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

Biological Opinion

Agency:	Permits, Conservation, and Education Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service
Activity Considered:	The Proposal to Issue Permit No. 13927 to Dr. James Hain for Aerial and Vessel Surveys of North Atlantic Right Whales off the southeastern U.S.
Consultation Conducted by:	Endangered Species Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service
Approved by:	
Date:	OCT 17 2011

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 *et seq.*) requires each federal agency to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" listed species or designated critical habitat, that agency is required to consult formally with either NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the listed resources that may be affected. Federal agencies are exempt from this requirement if they have concluded that an action "may affect", but is "unlikely to adversely affect" listed species or designated critical habitat, and NMFS and/or USFWS concur with that conclusion (50 CFR 402.14[b]).

For the actions described in this document, the action agency is NMFS' Office of Protected Resources – Permits, Conservation, and Education Division (Permits Division). The consulting agency is NMFS' Office of Protected Resources – Endangered Species Division (Endangered Species Division). This document represents NMFS' Biological and Conference Opinion (Opinion) of the effects of the proposed research activities on listed and proposed threatened and endangered species and designated critical habitat in accordance with section 7 of the ESA. This Opinion is based on the most current marine mammal stock assessment reports, past and current research and population dynamics modeling efforts, monitoring reports from prior research, other information provided by the applicant, and other biological opinions involving similar marine mammal research.

CONSULTATION HISTORY

On December 9, 2010, the Permits Division requested consultation with the Endangered Species Division on a proposed action to issue scientific research permit No. 13927 to Dr. James Hain, associate scientist at Woods Hole Marine Biological Laboratory, to perform aerial and vessel surveys of North Atlantic right whales in coastal waters of the southeastern U.S. primarily focused on areas south of St. Augustine, Florida. The permit would be valid for five years from the date of issuance. The initiation package included the permit application from the applicant, a draft of the proposed permit, and the draft Environmental Assessment detailing the anticipated effects of the proposed action.

Upon reviewing the initiation package, the Endangered Species Division deemed the information sufficient and initiated formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Permits Division proposes to issue a scientific research permit to Dr. James Hain for harassment of listed whales in coastal waters of the southeastern U.S. during aerial and vessel surveys, pursuant to section 104 of the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 *et seq*.) and section 10(a)(1)(A) of the ESA. These actions may result in direct "takes"[1] of North Atlantic right (*Eubalaena glacialis*) and humpback whales (*Megaptera novaeangliae*) and may also occur in portions of critical habitat designated for North Atlantic right whales (i.e. southeastern U.S. calving grounds off Florida). This ESA Section 7 consultation considers the effects of the proposed research on listed and proposed threatened and endangered species and designated critical habitat. **Table 1** below displays the anticipated "take" of threatened and endangered species as proposed by the permits division as part of their initiation package.

The objectives of the proposed research are to monitor the distribution of North Atlantic right whales in the portion of the southeastern U.S. critical habitat south of St. Augustine, Florida, to improve knowledge of right whale habitat utilization, to monitor reproductive success, to contribute to the photo-identification catalog for both North Atlantic right and humpback whales, and to explore linkages between right whale vocalizations and behavior as well as to evaluate the efficacy of a passive acoustic monitoring system. Research would occur in waters off Georgia and Florida from December through April each year over the five year permit duration.

1 The ESA defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct

Table 1. Proposed Take Numbers for Permit No. 13927

Species	Life Stage	Sex	Annual Take*	Takes per Animal	Research Method	Procedures
North Atlantic right whale	All	Male and female	50	3	Aerial surveys	Count/Survey; Photo-id
North Atlantic right whale	All	Male and female	10	3	Vessel surveys	Passive Acoustics Recording; Count/Survey; Behaviorial Observations; Photo-id
Humpback whale	All	Male and female	10	3	Aerial/ vessel surveys	Incidental harassment, Photo-id

* Takes = the maximum number of animals, not necessarily individuals, that may be targeted for research annually in each row of the table. If any animal is harassed more than once during research, each additional attempt (i.e., take) reduces the number of total takes remaining.

The proposed permit would not authorize any lethal "take" of listed species but would authorize "take" resulting from short-term harassment of listed species during aerial and vessel surveys including close approaches for photo-identification, behavioral observations, and passive acoustic recording. The ESA does not define harassment nor has NMFS defined the term pursuant to the ESA through regulation. However, the MMPA defines harassment as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal population in the wild or has the potential to disturb a marine mammal or marine mammal population in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering" [16 U.S.C. 1362(18)(A)]. The latter portion of this definition (that is, "...causing disruption of behavioral patterns including...migration, breathing, nursing, breeding, feeding, or sheltering") is almost identical to the U.S. Fish and Wildlife Service's regulatory definition of "harass" pursuant to the ESA. For this Opinion, "harassment" is defined similarily as an intentional or unintentional human act or omission that creates the probability of injury to an individual animal by disrupting one or more behavioral patterns that are essential to the animal's life history or its contribution to the population the animal represents.

The following sections briefly describe the research activities to be authorized in the proposed permit. Additional details on these activities can be found in the Environmental Assessment, the permit applications, and the permits themselves.

<u>Aerial Surveys</u>

The applicant proposes to use a variety of aerial platforms for locating and observing North Atlantic right and humpback whales. Aerial surveys using a twin-engine, slow-flight AirCam aircraft would be conducted from December through April in coastal waters of northeast Florida for the purpose of North Atlantic right whale photo-identification and documentation. Based on prior experience, flights would be conducted three or four days per week depending on weather conditions. Surveys would be conducted along pre-determined track lines approximately three nautical miles from

shore for approximately three and half hours. Aircraft may also respond opportunistically to sightings relayed from the shore network for whales located outside of the pre-planned track line. Humpback whales would not be targeted but would be approached opportunistically for photo-identification as well. In survey mode, the aircraft would fly at speeds of 60 knots at altitudes ranging from 750 to 1200 feet. To obtain photographs, the aircraft would descend to altitudes of 700 feet for approximately 15 minutes to obtain legible photographs. Multiple approaches to the same animal within the same day would be rare.

The applicant also proposes to use a variety of blimps to conduct aerial surveys for right whales. As with the fixed-wing aircraft, the blimp would fly at altitudes ranging from 750 to 1000 feet in survey mode, and will descend to a minimum of 700 feet for 15 minutes to obtain legible photographs. The sizes of blimps to be used would be 132 feet, 160 feet, and 194 feet, respectively. Blimps allow for extended observations (e.g., an hour or more for dive-time and behavioral observations) and would typically be conducted from non-obtrusive altitudes of 1200 feet or higher.

Vessel Surveys

Similar to the aerial surveys, vessel surveys would often be conducted in conjunction with the shore-based right whale sighting network program. On occasions when the whales are too distant from shore for useful shore-based photographs and an aircraft is not available, vessels would be used. Motorized vessels to be used include existing craft operated by local agencies (e.g., U.S. Coast Guard, Volusia County Beach Patrol) and other dedicated vessels (e.g., a rigid-bottomed inflatable with an outboard engine). To the extent possible, four-stroke engines would be used as they are quieter than two-stroke engines, and personnel with extensive experience in operating vessels near whales would be involved in the vessel approaches.

For vessel-based approaches, researchers would utilize a three-step methodology utilized in past research efforts. This methodology begins with an initial approach using a slow-moving converging course technique followed by a quieter, close approach at slow or idling speeds to within a minimum of 100 feet from the animal to obtain photographs and finally withdrawing to a greater distance (e.g., greater than a quarter of a mile from the animal) for further observations. In the event a behavioral disturbance is suspected, the vessel would cease the approach and depart the area. Vessel approaches would generally last less than 15 minutes.

Aerostat Observations

In conjunction with vessel surveys, researchers will obtain aerial photographs using an aerostat (i.e., tethered balloon) deployed at altitudes of 150 to 300 feet to obtain photographs over a wider area than photographs taken from the deck. In the past, a 45 foot lobster boat has been used, but a boat as small as 25 foot may also be used for these purposes. The boat would be positioned at a minimum of 100 feet from whales with the engine off. Observation periods would last from one to several hours depending on how long the whale stays in the vicinity of the vessel. Similar to other approaches, in the

event a behavioral disturbance is suspected, the vessel operators would cease the approach and depart the area.

