, A., P. A. Haase, E. S. Griffith, and A. A. Hohn. 2008. Modeling response of target and nontarget dolphins to biopsy darting. Journal of Wildlife Management 72(4):926-932.

Grant, S. C. H., and P. S. Ross. 2002. Southern Resident killer whales at risk: toxic chemicals in the British Columbia and Washington environment. Fisheries and Oceans Canada., Sidney, B.C.

Greene, C., A. Pershing, R. Kenney, and J. Jossi. 2003. Impact of Climate Variability on the Recovery of Endangered North Atlantic Right Whales. Oceanography 16(4):98-103.

Greer, A. W. 2008. Trade-offs and benefits: Implications of promoting a strong immunity to gastrointestinal parasites in sheep. Parasite Immunology 30(2):123–132.

Grieve, B. D., J. A. Hare, and V. S. Saba. 2017. Projecting the effects of climate change on Calanus finmarchicus distribution within the U.S. Northeast Continental Shelf. Sci Rep 7(1):6264.

Gulland, F. M. D., and coauthors. 1999. Adrenal function in wild and rehabilitated Pacific harbor seals (*Phoca vitulina richardii*) and in seals with phocine herpesvirus-associated adrenal necrosis. Marine Mammal Science 15(3):810-827.

Hall, J. D. 1982. Prince William Sound, Alaska: Humpback whale population and vessel traffic study. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Juneau Management Office, Contract No. 81-ABG-00265., Juneau, Alaska.

Hammond, P. S., S. A. Mizroch, and G. P. Donovan. 1990. Individual recognition of cetaceans: Use of photo-identification and other techniques to estimate population parameters. Report of the International Whaling Commission Special Issue 12.

Harrington, F. H., and A. M. Veitch. 1992. Calving success of woodland caribou exposed to low-level jet fighter overflights. Arctic 45(3):213-218.

Hartwell, S. I. 2004. Distribution of DDT in sediments off the central California coast. Marine Pollution Bulletin 49(4):299-305.

Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2017. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2016. National Marine Fisheries Service Northeast Fisheries Science Center, NMFS-NE-241, Woods Hole, Massachusetts.

Hazel, J., I. R. Lawler, H. Marsh, and S. Robson. 2007. Vessel speed increases collision risk for the green turtle *Chelonia mydas*. Endangered Species Research 3:105-113.

Henry, A. G., and coauthors. 2016. Serious Injury and Mortality Determinations for Baleen Whale Stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2010-2014. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center, 16-10, Woods Hole, Massachusetts.

Herraez, P., and coauthors. 2007. Rhabdomyolysis and myoglobinuric nephrosis (capture myopathy) in a striped dolphin. Journal of Wildlife Diseases 43(4):770-774.

Hildebrand, J. A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Marine Ecology Progress Series 395:5-20.

Hooker, S. K., R. W. Baird, S. Al-Omari, S. Gowans, and H. Whitehead. 2001. Behavioral reactions of northern bottlenose whales (*Hyperoodon ampullatus*) to biopsy darting and tag attachment procedures. Fishery Bulletin 99(2):303-308.

Hunt, K. E., R. M. Rolland, S. D. Kraus, and S. K. Wasser. 2006. Analysis of fecal glucocorticoids in the North Atlantic right whale (Eubalaena glacialis). Gen Comp Endocrinol 148(2):260-72.

IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], Geneva, Switzerland.

Isaac, J. L. 2008. Effects of climate change on life history: Implications for extinction risk in mammals. Endangered Species Research.

Isojunno, S., and P. J. O. Miller. 2015. Sperm whale response to tag boat presence: biologically informed hidden state models quantify lost feeding opportunities. Ecosphere 6(1).

Issac, J. L. 2009. Effects of climate change on life history: Implications for extinction risk in mammals. Endangered Species Research 7(2):115-123.

IWC. 2007. Whale population estimates. International Whaling Commission.

IWC. 2016. Report of the Scientific Committee. Journal of Cetacean Research and Management (Supplement) 17.

IWC. 2017a. Aboriginal subsistence whaling catches since 1985. International Whaling Commission.

IWC. 2017b. Catches under objection or under reservation since 1985. International Whaling Commission.

IWC. 2017c. Special permit catches since 1985. International Whaling Commission.

Jacobsen, J. K., L. Massey, and F. Gulland. 2010. Fatal ingestion of floating net debris by two sperm whales (*Physeter macrocephalus*). Marine Pollution Bulletin 60(5):765-767.

Jahoda, M., and coauthors. 2003. Mediterranean fin whale's (*Balaenoptera physalus*) response to small vessels and biopsy sampling assessed through passive tracking and timing of respiration. Marine Mammal Science 19(1):96-110.