Passive Acoustics

The applicant also proposes to collect passive acoustic data in the vicinity of right whales. In response to a right whale sighting, a hydrophone (*e.g.*, Model SQ26-MT, Cetacean Research Technology, Seattle, Washington) would be deployed from a vessel. Aided in part by the shore-based network, researchers would conduct follows for up to 12 hours. While boats may be positioned 100 feet or more from right whales, typical follows would occur at greater distances (approximately a quarter of a mile or more from the whale). During the boat follows or drifts, time-synched sighting and behavioral data would be collected. Passive acoustic recordings would emphasize North Atlantic right whale mother-calf pairs.

Mitigation Measures

The following section summarizes the mitigation measures associated with Permit No. 13927 to mitigate effects to targeted and any non-targeted protected species during research activities. More detailed information may be found in the associated permit and Environmental Assessment document. The following conditions are included in Dr. Hain's proposed permit:

1. In the event a serious injury or mortality of a protected species occurs, the Researchers must suspend permitted activities and contact the Chief, NMFS Permits, Conservation, and Education Division by phone within two business days. Researchers must also submit a written incident report. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of the permit.

2. If authorized take[2] is exceeded, the Researchers must cease all permitted activities and notify the Chief, NMFS Permits, Conservation, and Education Division by phone as soon as possible but not later than two business days. Researchers must also submit a written incident report within two weeks of the incident. The incident report must include a complete description of the events and identification of steps that will be taken to reduce the potential for additional exceedance of authorized take.

3. Any "approach"[3] of a cetacean constitutes a take by harassment and must be counted and reported.

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

3 An "approach" is defined as a continuous sequence of maneuvers (episode) involving a vessel or researcher's body in the water, including drifting, directed toward a cetacean or group of cetaceans closer than 100 yards for large whales, or 50 yards for smaller cetaceans.

4. During aerial surveys, any cetacean or sea turtle observed below 1,000 ft should be counted and reported as a take.

5. No individual animal may be taken more than 3 times in one day.

6. To minimize disturbance of the subject animals, the Permit Holder must exercise caution when approaching animals and must retreat from animals if behaviors indicate the approach may be interfering with reproduction, feeding, or other vital functions.

7. Where females with calves are authorized to be taken, researchers:

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

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

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

    d. Must not approach any mother or calf while the calf is actively nursing.

8. Aerial surveys must be flown at an altitude of 750-1000 feet. Descents for photo-identification must be made to no less than an altitude of 700 feet.

9. To minimize disturbance: If an animal shows a response to the presence of the aircraft, the aircraft must leave the vicinity and either resume searching or continue on the survey.

10. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities.

11. Persons who require state or Federal licenses to conduct activities authorized under the permit (e.g. pilots) must be duly licensed when undertaking such activities.

12. The Permit holder must submit annual reports to the Chief, NMFS Permits, Conservation, and Education Division and a final report must be submitted within 180 days after expiration of the permit, or, if the research concludes prior to permit expiration, within 180 days of completion of the research.

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

14. The Permit Holder must provide written notification of planned field work to the appropriate Assistant Regional Administrator(s) for Protected Resources. Such

notification must be made at least two weeks prior to initiation of a field trip/season and must include the locations of the intended field study and/or survey routes, estimated dates of research, and number and roles of participants.

15. To the maximum extent practicable, the Permit Holder must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals.

APPROACH TO THE ASSESSMENT

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

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

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

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

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

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

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

Destruction or adverse modification[4] determinations must be based on an action's effects on the conservation value of habitat that has been designated as critical to threatened or endangered species. If an area encompassed in a critical habitat designation is likely to be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary or secondary constituent elements included in the designation (if there are any) or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species are likely to respond to that exposure. If primary or secondary constituent elements of designated critical habitat (or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) are likely to respond given exposure to the direct or indirect consequences of the proposed action on the natural environment, we ask if those responses are likely to be sufficient to reduce the quantity, quality, or availability of those constituent elements or physical, chemical, or biotic phenomena.

If the quantity, quality, or availability of the primary or secondary constituent elements of the area of designated critical habitat (or physical, chemical, or biotic phenomena) are reduced, we ask if those reductions are likely to be sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area. In this step of our assessment, we combine information about the contribution of constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species, particularly for older critical habitat designations that have no constituent elements) to the conservation value of those areas of critical habitat that occur in the action area, given the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area.

If the conservation value of designated critical habitat in an action area is reduced, the final step of our analyses asks if those reductions are likely to be sufficient to reduce the conservation value of the entire critical habitat designation. In this step of our assessment, we combine information about the constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) that are likely to experience changes in quantity, quality, and availability given exposure to an action with information on the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area. We use the conservation value of the entire designated critical habitat as our point of reference for this comparison. For example, if the designated critical habitat has limited current value or potential value for the conservation of listed species that limited value is our point of reference for our assessment.

To conduct these analyses, we rely on all of the evidence available to us. This evidence might consist of monitoring reports submitted by past and present permit holders, reports

4 We are aware that several courts have ruled that the definition of destruction or adverse modification that appears in the section 7 regulations at 50 CFR 402.02 is invalid and do not rely on that definition for the determinations we make in this Opinion. Instead, as we explain in the text, we use the "conservation value" of critical habitat for our determinations which focuses on the designated area's ability to contribute to the conservation or the species for which the area was designated.

from NMFS Science Centers, reports prepared by State or Tribal natural resource agencies, reports from non-governmental organizations involved in marine conservation issues, the information provided by the Permits, Conservation and Education Division when it initiates formal consultation, and the general scientific literature. We supplement this evidence with reports and other documents – environmental assessments, environmental impact statements, and monitoring reports – prepared by other federal and state agencies like the Minerals Management Service, U.S. Coast Guard and U.S. Navy whose operations extend into the marine environment.

During each consultation, we conduct electronic searches of the general scientific literature using *American Fisheries Society*, *Google Scholar*, *ScienceDirect*, *BioOne*, *Conference Papers Index*, *JSTOR*, and *Aquatic Sciences and Fisheries Abstracts* search engines. We supplement these searches with electronic searches of doctoral dissertations and master's theses. These searches specifically try to identify data or other information that supports a particular conclusion (for example, a study that suggests whales will exhibit a particular response to aerial or vessel surveys) as well as data that does not support that conclusion.

We rank the results of these searches based on the quality of their study design, sample sizes, level of scrutiny prior to and during publication, and study results. Carefully designed field experiments (for example, experiments that control potentially confounding variables) are rated higher than field experiments that are not designed to control those variables. Carefully designed field experiments are generally ranked higher than computer simulations. Studies that produce large sample sizes with small variances are generally ranked higher than studies with small sample sizes or large variances. Finally, in keeping with the direction from the U.S. Congress to provide the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], when data are equivocal, or in the face of substantial uncertainty, our decisions are designed to avoid the risks associated with incorrectly concluding an action has no adverse effect on a listed species when, in fact, such adverse effects are likely (i.e. avoiding Type II error).

ACTION AREA

The action area is defined in 50 CFR 402.2 as "all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the action." Research would occur in the coastal waters of the southeastern U.S. off the coasts of Florida and Georgia with a majority of the effort would take place south of St. Augustine, Florida. Research would also occur in a portion of right whale critical habitat (i.e. southeastern U.S. calving grounds). For the purposes of this consultation, the action area to be analyzed is the area extending from southeastern coasts of Georgia and Florida out to three nautical miles.