Jenner, C., and coauthors. 2008. Mark recapture analysis of pygmy blue whales from the Perth Canyon, Western Australia 2000-2005. International Whaling Commission Scientific Committee, Santiago, Chile.

Jensen, A. S., and G. K. Silber. 2004. Large whale ship strike database. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

Kaufman, G. A., and D. W. Kaufman. 1994. Changes in body-mass related to capture in the prairie deer mouse (*Peromyscus maniculatus*). Journal of Mammalogy 75(3):681-691.

Keay, J. M., J. Singh, M. C. Gaunt, and T. Kaur. 2006. Fecal glucocorticoids and their metabolites as indicators of stress in various mammalian species: A literature review. Journal of Zoo and Wildlife Medicine 37(3):234-244.

Koehler, N. 2006. Humpback whale habitat use patterns and interactions with vessels at Point Adolphus, southeastern Alaska. University of Alaska, Fairbanks, Fairbanks, Alaska.

Koski, W. R., and coauthors. 2009. Evaluation of an Unmanned Airborne System for Monitoring Marine Mammals. Aquatic Mammals 35(3):347-357.

Koski, W. R., and coauthors. 2015. Evaluation of UAS for photographic re-identification of bowhead whales, *Balaena mysticetus*. Journal of Unmanned Vehicle Systems 3(1):22-29.

Krahn, M. M., and coauthors. 2007. Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales. Marine Pollution Bulletin 54(2007):1903-1911.

Kraus, S. D., and coauthors. 2005. North Atlantic right whales in crisis. Science 309(5734):561-562.

Kraus, S. D., and coauthors. 2016. Recent Scientific Publications Cast Doubt on North Atlantic Right Whale Future. Frontiers in Marine Science.

Kunc, H. P., K. E. McLaughlin, and R. Schmidt. 2016. Aquatic noise pollution: implications for individuals, populations, and ecosystems. Proc Biol Sci 283(1836).

Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17(1):35-75.

Law, R. J. 2014. An overview of time trends in organic contaminant concentrations in marine mammals: going up or down? Mar Pollut Bull 82(1-2):7-10.

Learmonth, J. A., and coauthors. 2006. Potential effects of climate change on marine mammals. Oceanography and Marine Biology: an Annual Review 44:431-464.

Lesage, V., A. Omrane, T. Doniol-Valcroze, and A. Mosnier. 2017. Increased proximity of vessels reduces feeding opportunities of blue whales in the St. Lawrence Estuary, Canada. Endangered Species Research 32:351-361.

Li, W. C., H. F. Tse, and L. Fok. 2016. Plastic waste in the marine environment: A review of sources, occurrence and effects. Sci Total Environ 566-567:333-349.

Lima, S. L. 1998. Stress and decision making under the risk of predation. Advances in the Study of Behavior 27:215-290.

Lockyer, C. H., and R. J. Morris. 1990. Some observations on wound healing and persistence of scars in *Tursiops truncatus*. Report of the International Whaling Commission Special Issue 12:113-118.

Lusseau, D. 2004. The hidden cost of tourism: Detecting long-term effects of tourism using behavioral information. Ecology and Society 9(1):2.

Macleod, C. D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: A review and synthesis. Endangered Species Research 7(2):125-136.

Madsen, P. T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. Marine Ecology Progress Series 309:279-295.

Malme, C. I., P. R. Miles, C. W. Clark, P. Tyack, and J. E. Bird. 1983. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Final report for the period of 7 June 1982 - 31 July 1983. Department of the Interior, Minerals Management Service, Alaska OCS Office, Anchorage, Alaska.

Mancia, A., W. Warr, and R. W. Chapman. 2008. A transcriptomic analysis of the stress induced by capture-release health assessment studies in wild dolphins (*Tursiops truncatus*). Molecular Ecology 17(11):2581-2589.

Mann, J. 1999. Behavioral sampling methods for cetaceans: A review and critique. Marine Mammal Science 15(1):102-122.

Marine Mammal Commission. 2016. Development and Use of UASs by the National Marine Fisheries Service for Surveying Marine Mammals. Marine Mammal Commission, Bethesda, Maryland.

Mathews, E. A. 1986. Multiple use of skin biopsies collected from free-ranging gray whales (Eschrichtius robustus): sex chromatin analysis, collection and processing for cell culture, microbiological analysis of associated microorganisms, behavioral response of whales to biopsying, and future prospects for using biopsies in genetic and biochemical studies. University of California, Santa Cruz.

Matkin, C. O., and E. Saulitis. 1997. Restoration notebook: killer whale (*Orcinus orca*). Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.

McCauley, R., and C. Jenner. 2010. Migratory patterns and estimated population size of pygmy blue whales (Balaenoptera musculus brevicauda) traversing the Western Australian coast based on passive acoustics. IWC SC/62/SH26.

Meyer-Gutbrod, E., and C. Greene. 2014. Climate-Associated Regime Shifts Drive Decadal-Scale Variability in Recovery of North Atlantic Right Whale Population. Oceanography 27(3).

Miller, P. J. O., K. Aoki, L. E. Rendell, and M. Amano. 2008. Stereotypical resting behavior of the sperm whale. Current Biology 18(1):R21-R23.

Molnar, J. L., R. L. Gamboa, C. Revenga, and M. D. Spalding. 2008. Assessing the global threat of invasive species to marine biodiversity. Frontiers in Ecology and the Environment 6(9):485-492.

Mullner, A., K. E. Linsenmair, and W. Wikelski. 2004. Exposure to ecotourism reduces survival and affects stress response in hoatzin chicks (Opisthocomus hoazin). Biological Conservation 118:549-558.

Muto, M. M., and coauthors. 2017. Alaska Marine Mammal Stock Assessments, 2016. Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, NMFS-AFSC-355, Seattle, Washington.

Nadeem, K., J. E. Moore, Y. Zhang, and H. Chipman. 2016. Integrating population dynamics models and distance sampling data: a spatial hierarchical state-space approach. Ecology 97(7):1735-1745.

New, L. F., and coauthors. 2015. The modelling and assessment of whale-watching impacts. Ocean & Coastal Management 115:10-16.

NMFS. 1998. Recovery plan for the blue whale (*Balaenoptera musculus*). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, Maryland.

NMFS. 2000. Biological Opinion on proposed Marine Mammal Permit No. 526-1523 which would authorize Sean Todd of Allied Whale, College of the Atlantic to conduct research on listed whales in the North Atlantic Ocean, Sea. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2000-754, Silver Spring, Maryland.

NMFS. 2010a. Permit No. 633-1763 Annual Reports. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2010b. Permit No. 655-1652 Annual Reports. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2010c. Recovery plan for the fin whale (*Balaenoptera physalus*). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, Maryland.

NMFS. 2011a. Fin whale (*Balaenoptera physalus*) 5-Year Review: Evaluation and Summary.

NMFS. 2011b. Final recovery plan for the sei whale (*Balaenoptera borealis*). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, Maryland.

NMFS. 2012. Sei whale (*Balaenoptera borealis*). 5-year review: Summary and evaluation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2013. Programmatic Geological and Geophysical Activities in the Mid and South Atlantic Planning Areas from 2013 to 2020. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2014. Permit No. 14603 Annual Reports. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2015. Biological Opinion on the US Navy's Northwest Training and Testing Activities. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2015-9110, Silver Spring, Maryland.

NMFS. 2016a. Biological Opinion and Conference Report on Navy's Surveillance Towed Array Sensor System Low Frequency Active Sonar Routine Training, Testing, and Military Operations and NMFS' Associated Letters of Authorization. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2016-9165, Silver Spring, Maryland.

NMFS. 2016b. Biological Opinion on NMFS Permits and Conservation Division's issuance of two Permits (19225 and 19257), for research on marine mammal species pursuant to section 10(a)(1)(A) of the Endangered Species Act. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2016-9163, Silver Spring, Maryland.

NMFS. 2016c. Biological Opinion on the Issuance of Permit Nos. 19674 and 19315. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, FPR-2016-9170, Silver Spring, Maryland.

NMFS. 2016d. Permit No. 14233 Annual Reports. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2017a. Biological and Conference Opinion on the Issuance of Permit No. 18786-01 to the Marine Mammal Health and Stranding Response Program and Implementation of the Marine Mammal Health and Stranding Response Program (2017 Reinitiation). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2017-9204, Silver Spring, Maryland.

NMFS. 2017b. Biological and Conference Opinion on the Issuance of Permit No. 20465 to NMFS Alaska Fisheries Science Center Marine Mammal Laboratory for Research on Cetaceans. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2017-9186, Silver Spring, Maryland.

NMFS. 2017c. Biological and Conference Opinion on the Issuance of Permit No. 20605 to Robin Baird, Cascadia Research Collective, and Permit No. 20043 to Whitlow Au, University of Hawaii, for Research on Cetaceans. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2017-9191 and FPR-2017-9218, Silver Spring, Maryland.

NMFs. 2017d. Biological Opinion on the Issuance of Scientific Research Permit No. 18059 to David Wiley, Research Coordinator, Stellwagen Bank National Marine Sanctuary, for research on fin and sei whales. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2016-9180, Silver Spring, Maryland.

NMFS. 2017e. Ecological and Population Study of Balaenopterids and some odontocetes in the Northern Gulf of Maine. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Permit No. 20951 Application, Silver Spring, Maryland.