STATUS OF THE SPECIES

NMFS' Office of Protected Resources – Endangered Species Division has determined that the following listed resources provided protection under the ESA occur within the action area and may be affected by proposed action:

Common Name	Scientific Name	Listing Status
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
North Atlantic right whale	*Eubalaena glacialis*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Green sea turtle	*Chelonia mydas*	Endangered[5]
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
Loggerhead sea turtle Northwest Atlantic Ocean Distinct Population Segment[6]	*Caretta caretta*	Proposed Endangered
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered
Smalltooth Sawfish	*Pristis pectinata*	Endangered
North Atlantic Right Whale Critical Habitat		Designated

Listed Resources Not Likely to be Adversely Affected

Endangered blue, fin, sei, and sperm whales occur in the range of the proposed action and could be subject to harassment and/or harm from boat strikes as a result of the proposed activities. However, these species are typically located further offshore in deeper waters than the areas targeted by the proposed research and would be highly unlikely to be encountered during aerial or vessel surveys performed by the research applicants. These species are highly unlikely to be exposed to the effects of the proposed action and any potential threats are discountable. Therefore, the proposed action is not likely to adversely affect blue, fin, sei, and sperm whales and these species will not be considered further in this Opinion.

Five species of listed sea turtles (green, hawksbill, Kemp's ridley, leatherback, and loggerhead) including one proposed DPS of loggerhead sea turtle (Northwest Atlantic Ocean DPS) occur in the action area and could therefore be disturbed by the proposed aerial and/or vessel surveys to be conducted by the researchers. However, because the

5 Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to difficulties in distinguishing between individuals from the Florida breeding population from other populations, green sea turtles are considered endangered wherever they occur in U.S. waters.

6 A distinct population segment, is a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species. The ESA provides for listing species, subspecies, or distinct population segments of vertebrate species.

proposed research activities are targeted specifically to whales, any interactions with and threats to the sea turtles are extremely unlikely and therefore discountable. NMFS' expects that the slow transit speeds during vessel surveys allow non-targeted sea turtles ample time to move away from the oncoming vessels. Moreover, observers looking for targeted species would identify sea turtles so that evasive maneuvers, if necessary, could be employed to avoid harassing any sea turtles encountered. Consequently, the increases in vessel traffic caused by the proposed research may affect, but would be unlikely to have any measurable adverse effect on listed sea turtles. Therefore, the proposed action is not likely to adversely affect any listed sea turtle species and these species will not be considered further in this opinion.

Two listed anadromous fish species (i.e. shortnose sturgeon and smalltooth sawfish) occur in the action area closer to shore and may be affected by vessel surveys, including unintentional fuel spills. However, research activities are expected to occur in waters further offshore than where these species are typically found. These species are highly unlikely to be exposed to the effects of the proposed action and any potential threats are discountable. Therefore, the proposed action is not likely to adversely affect shortnose sturgeon or smalltooth sawfish and these species will not be considered further in this Opinion.

Listed Resources Likely to be Adversely Affected

The sections below provide information on the status of listed resources likely to be adversely affected by the proposed action. The biology and ecology of these species as well as their global status and trends are described below, and inform the effects analysis for this Opinion.

North Atlantic Right Whale

Species Description, Distribution, and Population Structure

The North Atlantic right whale is one of the most endangered of the large baleen whales. Some defining characteristics include a stocky body, large head, strongly bowed margin of the lower lip, callosities (raised patches of roughened skin) on the head region, and a lack of a dorsal fin. Right whales occur in sub-polar to temperate waters with a migratory pattern of high latitudes in the warmer seasons and lower latitudes in the winter seasons (Perry et al., 1999). All North Atlantic right whales compose a single population and no subpopulation has been identified. The western North Atlantic region has six major habitats or congregation areas: coastal waters of the southeastern U.S., the Great South Channel, Georges Bank/Gulf of Maine, Cape Cod and Massachusetts Bays, the Bay of Fundy, and the Scotian Shelf (Winn et al., 1986). Nichols et al. (2008) notes that right whale distribution in the western North Atlantic has shown some year-to-year variation in space and time, likely resulting from patchy prey distribution. While right whales have been documented in the eastern North Atlantic, reported sightings are very rare (Best et al., 2001a).

North Atlantic right whales exhibit extensive migratory patterns, traveling from foraging areas along the eastern seaboard of the U.S. and Canada to calving areas off the coasts of Georgia and Florida in late fall/early winter and then back again in late spring/early

summer. While cow-calf pairs are regularly seen in the southeastern calving grounds during the winter, the whereabouts of much of the population during the winter months remains unknown (Waring et al., 2009). Knowlton et al. (1992) reported several long distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland. In addition, Mate et al. (1997) reported radio-tagged whales making extensive excursions moving from the Gulf of Maine into deeper waters off the continental shelf. These long range movements indicate evidence of extended ranges for some North Atlantic right whale individuals and perhaps the existence of additional habitat areas important to the species which have not yet been identified.

Based on the lack of data, precise distribution and migration patterns of the eastern North Atlantic right whale population are largely unknown. The 1998 IWC Workshop on the Comprehensive Assessment of Right Whales agreed that only animals found in the western North Atlantic can be considered a functioning extant unit based on current sightings information.

Life History Information

Female right whales usually reach sexual maturity between 7 and 10 years of age (Best and Kishino, 1998; Hamilton et al., 1998). In the western North Atlantic, calving takes place between December and March in shallow, coastal waters. Gestation lasts from 357 to 396 days in southern right whales, and is likely similar in the North Atlantic species (Best, 1994). Weaning seems to be variable, but has been reported to be 8-17 months in duration (Hamilton et al., 1995). An analysis of the age structure suggests that the population contains a smaller proportion of juvenile whales than expected (Hamilton et al., 1998; Best et al., 2001b) which may reflect lowered recruitment and/or high juvenile mortality.

The calving interval for North Atlantic right whales is between 2 and 7 years (Knowlton et al., 1994; Best et al., 2001b; Burnell, 2001; Cooke et al., 2001). From 1980 to 1992, the average calving interval for females was 3.67 years (Knowlton et al., 1994); however, from 1990-1998 that interval increased to 5.8 years (Kraus et al., 2001), effectively lowering the reproductive rate of the western North Atlantic right whale population. Possible causes for the depressed reproductive rate include low genetic diversity, loss of habitat, food limitation and contaminants, biotoxins, and disease. Interestingly, calving data from 2001-2005 showed a dramatic increase in North Atlantic right whale calving (23 calves per year) indicating that the calving interval may have since decreased in this population (Kraus et al., 2005).

Right whales fast during the winter and feed during the summer, although some may opportunistically feed during periods of migration. They rely on dense patches of copepods (largely of the genus *Calanus* and *Pseudocalanus*) found in highly variable and spatially unpredictable locations in the Bay of Fundy, Roseway Basin, Cape Cod Bay, the Great South Channel, and other areas off the northern U.S. and Canadian coastlines (Wishner et al., 1988; Murison and Gaskin, 1989; Mayo and Marx, 1990; Baumgartner et al., 2003; Baumgartner and Mate, 2003). Although right whales feed on copepod aggregations at the surface (Mayo and Marx, 1990), they more commonly dive below the

surface to exploit areas of high prey density (Kenney et al., 1995; Baumgartner et al., 2003; Baumgartner and Mate, 2003). Mothers and calves have been known to spend prolonged periods of time at the surface compared to other foraging individuals (Baumgartner and Mate, 2003).

Evidence indicates that the North Atlantic right whales, like other baleen whales, are able to hear at least low frequency sounds (less than 1 kHz) based on the morphology of its auditory apparatus (Ketten, 1997) suggesting that the auditory system of this species is more sensitive to low frequency sounds than that of smaller toothed whales (Ketten, 1997). Parks et al. (2007) reported the hearing range of North Atlantic right whales to be from 10 Hz to 22 kHz and vocalizations are expected to fall within this range as well (Richardson et al., 1995).

Listing Status

The North Atlantic right whale was originally listed as endangered under the precursor to the ESA and under the ESA since its inception in 1973 (35 FR 8495). The original listing included both the North Atlantic and the North Pacific populations. Following a comprehensive status review, NMFS concluded that these two populations consisted of two distinct species. On December 27, 2006 (71 FR 77704 and 71 FR 77694), NMFS published two proposed rules to list these species separately. The final rule published on March 6, 2008 (73 FR 12024). The North Atlantic right whale is also protected by CITES and the MMPA. Critical habitat was designated for right whales on June 3, 1994 under the original northern right whale listing (see next subsection for further information on designated critical habitat for North Atlantic right whales).