NMFS. 2017f. Letter of concurrence on the issuance of Permit No. 20527 to Ann Pabst for vessel and aerial surveys of blue, fin, North Atlantic right, sei, and sperm whales. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, FPR-2017-9199, Silver Spring, Maryland.

NMFS. 2017g. Report: Drones for Whale Research Documented reactions of whales to drone overflights. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Permit No. 18636, Silver Spring, Maryland.

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

Noda, K., H. Akiyoshi, M. Aoki, T. Shimada, and F. Ohashi. 2007. Relationship between transportation stress and polymorphonuclear cell functions of bottlenose dolphins, *Tursiops truncatus*. Journal of Veterinary Medical Science 69(4):379-383.

Noren, D. P., and J. A. Mocklin. 2012. Review of cetacean biopsy techniques: Factors contributing to successful sample collection and physiological and behavioral impacts. Marine Mammal Science 28(1):154-199.

Nowacek, D. P., L. H. Thorne, D. W. Johnston, and P. L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review 37(2):81-115.

NRC. 2003. National Research Council: Ocean noise and marine mammals. National Academies Press, Washington, D.C.

O'Connor, S., R. Campbell, H. Cortez, and T. Knowles. 2009. Whale Watching Worldwide: Tourism numbers, expenditures and expanding economic benefits, a special report from the International Fund for Animal Welfare. International Fund for Animal Welfare, Yarmouth, Massachusetts.

Ohsumi, S., and S. Wada. 1974. Status of whale stocks in the North Pacific, 1972. Report of the International Whaling Commission 24:114-126.

Palka, D. 2012. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2011 line transect survey.

Parsons, E. C. M. 2012. The Negative Impacts of Whale-Watching. Journal of Marine Biology 2012:1-9.

Parsons, K., J. Durban, and D. Claridge. 2003. Comparing two alternative methods for sampling small cetaceans for molecular analysis. Marine Mammal Science 19(1):224-231.

Pershing, A. J., E. H. J. Head, C. H. Greene, and J. W. Jossi. 2010. Pattern and scale of variability among Northwest Atlantic Shelf plankton communities. Journal of Plankton Research 32(12):1661-1674.

Peters, R. H. 1983. The Implications of Body Size. Cambridge University Press.

Pitman, R. L. 2003. Good whale hunting. Natural History December 2003/January 2004:24-26, 28.

Polyakov, I. V., V. A. Alexeev, U. S. Bhatt, E. I. Polyakova, and X. Zhang. 2009. North Atlantic warming: patterns of long-term trend and multidecadal variability. Climate Dynamics 34(2-3):439-457.

Ramp, C., J. Delarue, P. J. Palsboll, R. Sears, and P. S. Hammond. 2015. Adapting to a warmer ocean--seasonal shift of baleen whale movements over three decades. PLoS One 10(3):e0121374.

Reeb, D., and P. B. Best. 2006. A biopsy system for deep-core sampling of the blubber of southern right whales, *Eubalaena australis*. Marine Mammal Science 22(1):206-213.

Reilly, S. B., and coauthors. 2013. *Balaenoptera physalus*. The IUCN Red List of Threatened Species. The IUCN Red List of Threatened Species 2013:e.T2478A44210520.

Richardson, W. J., C. R. Greene, and B. Wursig, editors. 1985. Behavior, disturbance responses and distribution of bowhead whales (*Balaena mysticetus*) in the eastern Beaufort Sea, 1980-84: A summary. LGL Ecological Research Associates, Inc., Bryan, Texas.

Richardson, W. J., C. R. Greene Jr, C. I. Malme, and D. H. Thomson. 2013. Marine mammals and noise. Academic press.

Richardson, W. J., and B. Wursig. 1997. Influences of man-made noise and other human actions on cetacean behaviour. Marine and Freshwater Behaviour and Physiology 29:183-209.

Richter, C., S. Dawson, and E. Slooten. 2006. Impacts of commercial whale watching on male sperm whales at Kaikoura, New Zealand. Marine Mammal Science 22(1):46-63.

Richter, C. F., S. M. Dawson, and E. Slooten. 2003. Sperm whale watching off Kaikoura, New Zealand: Effects of current activities on surfacing and vocalisation patterns. Department of Conservation, Wellington, New Zealand. Science For Conservation 219. 78p.

Rolland, R. M., and coauthors. 2012. Evidence that ship noise increases stress in right whales. Proc Biol Sci 279(1737):2363-8.

Romero, L. M. 2004. Physiological stress in ecology: lessons from biomedical research. Trends in Ecology and Evolution 19(5):249-255.

Ross, P. S. 2002. The role of immunotoxic environmental contaminants in facilitating the emergence of infectious diseases in marine mammals. Human and Ecological Risk Assessment 8(2):277-292.

Ruzicka, J. J., J. H. Steele, T. Ballerini, S. K. Gaichas, and D. G. Ainley. 2013. Dividing up the pie: Whales, fish, and humans as competitors. Progress in Oceanography 116:207-219.

Sapolsky, R. M., L. M. Romero, and A. U. Munck. 2000. How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. Endocrine Reviews 21(1):55-89.

Scheidat, M., A. Gilles, K.-H. Kock, and U. Siebert. 2006. Harbour porpoise (*Phocoena phocoena*) abundance in German waters (July 2004 and May 2005). International Whaling Commission Scientific Committee, St. Kitts and Nevis, West Indies.

Senigaglia, V., and coauthors. 2016. Meta-analyses of whale-watching impact studies: comparisons of cetacean responses to disturbance. Marine Ecology Progress Series 542:251-263.

Smith, C. E., and coauthors. 2016. Assessment of known impacts of unmanned aerial systems (UAS) on marine mammals: data gaps and recommendations for researchers in the United States. Journal of Unmanned Vehicle Systems 4(1):31-44.

Southall, B. L., D. P. Nowacek, P. J. O. Miller, and P. L. Tyack. 2016. Experimental field studies to measure behavioral responses of cetaceans to sonar. Endangered Species Research 31:293-315.

Sremba, A. L., B. Hancock-Hanser, T. A. Branch, R. L. LeDuc, and C. S. Baker. 2012. Circumpolar diversity and geographic differentiation of mtDNA in the critically endangered Antarctic blue whale (Balaenoptera musculus intermedia). PLoS One 7(3):e32579.

St. Aubin, D. J., and J. R. Geraci. 1988. Capture and handling stress suppresses circulating levels of thyroxine (T4) and triiodothyronine (T3) in beluga whale, *Delphinapterus leucas*. Physiological Zoology 61(2):170-175.

St. Aubin, D. J., S. H. Ridgway, R. S. Wells, and H. Rhinehart. 1996. Dolphin thyroid and adrenal hormones: Circulating levels in wild and semidomesticated *Tursiops truncatus*, and influence of sex, age, and season. Marine Mammal Science 12(1):1-13.

Sutherland, W. J., and N. J. Crockford. 1993. Factors affecting the feeding distribution of red breasted geese, Branta ruficollis, wintering in Romania. Biological Conservation 63:61-65.

Swingle, W. M., S. G. Barco, T. D. Pitchford, W. A. McLellan, and D. A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Marine Mammal Science 9(3):309-315.

Thomas, P. O., R. R. Reeves, and R. L. Brownell. 2016. Status of the world's baleen whales. Marine Mammal Science 32(2):682-734.

Thomson, C. A., and J. R. Geraci. 1986. Cortisol, aldosterone, and leukocytes in the stress response of bottlenose dolphins, *Tursiops truncatus*. Canadian Journal of Fisheries and Aquatic Sciences 43(5):1010-1016.

U.S. Maritime Administration. 2016. 2015 Vessel Calls in U.S. Ports, Selected Terminals and Lightering Areas.

van der Hoop, J., P. Corkeron, and M. Moore. 2017a. Entanglement is a costly life-history stage in large whales. Ecol Evol 7(1):92-106.

van der Hoop, J. M., D. P. Nowacek, M. J. Moore, and M. S. Triantafyllou. 2017b. Swimming kinematics and efficiency of entangled North Atlantic right whales. Endangered Species Research 32:1-17.

Vanderlaan, A. S., and C. T. Taggart. 2007. Vessel collisions with whales: The probability of lethal injury based on vessel speed. Marine Mammal Science 23(1):144-156.

Walker, B. G., P. Dee Boersma, and J. C. Wingfield. 2005. Physiological and behavioral differences in magellanic Penguin chicks in undisturbed and tourist-visited locations of a colony. Conservation Biology 19(5):1571-1577.

Watkins, W. A., K. E. Moore, D. Wartzok, and J. H. Johnson. 1981. Radio tracking of finback (*Balaenoptera physalus*), and humpback (*Megaptera novaeangliae*) whales in Prince William Sound, Alaska, USA. Deep Sea Research Part I: Oceanographic Research Papers 28(6):577-588.

Weilgart, L. S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Canadian Journal of Zoology 85:1091-1116.

Weinrich, M., and C. Corbelli. 2009. Does whale watching in Southern New England impact humpback whale (*Megaptera novaeangliae*) calf production or calf survival? Biological Conservation 142(12):2931-2940.

Weinrich, M. T., R. Lambertsen, C. S. Baker, M. R. Schilling, and C. R. Belt. 1991. Behavioural responses of humpback whales (*Megaptera novaeangliae*) in the southern Gulf of Maine to biopsy sampling. Reports of the International Whaling Commission (Special Issue 13):91-97.