Status and Trends

Historically, North Atlantic right whales were greatly affected by commercial whaling activities. An estimate of pre-exploitation population size of North Atlantic right whales is not available; however, Reeves and Mitchell (1987) and Reeves et al. (1992) concluded that there were atleast hundreds to over a 1,000 right whale individuals, respectively, in the western North Atlantic in the 1600's with the greatest rate of population decline occurring in the 1700's. These studies were based on incomplete whaling data and should be viewed with caution. Back calculations using the present population size and growth rate suggest that the population may have numbered fewer than 100 individuals by 1935 when the IWC extended protection to right whales (Hain, 1975; Reeves et al., 1992); however, this estimate should also be viewed with caution since little is known about the population dynamics of right whales in the years since whaling began.

In 1992, the western North Atlantic right whale population was estimated to be 295 individuals and an updated analysis gives a minimum population size of 345 individuals for 2005 based on the most recent reviews of the photo-id recapture database (Waring et al., 2009). The population growth rate reported for the period 1986-1992 by Knowlton et al. (1994) was 2.5 percent (CV=0.12) suggesting that the stock was showing signs of recovery. However, work by Caswell et al. (1999) suggested that the crude survival probability declined from about 0.99 in the early 1980's to about 0.94 in the late 1990's. The authors also determined that if the mortality rate is not slowed and reproduction not

improved, extinction could occur within 100 years from the time of the study. Additional work conducted in 1999 showed that survival had indeed declined in the 1990's particularly for adult females (Best et al., 2001b; Clapham, 2002). The most recent stock assessment for the species reported a mean growth rate of 1.8 percent for the period 1990-2005, giving evidence that annual growth in the population remains extremely low (Waring et al. 2009). The number of right whales in the eastern North Atlantic Ocean is probably much smaller, although there is insufficient data available to make an estimation of the size of this population.

Mortalities due to fishing gear and ship strikes have been a cause for concern and threaten to accelerate the declining trend in growth rates in this population (NMFS, 2005). There were 24 confirmed reports of North Atlantic right whales being entangled in fishing gear between 2004 and 2008 off the Atlantic coast of the U.S. and Maritime Provinces of Canada, with 3 whales dying of their wounds and one additional whale sustaining serious injuries (Glass et al., 2010). For ship strikes, there were 17 confirmed reports with 8 whales dying of their wounds and 2 additional whales sustaining serious injuries (Glass et al., 2010). Deaths of females, in particular, are especially threatening the ability of the population recover. For instance, in 2005, mortalities included six adult females, three of which were carrying near-term fetuses and four of which were just starting to bear calves, thereby representing a lost reproductive potential of as many as 21 individuals (Kraus et al., 2005). More recently, a right whale female that had been calving regularly for the past ten years based on prior catalogued data was found dead off the coast of Virginia in early March of 2011, possibly from a ship strike (NMFS, 2011a). The fact that this female had successfully reproduced multiple times during her lifetime is particularly concerning given that she not only would have been expected to continue reproducing but may also have produced calves with similar reproductive potential. With such small numbers of North Atlantic right whales occurring in the North Atlantic, it is expected that ship strikes, especially to females, will continue to threaten survival and recovery of the species in the near future.

Levels of chromium reported in right whale blubber samples are sufficient to be mutagenic and may be affecting recovery of the species along with exposure to other contaminants in the marine environment (Chen et al., 2009; Wise et al., 2009). Annual mortality rate, and calculations based on demographic data through 1999 indicate that this mortality rate increase could reduce population growth by approximately 10 percent per year (Fujiwara and Caswell, 2001, Kraus et al., 2005).

Concerns also exist for changes in climate and its effect on the ability of North Atlantic right whales to recover in future years (Greene et al., 2003). Specifically, the variations in oceanography resulting from current shifts and water temperatures may significantly affect the occurrence of the North Atlantic right whale's primary prey resource (i.e. copepod crustaceans). To adapt, North Atlantic right whales may have to shift their distribution to reflect changes in prey distribution, pursue other prey types, or face prey shortage. Changes in calving intervals with sea surface temperature have already been documented for southern right whales (Leaper et al., 2006); however there is insufficient data to know the effects that current climate-related trends are having on the North

Atlantic right whale population.

North Atlantic right whales venturing into Gulf of Mexico waters continue to feel the effects of past and present oil spills occurring in the region. The Gulf of Mexico is located in an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (such as the current *Deep Horizon* oil spill, *Ixtoc I* oil well blowout and fire in the Bay of Campeche in 1979, and the explosion and destruction of a loaded supertanker, the *Mega Borg*, near Galveston in 1990). Oil spills can impact marine mammals through ingestion, absorption, and inhalation and effects may range from instant death to sub-lethal damage to mild irritation, depending on concentration and length of exposure (Geraci, 1990). Marine mammals may inhale toxic doses of petroleum vapor when at the surface in the vicinity of an oil spill (Geraci, 1990; Geraci and Williams, 1990) and may directly injest oil or feed on contaminated prey below the surface. Few studies on oil spills have focused exclusively on cetaceans; however, bottlenose dolphins (Smultea and Wursig, 1995) and gray whales (Kent et al., 1983 *as cited in* Moore and Clarke, 2002) have been observed swimming through oil slicks and sheens making it likely that other cetacean species occurring in the Gulf of Mexico would be similarly exposed as a result of the recent *Deep Horizon* oil spill event.

Experience gained during the *Exxon Valdez* spill indicates that large-scale spills can cause persistent negative effects on wildlife that can last for decades (Peterson et al., 2003). Matkin et al. (2008) utilized photo-identification methods to monitor two killer whale populations 5 years prior to and 16 years after the *Exxon Valdez* oil spill and noted that in both cases, the two populations had not recovered from pre-spill numbers. Current numbers available at the time of this consultation report 115 confirmed cetacean mortalities in the vicinity of the *Deep Horizon* oil spill in the Gulf of Mexico (including two large cetacean deaths [sperm whales]), although the cause of that mortality is unknown (NMFS, 2011b). Although the extent of effects of past and present oil spills on large cetacean species is uncertain, the persistent impacts observed for other species of marine mammals suggest that oil spills will continue to threaten the survival and recovery of these species occurring in Gulf of Mexico waters for years to come.

North Atlantic Right Whale Critical Habitat

Habitat Description, Listing Status, and Essential Features

Critical habitat has been designated for the endangered North Atlantic right whale in the Great South Channel[7,] Cape Cod Bay[8], and off the states of Georgia and Florida[9] (59 FR 28793; June 3, 1994). The critical habitat designation encompasses three primary feeding and nursery habitats in the United States used by right whales during their annual

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7 Right whale critical habitat in the Great South Channel is bounded by 41° 40' N and 69° 45' W; 41° 0' N and 69° 5' W; 41° 38' N and 68° 13' W; and 42° 10' N and 68° 31' W.

8 Right whale critical habitat in Cape Cod Bay is bounded by 42° 04.8' N and 70° 10.0' W; 42° 12' N and 70° 15' W; 42° 12' N and 70° 30' W; 41° 46.8' N and 70° 30' W; and on the south and east by the interior shoreline of Cape Cod, Massachusetts.

9 Off the southeastern United States, right whale critical habitat is designated in waters between 31° 15' N and 30° 15' N (or approximately from the mouth of the Altamaha River in Georgia to Jacksonville, Florida) from the shoreline to 15nm offshore; as well as the waters between 30° 15' N and 28° 00' N (or Jacksonville south to Sebastian Inlet, Florida) from the shoreline out to 5nm.

migration. The physical, chemical, and biotic features that form right whale critical habitat include the composition of zooplankton in feeding areas, the topographic and seasonal oceanographic characteristics conducive to zooplankton growth; and water depth, water temperatures, and distance from shore for calving and nursery areas (59 FR 28793; June 3, 1994).

The Great South Channel is a large funnel-shaped bathymetric feature at the southern extreme of the Gulf of Maine between Georges Bank and Cape Cod, Massachusetts. The channel is bordered on the west by Cape Cod and Nantucket Shoals, and on the east by Georges Bank. The Great South Channel has an average depth of 175m and a maximum depth of 200m to the north. The late winter/early spring mixing of warmer shelf waters with the cold Gulf of Maine water funneled through the channel causes a dramatic increase in faunal productivity in the area, including zooplankton species important to North Atlantic right whales (Wishner et al., 1988).

Cape Cod Bay is a large embayment on the U.S. Atlantic Ocean off the state of Massachusetts that is bounded on three sides by Cape Cod and the Massachusetts coastline. Cape Cod Bay has an average depth of about 25 m and a maximum depth of about 65 m. Just as with the Great South Channel, late winter/early spring mixing causes an increase of zooplankton fauna important to North Atlantic right whales and other cetaceans. Samples taken in the daytime indicated greater densities of copepods at greater depths with densities of 100 individuals per cubic meter or more occurring from April through June (Mayo and Marx, 1990).

The southeastern U.S. migratory corridor and calving grounds average about 30 m in depth with a maximum depth of about 60 m. The deepest waters occur along the coast of Florida, just south of Cape Canaveral. The continental shelf slopes gently from the coast to approximately the 50 m (164 ft) isobath; where it drops off to the 200 m (656 ft) isobath. While these areas are not considered important feeding grounds for North Atlantic right whales, they do represent the primary calving and nursery ground for the species.

Status of the Habitat

Threats affecting the status and conservation value of North Atlantic right whale critical habitat are similar to threats affecting North Atlantic right whale individuals and populations occurring within these areas (e.g. vessel interactions, ocean noise, other forms of habitat contamination, etc.). Please refer to the *Status and Trends* section for North Atlantic right whales above and the *Environmental Baseline* Section of this Opinion for more information on these threats affecting the status of both the North Atlantic right whale species and its designated critical habitat. The discussion below expands on the threats shaping the global status of North Atlantic right whales to include additional factors shaping the status of critical habitat areas for the species.

Sea surface temperatures in the North Atlantic Ocean are closely related to the North Atlantic Oscillation (NAO) Index and influence the abundance of zooplankton in foraging areas important to the North Atlantic right whale. In the 1970s and 1980s, the

NAO Index was positive and sea surface temperatures increased. These increases are believed to have produced conditions that were favorable for the copepod *Calanus finmarchicus* (the principal prey of North Atlantic right whales) and may have increased calving rates (Greene et al., 2003). In the late 1980s and 1990s, the NAO Index was mainly positive but exhibited two substantial, multi-year reversals to negative values. This was followed by two major, multi-year declines in copepod prey abundance (Drinkwater et al., 2003). Calving rates for North Atlantic right whales followed the declining trend in copepod abundance, although there was a time lag between the two (Greene et al., 2003). Although the NAO Index has been positive for the past 25 years, atmospheric models suggest that increases in ocean temperature associated with climate change forecasts may produce more severe fluctuations in the North Atlantic Oscillation. Such fluctuations would be expected to cause dramatic shifts in the reproductive rate of critically endangered North Atlantic right whales (Drinkwater et al., 2003; Greene et al., 2003) and possibly a northward shift in the location of right whale calving areas (Kenney, 2007).

The availability of dense concentrations of zooplankton blooms in Cape Cod Bay in late winter and the Great South Channel in spring is described as the key factor for right whale utilization of these areas. However, the combination of highly oxygenated water and dense zooplankton concentrations are optimal conditions for the small schooling fishes (sand lance, herring and mackerel) that prey upon some of the same zooplankton as North Atlantic right whales. Efforts being made to recover commercially targeted finfish stocks from their current overfished condition may lead to a reduction in the biomass of these types of small schooling fish throughout the region thereby reducing interspecific competition for prey and increasing the conservation value of this critical habitat for North Atlantic right whales. While it is not known whether zooplankton densities that occur seasonally in Cape Cod Bay or the Great South Channel are expected to increase significantly, increased predation by groundfish on small schooling fish in certain areas and at specific critical periods may allow the necessary high zooplankton densities to be maintained in these areas for longer periods, or accumulate in other areas at levels acceptable to North Atlantic right whales.

The presence of commercial and recreational vessels and the threat of entanglement in fishing gear pose significant threats to the conservation value of these habitat areas by potentially interrupting feeding or nursing behavior or even causing temporary habitat displacement in areas essential to the survival of the species. Habitat contamination and pollution from land based sources may contaminate prey resources important to North Atlantic right whales, thereby lowering the conservation value of foraging grounds in the northeast. These threats are expected to continue to affect the conservation value of foraging grounds and/or calving areas for North Atlantic right whales and remain a significant threat to the recovery of the species as whole.

Humpback Whale

Species Description, Distribution, and Population Structure

Humpback whales (*Megaptera novaeangliae*) are large baleen whales known for their long pectoral fins (up to 15 ft in length) and complex whale songs. Humpback whales

occur throughout the world's oceans and are generally found over continental shelves, shelf breaks, and around oceanic islands (Balcomb and Nichols, 1978; Whitehead, 1987). Humpback whales exhibit seasonal migrations between warmer temperate and tropical waters in winter and cooler waters of high prey productivity in summer (Gendron and Urban, 1993), although the seasonal distributions of this species have yet to be fully understood (Reeves et al., 2004). Humpback whales have the longest known migratory movements of any mammal, with one-way distances up to 8,461 km (Rasmussen et al., 2007). They usually migrate through deep, pelagic waters before settling in shallower, coastal waters at each end of the migration route (Winn and Reichley, 1985).

In the North Atlantic, humpback whales summer in six different regions: off the eastern coast of the United States, the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and northern Norway (Katona and Beard, 1990; Christensen et al., 1992; Palsbøll et al., 1997; Perry et al., 1999). These regions represent relatively discrete subpopulations (Clapham and Mayo, 1987). In the fall and winter, humpback whales from all feeding areas migrate to calving and mating grounds in the Caribbean, where mixing among subpopulations occurs (Katona and Beard, 1990; Clapham et al., 1993; Palsbøll et al., 1997; Stevick et al., 1998; Bérubé et al., 2004). In addition, there are reports of humpback whales in winter off Greenland, Norway, Newfoundland, the southern Gulf of Maine, Bermuda, and also in the eastern North Atlantic off the Cape Verde Islands (Katona et al., 1990; NMFS, 2006). The species uses U.S. mid-Atlantic and U.S. southern waters as a migratory pathway and apparently as a feeding area, at least for juveniles (Wiley et al., 1995; Barco et al., 2002).

Humpback whales also occur in the North Pacific and Southern Hemisphere. In the North Pacific, the species is found off the Hawaiian Islands, from Mexico north to the Gulf of Alaska and Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and Sea of Okhotsk (Nemoto, 1957; Tomilin, 1957; Johnson and Wolman, 1984 *as cited in* NMFS, 1991; NMFS, 1991). Humpback whales that occur off Central America and Mexico in the winter and spring migrate to the coast of California north to British Columbia in summer and fall (Steiger et al., 1991). Although the Pacific coast of Central America is not considered a major wintering area for this species, humpback whales are reported off the west coast of Panama as well as Costa Rica (Steiger et al., 1991). In Asia, humpbacks have been observed in the vicinity of Taiwan, the Ogasawara Islands, and the Northern Mariana Islands (NMFS, 1991). Humpback whales are also found in the Arabian Sea in the northern Indian Ocean (Mikhalev, 1997; Perry et al., 1999). In the Southern Hemisphere, humpback whales occur during winter along the tropical and western sides of continents, along eastern coastlines, and around islands (Perry et al., 1999). During the austral summer, the species occurs in South Georgia, the South Shetlands, and along the west and east coasts of Africa, Australia, and South America (Dawbin, 1966 *as cited in* Perry et al., 1999; Best et al., 1998).

In the past, humpback whales in the North Atlantic were treated as a single population for management purposes (Waring et al., 1999). However, humpback whales in the Gulf of Maine were subsequently recognized by NMFS as a separate feeding aggregation based upon the strong fidelity of individual whales to this region (Palsbøll et al., 2001 *as cited*

in Waring et al., 2009). In 2002, the IWC acknowledged the evidence for treating the Gulf of Maine as a separate management unit (IWC, 2002 *as cited in* Waring et al., 2009).