Weinrich, M. T., and coauthors. 1992. Behavioral reactions of humpback whales *Megaptera novaeangliae* to biopsy procedures. Fishery Bulletin 90(3):588-598.

Wilcove, D. S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48(8):607-615.

Wiley, D. N., R. A. Asmutis, T. D. Pitchford, and D. P. Gannon. 1995. Stranding and mortality of humpback whales, *Megaptera novaeangliae*, in the mid-Atlantic and southeast United States, 1985-1992. Fishery Bulletin 93(1):196-205.

Wiley, D. N., C. A. Mayo, E. M. Maloney, and M. J. Moore. 2016. Vessel strike mitigation lessons from direct observations involving two collisions between noncommercial vessels and North Atlantic right whales (*Eubalaena glacialis*). Marine Mammal Science.

Wiley, D. N., J. C. Moller, R. M. Pace, 3rd, and C. Carlson. 2008. Effectiveness of voluntary conservation agreements: case study of endangered whales and commercial whale watching. Conserv Biol 22(2):450-7.

Williamson, M. J., A. S. Kavanagh, M. J. Noad, E. Kniest, and R. A. Dunlop. 2016. The effect of close approaches for tagging activities by small research vessels on the behavior of humpback whales (*Megaptera novaeangliae*). Marine Mammal Science.

Wursig, B., S. K. Lynn, T. A. Jefferson, and K. D. Mullin. 1998. Behaviour of cetaceans in the northen Gulf of Mexico relative to survey ships and aircraft. Aquatic Mammals 24(1):41-50.

16 APPENDICES

Appendix A: Draft Permit No. 20951 (August 1, 2017)

*Final permit may have minor changes that would not affect this opinion. Permit No. 20951

Permit No. 20951

Expiration Date: August 31, 2022

Reports Due: November 31, annually

PERMIT TO TAKE PROTECTED SPECIES[4] FOR SCIENTIFIC PURPOSES

I. Authorization

This permit is issued to Ann Zoidis, Ph.D., Cetos Research Organization, 11 Des Isle Avenue, Bar Harbor, ME, 04609, (hereinafter "Permit Holder"), pursuant to the provisions of the Marine Mammal Protection Act of 1972 as amended (MMPA; 16 U.S.C. 1361 *et seq.*); the regulations governing the taking and importing of marine mammals (50 CFR Part 216); the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq.*); and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR Parts 222-226).

II. Abstract

The objectives of the permitted activity, as described in the application, are to further the understanding of seasonal migration movements, foraging habits, and behaviors of marine mammals in the Gulf of Maine.

III. Terms and Conditions

[4] "Protected species" include species listed as threatened or endangered under the ESA, and marine mammals.

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 attachments and appendices. 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 August 31, 2022. This permit expires on the date indicated and is non-renewable. This permit may be extended by the Director, NMFS Office of Protected Resources, pursuant to applicable regulations and the requirements of the MMPA and ESA.

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

a. If serious injury or mortality[5] of protected species occurs.

b. If authorized take[6] is exceeded in any of the following ways:

i. More animals are taken than allowed in Table 1 of Appendix 1.

ii. Animals are taken in a manner not authorized by this permit.

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

[6] 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; 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, capture, or collect, or attempt to do any of the preceding.

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[7] acquired[8] under this permit after permit expiration without additional written authorization, provided the samples are maintained as specified in this permit.

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

1. The table in Appendix 1 outlines the number of protected species, by species and stock, authorized to be taken, and the locations, manner, and time period in which they may be taken.

2. Researchers working under this permit may collect visual images (e.g., photographs, video) 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 does not result in takes.

3. The Permit Holder may use visual images and audio recordings collected under this permit, including those authorized in Table 1 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. 20951. This statement must accompany the images and recordings in all subsequent uses or sales.

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:

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[7] 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.
[8] Authorized methods of sample acquisition are specified in Appendix 1.

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:

Counting and Reporting Takes

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

b. Count and report 1 take per cetacean per day including all approaches[9] in water and attempts to remotely biopsy and tag.

c. During Unmanned Aircraft System (UAS) surveys, count 1 take per cetacean approached per day, regardless of the number of passes.

[9] 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 sperm and baleen whales (excluding minke whales) and 50 yards for all other cetaceans.

General

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

e. 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;

   ii. 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.

Unmanned Aircraft Systems (UAS)

f. Researchers are authorized to use a vertical take-off and landing UAS.

g. UAS must be flown at an altitude no lower than 35 meters.

Remote Biopsy Sampling

h. Researchers may attempt (deploy or discharge/fire) a biopsy procedure on an animal 3 times a day.

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

j. Researchers must use sterile[10] biopsy tips.