In the North Pacific, NMFS recognizes three stocks of humpback whales for management purposes under the MMPA: the western North Pacific, central North Pacific, and eastern North Pacific stocks. The IWC considers there to be one North Pacific management stock, and no clear consensus exists on population structure for the species in this ocean (Calambokidis et al., 2001). In the Southern Hemisphere, Donovan (1991) reported four groupings of humpback whales found in IWC Areas II through IV; however, migration of the species between oceans is noted (e.g., between the Indian Ocean and South Atlantic, based on genetic data) (Pomilla and Rosenbaum, 2005). Relatively recent data compiled by the IWC on breeding stocks suggests multiple groupings of humpback whales (Bannister, 2005) but how such aggregations translate into individual biological populations remains uncertain.

Life History Information

Sexual maturity in humpback whales is reached between 5 and 11 years of age (Clapham, 1992; Gabriele et al., 2007). Humpback whale reproductive activities occur primarily in winter and gestation takes about 11 months (Winn and Reichley., 1985), followed by a nursing period of up to 12 months (Baraff and Weinrich, 1993). Calving primarily occurs in the shallow coastal waters of continental shelves and some oceanic islands (Perry et al., 1999). The calving interval is likely 2-3 years (Clapham and Mayo, 1987), although there is some evidence of calving occurring in consecutive years (Glockner-Ferrari and Ferrari, 1985; Clapham and Mayo, 1987; 1990; Weinrich et al., 1993). During the breeding season, humpback whales form small unstable groups (Clapham, 1996), and males sing long, complex songs directed toward females and other males. Males compete for mates and are polygamous (Clapham, 1996).

Although largely solitary, humpback whales often cooperate during feeding activities (Elena et al., 2002). They exhibit a wide range of foraging behaviors, and feed on a range of prey types including small schooling fishes, euphausiids, and other large zooplankton (Nemoto, 1957; Nemoto, 1959; Nemoto, 1970; Krieger and Wing, 1984; 1986). Since a majority of humpback whale prey is found above 300 m (or 984 ft), most dives are relatively shallow (approximately 60-170 m) (Hamilton et al., 1997). Dives usually range between 2-5 min, but can last as long as 20 min (Dolphin, 1987). Feeding groups can be stable for long periods of times, and there is good evidence of some territoriality on both feeding (Clapham, 1996) and wintering grounds (Tyack, 1981).

Humpback whale vocalization is much better understood than hearing sensitivity, although like other baleen whales, evidence indicates the species can hear at least low frequency sounds (less than 1 kHz) based on the morphology of its hearing apparatus suggesting that the auditory system of the species is more sensitive to low frequency sounds than that of smaller toothed whales (Ketten, 1997). Houser et al. (2001) reported the hearing range of humpback whales to be in the range of 700 Hz to 10 kHz. In terms of vocalization, different calls by humpback whales have been associated with different

functions including feeding, breeding, and other social calls. Humpback whales are reported to be less vocal when found on their high-latitude feeding grounds in summer compared with their lower-latitude winter ranges (Richardson et al, 1995). Au (2000) compiled information on humpback whale vocalizations and reported sounds to include grunts in the frequency range of 25-1,900 Hz, pulses in the frequency range of 25-89 Hz, and songs with components ranging from 30-8,000 Hz.

Listing Status

Humpback whales have been listed as endangered under the ESA since 1973. The IWC first protected humpback whales in the North Pacific in 1965, and this species is also protected by CITES and the MMPA. Humpback whales are also listed as "vulnerable" under the IUCN Red List of threatened species (IUCN, 2005).

Status and Trends

Historically, humpback whale populations worldwide were greatly affected by commercial whaling activities. Based on mitochondrial DNA analysis, Roman and Palumbi (2003) estimated pre-exploitation populations of humpback whales to be as many as 1,000,000 worldwide with 240,000 occurring in the North Atlantic alone. Between 1805 and 1909, American whalers harvested between 14,164-18,212 humpback whales in the North Atlantic while the Pacific kill was estimated to be about 28,000 (Best, 1987 *as cited in* NMFS, 1991). Records also show that from the late 1880's to the mid-1970's, whaling operations took 1,397 humpback whales off eastern Canada and 522 off West Greenland in the western North Atlantic (Kapel, 1979; Mitchell, 1974), 1,579 in the eastern North Atlantic and Arctic Oceans (Perry et al., 1999), nearly 30,000 in the Pacific Ocean (Perry et al., 1999), and over 68,000 in the Southern Ocean (Bonner, 1982).

Current estimates for the North Atlantic humpback whale population include the estimates by Palsbøll et al. (1997) of 4,894 males and 2,804 females, based on genetic tagging data. However, some authors believe this combined total of 7,698 whales to be an underestimate of the true population size (Clapham et al., 1995; Palsbøll et al., 1997). Several researchers report an increasing trend in abundance for the North Atlantic population, and an independent increase in numbers of individuals sighted within the Gulf of Maine feeding aggregation (Katona and Beard, 1990; Barlow and Clapham, 1997; Smith et al., 1999; Waring et al., 2009). Stevick et al., (2003) estimated that approximately 11,570 animals existed in 1993 with an estimated rate of increase of 3.1 percent per year. Assuming that this rate of increase has remained constant, the estimated 2010 population size for North Atlantic humpback whales would be around 19,473 individuals, a number still significantly lower than Roman and Palumbi's (2003) pre-exploitation estimate of 240,000 individuals.

In the 1980s, North Pacific humpback whale population estimates ranged from 1,407 to nearly 2,100 (Darling and Morowitz, 1986; Baker and Herman, 1987); however, by the mid-1990s, the population was estimated to have risen to around 6,000 (Calambokidis et al., 1997). Between 2004 and 2006, a comprehensive assessment of the population of humpback whales in the North Pacific identified 7,971 unique individuals from

photographic records (Calambokidis et al., 2008). Based on the results of that effort, Calambokidis et al. (2008) estimated that the current population of humpback whales in the North Pacific Ocean consisted of about 18,300 adult individuals. Rice (1978) estimated pre-exploitation numbers of humpback whales in the North Pacific to be around 15,000; however, this data has been shown to be statistically unreliable.

In the Southern Hemisphere, the IWC estimated the humpback whale population at 19,851 individuals extrapolated from survey data of whales south of the 60°S latitude (IWC, 1996) although this estimate has been shown to be statistically unreliable and should be taken with caution (Perry et al., 1999). Nevertheless, these estimates are far lower than the pre-exploitation abundances reported by Gambell (1976) who estimated the humpback whale numbers in the Southern Ocean to be as high as 100,000 individuals.

At present, there are several stressors affecting humpback whales globally, although the significance of any effects emanating from these individual stressors remains uncertain. Entanglement in commercial fishing gear continues to be a problem as there were 81 confirmed reports of humpback whales being entangled in fishing gear between 2004 and 2008 off the Atlantic coast of the U.S. and Maritime Provinces of Canada, with 5 whales dying of their wounds and an additional 11 sustaining serious injuries (Glass et al., 2010). Mortality from ship strikes is also a threat to recovery. Along the Pacific coast, a humpback whale is known to be killed about every other year by ship strikes (Barlow et al., 1997). Along the Atlantic coast of the U.S. and Canada between 2004 and 2008, there were 14 confirmed reports of humpback whales being struck by vessels with 8 whales dying of their wounds (Glass et al., 2010).

Organochlorines, including PCB and DDT, have been identified from humpback whale blubber samples (Gauthier et al., 1997). These contaminants are transferred to young through the placenta, leaving newborns with contaminant loads equal to that of mothers before bioaccumulating additional contaminants during life and passing the additional burden to the next generation (Metcalfe et al., 2004).

The current IWC quota for subsistence harvest of western North Atlantic humpback whales is 20 total individuals over the seasons 2008-2012, to be caught by the Bequians of St. Vincent and the Grenadines. Japan has conducted its scientific whaling program JARPA II (Japanese Whale Research Program under a Special Permit in the Antarctic) with anticipated harvests of 50 humpback whales from the D and E management stocks each year (Nishiwaki et al., 2006). Other current threats affecting humpback whale recovery include effects of ocean noise as well as disturbance from whale watching and other scientific research activities occurring within and outside of the action area considered in this Opinion.

Effects of past and present oil spills will continue to affect humpback whales venturing into Gulf of Mexico waters similar to affects to other cetacean species (see North Atlantic right whale subsection above for more information). Although the extent of effects of past and present oil spills on humpback whale populations is uncertain, the persistent impacts observed for other species of marine mammals suggest that oil spills will

continue to threaten the survival and recovery of cetacean species occurring in the Gulf of Mexico region for years to come.

ENVIRONMENTAL BASELINE

By regulation, environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR §402.02).

The purpose of the *Environmental Baseline* section is to step down from the species level discussion in the *Status of the Species* section and establish the current and projected viability or fitness of individuals and populations within the action area so that the effects of the proposed research activities can be measured and assessed. The following sections summarize the natural phenomena as well as the anthropogenic activities that have affected and continue to affect listed listed cetaceans within the action area. While some stressors uniquely occur within the action area and are thus easily identified for their respective impacts, there are other stressors where the impacts are felt only in part within the action area at an unspecified magnitude (e.g. disease, effects from prior commercial exploitation etc.). In those situations, we will discuss impacts generally and make the assumption that listed cetaceans are exposed to these ongoing effects in the action area at an unspecified degree.

Natural Sources of Stress and Mortality

Predation and Interspecific Competition

Humpback whales have been known to be preyed upon in the eastern Pacific (Steiger et al., 2008); however, it is not known if humpback whales are currently affected in the North Atlantic. Large sharks and killer whales may conceivably prey on North Atlantic right whales as scars have been reported indicating evidence of attacks (Kraus, 1990; NMFS, 2005); however it is not known what impact these attacks have on right whale populations. In addition to threats from shark and killer whale attacks, several researchers have suggested the recovery of the North Atlantic right whale has been impeded by competition with other whales (most notably Sei whales) for copepod food resources in the western North Atlantic (Rice, 1974; Mitchell, 1975; Scarff, 1986).

Diseases, Parasites, and Biotoxins

Parasites and biotoxins from red-tide blooms are other potential causes of mortality of listed baleen whales in the action area (Perry et al., 1999). The occurrence of the nematode *Crassicauda boopis* appears to increase the potential for kidney failure in humpback whales and may be affecting recovery of these species (Lambertsen, 1992). The threat of mortality and debilitation of North Atlantic right whales from similar diseases and red tide events is currently unknown; however, given their low numbers, right whales are expected to have a lower resilience to disease-related stressors that could affect this species' ability to recover.

Oceanographic Features and Climatic Variability
Increases in ocean temperature due to interannual, decadal, and longer time-scale variability in climate may cause dramatic shifts in the reproductive rate of North Atlantic right whales (Drinkwater et al., 2003; Greene et al., 2003) and possibly a northward shift in the location of right whale calving areas (Kenney, 2007). However, gaps in information and the complexity of climatic interactions complicate the ability to predict the effects that climate variability may have to these species from year to year (Kintisch, 2006; Simmonds and Isaac, 2007).

Other possible effects of climatic variability for listed whales in the action area include the alteration of community composition and structure, changes to migration patterns or community structure, changes to species abundance, increased susceptibility to disease and contaminants, and altered timing of breeding (MacLeod et al., 2005; Robinson et al., 2005; Kintisch, 2006; Learmonth et al., 2006; McMahon and Hays, 2006).

Anthropogenic Sources of Stress and Mortality

Commercial Whaling
Large whale populations in the action area were historically impacted by commercial whaling. Humpback whales were one of the predominant species targeted by commercial whaling operations in the western North Atlantic between the early 1800's and the early part of the 1900's including areas off the U.S. southeastern coast where the proposed research activities are expected to occur (Stevick et al., 2003). American whalers alone harvested 14,164-18,212 humpbacks in the North Atlantic between 1805-1909 (Best, 1987 *as cited in* NMFS, 1991). North Atlantic right whales were also historically impacted by commercial whaling with their greatest rates of population decline probably occurring in the 1700's (Reeves and Mitchell, 1987; Reeves et al., 1992). Hunting in the 19th and early 20th centuries, largely by Norwegian whaling operations, are likely to have irreversibly damaged or extirpated this stock (Collett, 1909; Brown, 1976).

Prior exploitation may have altered the population structure and social cohesion of these species such that effects on abundance and recruitment may continue for years after harvesting ceased. Significantly lower numbers have resulted in a loss of genetic diversity that could affect the ability of the current populations to successfully reproduce in the future (e.g., decreased conceptions, increased abortions, increased neonate mortality). Also, historical whaling pressure significantly lowered population numbers such that their ability to resist the effects of deleterious phenomena such as demographic stochasticity, inbreeding depression, and Allee effects, is lowered thereby greatly affecting the ability of these species to recover to pre-exploitation levels.

Habitat Degradation
A number of human activities may be directly or indirectly affecting listed whale species and designated critical habitat in the action area through habitat degradation. Anthropogenic activities such as discharges from wastewater systems, dredging, ocean dumping and disposal, aquaculture, and additional impacts from coastal development are known to degrade coastal waters utilized by listed whales in the action area including

calving grounds designated as critical habitat for North Atlantic right whales. Multiple municipal, industrial and household sources as well as atmospheric transport introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g. DDT and PCBs), and other pollutants that may cause adverse health effects to listed whales (Iwata, 1993; Grant and Ross, 2002; Garrett, 2004; Hartwell, 2004).

The accumulation of persistent pollutants through trophic transfer may cause mortality and sub-lethal effects to marine mammals (Waring et al, 2009), including immune system abnormalities, endocrine disruption and reproductive effects (Krahn et al., 2007). Due to their large amount of blubber, marine mammals readily accumulate lipid-soluble contaminants such as PCBs (O'Hara and Rice, 1996) and concentrations of organochlorides have been documented in blubber samples collected for the species targeted by the proposed research activities (Aguilar and Borrell, 1988; Gauthier et al., 1997; Metcalfe et al., 2004). Recent efforts have led to improvements in regional water quality in the action area, although the more persistent chemicals are still detected and are expected to endure for years (Mearns, 2001; Grant and Ross, 2002). Also, acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges are known to cause behavioral changes in marine mammals (Grant and Ross, 2002) and may directly injure individuals through skin contact with oils (Geraci, 1990), inhalation at the water's surface and ingesting compounds while feeding (Matkin and Saulitis, 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area.

Habitat in the action area may also be degraded by various sources of marine debris such as plastics, glass, metal, polystyrene foam, rubber, and derelict fishing gear. Marine debris is introduced into the marine environment through ocean dumping, littering, or hydrologic transport of these materials from land-based sources. Listed whales may become entangled in marine debris or directly ingest it while feeding, potentially leading to digestive problems, injury, or even death.

Ocean Noise

Increases in underwater sound generated from various man-made sources such as commercial shipping and recreational vessels, whale watch cruises, seismic exploration, offshore construction (e.g. for offshore wind farms), and sonars of various types have the potential to affect listed whales in the action area at various times throughout the year. Marine mammals use sound in the ocean environment to find prey, locate mates, rear young, navigate, and to avoid predators (Bradley and Stern, 2008). Underwater noise generated in the marine environment have the potential to increase stress levels, alter behavior, result in temporary or permanent hearing loss, and/or, in extreme cases, result in direct injury and even even death (Richardson et al., 1995; NRC 2003, 2005; Clark and Ellison, 2004; Nowacek et al., 2007; Southall et al., 2007; Wright et al., 2008).

Commercial shipping traffic is a major source of low frequency anthropogenic noise in the action area (NRC, 2003). Although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships at levels exceeding 2 kHz,

which may interfere with important biological functions of cetaceans (Holt, 2008). However, the primary concern of incidental shipping noise is not related to acute exposures, but rather to the general increase in continuous background ambient noise and the potential masking of marine animals' communication systems, their ability to hear mating calls, and their ability to pick up acoustic environmental cues that animals use to navigate and/or sense their surroundings, including sounds that are used to detect predators (OSPAR, 2009).