   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 must be used.

   ii. If a new, sterile biopsy tip is not available, the contaminated tip must be completely cleaned and disinfected[11] following the veterinary-approved protocol described in the application.

k. Researchers may biopsy sample adults, juveniles, and calves 6 months of age or older.

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

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

[10] 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 veterinary-approved protocol for sterilization (e.g., gas).
[11] Disinfection = eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects usually by liquid chemicals (CDC 2008).

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).

   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:

      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:

      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. Qualifications, Responsibilities, and Designation of Personnel

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 – Ann Zoidis.

b. Co-Investigator(s) – 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 – including UAS operators) 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. 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. <u>Possession of Permit</u>

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:

   a. Engaged in a permitted activity.

   b. A protected species is in transit incidental to a permitted activity.

   c. A protected species taken under the permit is in the possession of such persons.

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. Any time a serious injury or mortality of a protected species occurs, a written report must be submitted within two weeks.

c. 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 (from September 1st to August 31st) must:

a. be submitted by November 30th each year for which the permit is valid, and

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

4. A final report summarizing activities over the life of the permit must be submitted by (February 28, 2023), or, if the research concludes prior to permit expiration, within 180 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.

6. The Permit Holder must submit with the annual report data on disturbance rates of marine mammals specific to UAS operations. Details should include, but not be limited to: species, altitude and angle of approach, context of exposure (e.g., behavioral states), and observed behavioral responses to the UAS.

F. Notification and Coordination

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 Office listed below at least two weeks prior to initiation of each field trip/season.

   a. Notification must include the:

      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 Administrator for Protected Resources as applicable to the location of your activity:

      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 Regional Office 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 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[12] from the Permit Holder;

[12] 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 or 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.

J. Acceptance of Permit

1. In signing this permit, the Permit Holder:

a. agrees to abide by all terms and conditions set forth in the permit, all restrictions and relevant regulations under 50 CFR Parts 216, and 222-226, and all restrictions and requirements under the MMPA, and the ESA;

b. acknowledges that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director; and

c. acknowledges that this permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with any other Federal, State, local, or international laws or regulations.

______________________________ ____________________

Donna S. Wieting Date Issued

Director, Office of Protected Resources

National Marine Fisheries Service

______________________________ ____________________

Ann Zoidis Date Effective

Cetos Research Organization

Permit Holder

Appendix 1: Table Specifying the Kinds of Protected Species, Location, and Manner of Taking

Table 1. Authorized annual takes of wild male and female marine mammals in the Atlantic Ocean off the coast of Maine during vessel and aerial surveys. Activities include direct takes and incidental harassment to non-target cetaceans during any directed research. Calves at least 6 months of age may be sampled on the Northeast feeding grounds.

Line	Species	Stock/ Listing Unit	Life stage	No. of Takes[13]	Takes Per Animal	Take Action	Procedures	Details
1	Dolphin, Atlantic spotted	Western North Atlantic Stock	All	100	1	Harass	Count/survey; Incidental harassment; Observations, monitoring and behavioral; Photograph/video; Photogrammetry; Remote vehicle, aerial (VTOL)	Manned and unmanned aerial and vessel surveys; no biopsy sampling
2	Dolphin, Atlantic white-sided	Western North Atlantic Stock		500				
3	Dolphin, bottlenose	Western North Atlantic Northern Migratory Coastal Stock		100				
4	Dolphin, bottlenose	Western North Atlantic Offshore Stock		100				
5	Dolphin, common, short-beaked	Western North Atlantic Stock		200				
6	Dolphin, Risso's	Western North Atlantic Stock		40				
7	Dolphin, striped	Western North Atlantic Stock		200				
8	Dolphin, white-beaked	Western North Atlantic Stock		20				

[13] 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 1. Authorized annual takes of wild male and female marine mammals in the Atlantic Ocean off the coast of Maine during vessel and aerial surveys. Activities include direct takes and incidental harassment to non-target cetaceans during any directed research. Calves at least 6 months of age may be sampled on the Northeast feeding grounds.

Line	Species	Stock/ Listing Unit	Life stage	No. of Takes[13]	Takes Per Animal	Take Action	Procedures	Details
9	Whale, sperm	North Atlantic Stock (NMFS Endangered)		50				
10	Whale, killer	Range-wide		100				
11	Whale, pilot (long and short finned)	Range-wide		400				
12	Whale, right, North Atlantic	Range-wide (NMFS Endangered)	All	50	1	Harass	Count/survey; Incidental harassment; Observations, monitoring and behavioral; Photograph/video; Photogrammetry; Remote vehicle, aerial (VTOL)	Manned and unmanned aerial and vessel surveys; no biopsy sampling
13	Whale, blue	Range-wide (NMFS Endangered)	All	50	1	Harass	Count/survey; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
14			Adult/ Juvenile	30	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to 6 adult or juvenile blue whales may be resampled annually.

Table 1. Authorized annual takes of wild male and female marine mammals in the Atlantic Ocean off the coast of Maine during vessel and aerial surveys. Activities include direct takes and incidental harassment to non-target cetaceans during any directed research. Calves at least 6 months of age may be sampled on the Northeast feeding grounds.

Line	Species	Stock/ Listing Unit	Life stage	No. of Takes[13]	Takes Per Animal	Take Action	Procedures	Details
15	Whale, fin	Western North Atlantic Stock (NMFS Endangered)	All	400	1	Harass	Count/survey; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
16			Adult/ Juvenile	100	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to 20 adult or juvenile fin whales may be resampled annually.
17			Calf	10	2		Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Only calves at least 6 months old and 1/3 length of companion whale will be sampled. Up to 2 fin whale calves may be resampled annually.

Table 1. Authorized annual takes of wild male and female marine mammals in the Atlantic Ocean off the coast of Maine during vessel and aerial surveys. Activities include direct takes and incidental harassment to non-target cetaceans during any directed research. Calves at least 6 months of age may be sampled on the Northeast feeding grounds.								
Line	**Species**	**Stock/ Listing Unit**	**Life stage**	**No. of Takes[13]**	**Takes Per Animal**	**Take Action**	**Procedures**	**Details**
18	Whale, humpback	West Indies Distinct Population Segment (DPS)	Adult	400	1	Harass	Count/survey; Observations, behavioral; Photo-id; Photograph/video; photogrammetry; Remote vehicle, aerial (VTOL)	Manned and unmanned aerial and vessel surveys; no biopsy sampling
19			Adult/ Juvenile	100	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to 20 adult or juvenile humpback whales may be resampled annually.
20			Calf	10	2		Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy	Only calves at least 6 months old and 1/3 length of companion whale will be biopsy sampled. Up to 2 humpback calves may be resampled annually.

Table 1. Authorized annual takes of wild male and female marine mammals in the Atlantic Ocean off the coast of Maine during vessel and aerial surveys. Activities include direct takes and incidental harassment to non-target cetaceans during any directed research. Calves at least 6 months of age may be sampled on the Northeast feeding grounds.								
Line	**Species**	**Stock/ Listing Unit**	**Life stage**	**No. of Takes[13]**	**Takes Per Animal**	**Take Action**	**Procedures**	**Details**
21	Whale, minke	Range-wide	All	100	1	Harass	Count/survey; Observations, monitoring and behavioral; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
22			Adult/ Juvenile	30	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to 6 adult minke whales may be resampled annually.
23	Whale, sei	Range-wide (NMFS Endangered)	All	100	1	Harass	Count/survey; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry	Manned and unmanned aerial and vessel surveys; no biopsy sampling
24			Adult/ Juvenile	30	2	Harass/ Sampling	Count/survey; Import/export/receive, parts; Observations, monitoring and behavioral; Photo-id; Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy	Includes vessel-based biopsy sampling. Up to 6 adult sei whales may be resampled annually.

Appendix 2: NMFS-Approved Personnel and Authorized Recipients for Permit No. 20951.

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

Name (Role)	**Activities**
Ann M. Zoidis (Principal Investigator)	All research activities: *Level A*: skin/blubber biopsy sampling *Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Michael Cornish (Co-Investigator)	*Level B*: Photograph/video; Remote vehicle, aerial (VTOL); photogrammetry; Sample, skin and blubber biopsy
Leah Crowe (Co-Investigator)	*Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Dan DenDanto (Co-Investigator)	*Level A*: skin/blubber biopsy sampling *Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Tanya Lubansky (Co-Investigator)	*Level A*: skin/blubber biopsy sampling *Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Kaitlyn Mullen (Co-Investigator)	*Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Rosie Seton (Co-Investigator)	*Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Toby Stephenson (Co-Investigator)	*Level A*: skin/blubber biopsy sampling *Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Peter Stevick (Co-Investigator)	*Level A*: skin/blubber biopsy sampling *Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Sean Todd (Co-Investigator)	*Level A*: skin/blubber biopsy sampling *Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry
Chris Tremblay (Co-Investigator)	*Level A*: skin/blubber biopsy sampling *Level B*: Count/survey; Incidental harassment; Observation, monitoring and behavioral; Photo-id; Photograph/Video; Photogrammetry

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

Sample Type	Disposition	Authorized Recipient
Skin and blubber	Process/ Curate	Sean Todd- College of the Atlantic, 105 Eden Street, Bar Harbor, ME, 04609
Skin and blubber	Process/ Curate	Dan DenDanto- Allied Whale, College of the Atlantic, 105 Eden Street, Bar harbor, ME 04609