Another concern of increased sound from shipping traffic and recreational vessels is the gradual habituation of listed whales to these types of sound sources. Habituation may increase the risk of vessel strikes since the whales do not actively avoid the acoustic noise generated by an oncoming vessel. A study looking at the use of acoustic tags and controlled exposure experiments with North Atlantic right whales resulted in five of six individual whales responding strongly (interrupted dive pattern and swimming rapidly to the surface) to the presence of an artificial alarm stimulus while ignoring the playbacks of vessel noise, citing evidence of habituation (Nowacek et al., 2004). Several investigators have suggested that vessel noise may have caused humpback whales to avoid or leave feeding or nursey areas (Jurasz and Jurasz, 1979; Glockner-Ferrari and Ferrari, 1985; 1990; Salden, 1988), while others have suggested humpback whales may become habituated to vessel traffic and its associated noise (e.g. Watkins, 1986). Croll et al. (2001) examined exposure of fin whales to low frequency noise and found that whale foraging activity continued after exposure, and there were no apparent responses of whales to loud, low frequency noise sources; however, the authors acknowledged that these results do not address the cumulative impact of this noise over larger spatial and time scales. Parks et al. (2010) measured upcalls from North Atlantic right whales in the Bay of Fundy and observed noise-dependent amplitude modification of calls under varying background underwater noise levels. The results suggest that increased call amplitude may be an immediate short term response to moderate noise levels, while frequency change may be more gradual. These studies show that increased vessel traffic in the action area will continue to affect the ability of cetaceans to perceive threats as well as to communicate with mates and other conspecifics within and near the action area.

Source sound pressure levels vary widely between construction activities with drilling operations being relatively low while pile-driving and the use of explosives comprising very high source levels (OSPAR, 2009). While studies documenting the effects of marine construction and industrial activities on cetaceans are limited, it's expected that given the comparatively low source levels, injuries from either dredging or drilling operations are unlikely in marine mammals, except those located very close to the source (Southall et al., 2007). Underwater explosions, on the other hand, have the ability to permanently injure the auditory systems of marine mammals as Ketten et al. (1993) reported injury in the ears of two humpback whales stranded after underwater explosions. While noise generated from marine construction has the potential to affect individuals in the action area, it is unknown how these activities affect these listed whales at the population level. As more energy facilities are built in marine environments, studies will need to be done to understand the full range of effects that such operations have on whale population dynamics.

Commercial sonar systems are used on recreational and commercial vessels and may affect listed whales in the action area (NRC, 2003). Sonar signals could affect several vocal characteristics or behaviors of cetaceans; however the degree to which these changes significantly affect cetaceans in the action area is unknown. Sonar is a lesser contributor to the overall ocean noise budget than other sources of anthropogenic sound (OSPAR, 2009). Also, the distribution of these sounds would be small because of their short durations and the fact that the high frequencies of the signals attenuate quickly in seawater (Richardson et al., 1995). Nevertheless, increased sonar emanating from multiple sources may increase effects of masking and cause short-term behavioral effects of cetaceans in the action area.

Seismic surveys using towed airguns also occur within the action area and are the primary exploration technique for oil and gas deposits and for fault structure and other geological hazards. Airguns generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of 10-20 seconds for extended periods (NRC, 2003). Most of the energy from the guns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235-240 dB at dominant frequencies of 5-300Hz (NRC, 2003). Most of the sound energy is at frequencies below 500Hz. Very little data exists on the effects of seismic surveys on cetaceans beyond short-term behavioral responses; however, where responses have been observed, it is not known whether these reactions were significant at the population level (OSPAR, 2009). In the United States, all seismic surveys for oil and gas exploration and most research activities involving the use of airguns with the potential to take marine mammals are covered by incidental harassment authorizations under the MMPA.

In summary, listed whales occurring in the action area are regularly exposed to several sources of anthropogenic sound sources, the effects of which are not well understood. Short-term exposure to high-energy sound sources such as underwater explosions, pile driving and other marine construction have the potential to result in direct injury or even death to listed whales located near the sound source while the effects of exposure to more moderate but generally increasing background sound levels from vessel traffic, seismic surveys, and sonar pings may increase the effects of masking in listed whales as well as the long term-habitat quality in the action area. The latter has the potential to lead to more population level effects such as overall distribution and rates of reproduction although more work needs to be done to confirm this.

U.S. Military Activities

U.S. Navy vessel operations and ordinance detonations have and continue to adversely affect listed species in the action area. From early July through early August 2007, the U.S. Navy conducted a Composite Training Unit-Joint Task Force Exercise within and seaward of the Cherry Point and Jacksonville-Charleston Operating Areas located off South Carolina, North Carolina, Georgia, and Florida. These exercises employed between 340 and 355 hours of mid-frequency active sonar. The Navy reported that observers spotted a group of dolphins during these exercises. Active sonar usage was shut down in response to this sighting. However, the actual number of marine animals

that might have been exposed to mid-frequency active sonar during that exercise, and their resulting responses, is unknown.

Past and ongoing U.S. Navy aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (e.g. 500 and 1,000 lb bombs) is estimated to have the potential to annually injure or kill listed sea turtles as well as marine mammals. In August and September 2008, the U.S. Navy conducted a ship shock trial on the MESA VERDE in waters east of Jacksonville, Florida, using high blast explosives. Surveys conducted after these activities did not detect any dead or injured listed marine mammals. In addition, no marine mammal stranding has been attributed to the shock trial. However, the lack of direct observations of adverse responses to these activities does indicate that that no responses occurred as a result of these activities. NMFS and the U.S. Navy have been working cooperatively to establish a policy for monitoring and managing acoustic impacts from anthropogenic sound sources in the marine environment.

In June 2009, NMFS issued a biological opinion on the NMFS Office of Protected Resources – Permits, Conservation and Education Division's proposal to promulgate regulations that would authorize the U.S. Navy to "take" marine mammals incidental to continued training activities conducted within and adjacent to waters off the (a) Northeast coast of the United States, (b) the Virginia Capes Range Complex; (c) the Cherry Point Range Complex, and (d) and the Charleston-Jacksonville Range Complex over a five-year period. This biological opinion also evaluated the U.S. Navy's proposal to establish a transit protection system at Naval Submarine Base Kings Bay, Georgia, to escort nuclear powered ballistic submarines during transit between the Naval Submarine Base and the dive/surface site. According to that biological opinion, NMFS expected these activities to harass listed marine mammals by exposing them to sound fields produced by underwater detonations or ship noise at received levels that would cause individual animals to change their behavior from activities that require lower energy expenditures to those that require higher energy expenditures.

Between January and August 2009, the U.S. Navy conducted three Composite Training Unit Exercises and one Southeastern Anti-Submarine Warfare Integrated Training Initiative. The U.S. Navy also conducted three Integrated Anti-Submarine Warfare courses in conjunction with three of the Composite Training Unit Exercises it conducted during this time. The total number of sonar hours that were associated with each of these exercises is classified and are thus not reported here; however, there exists the possibility that marine mammals could have been exposed to these exercises and may have undergone short-term behavioral reactions to the sonar exposure.

On 28 July 2009, NMFS issued a final biological opinion on the U.S. Navy's proposal to place a network of underwater transducer devices and undersea cables in a 1,713 square kilometer area of the ocean about 93 km (or 50 nm) offshore of northeastern Florida beginning in 2012 or 2013 with operations scheduled to begin sometime in 2014 or 2015. The instrumented area, which would be called the Undersea Warfare Tracking Range, would be connected by cable to a facility that would be located on shore where the data collected would be used to evaluate the performance of participants in shallow water

training exercises. NMFS concluded that 106 humpback whales and 47 North Atlantic right whales might be exposed to active sonar operations at received levels that might result in behavioral responses.

Fishing Activities

NMFS records show that from 1990-2007, there were 46 confirmed North Atlantic right whale entanglements with fishing gear, including whales in weirs, gillnets, and trailing line and buoys (Waring et al., 2009). In addition, of the 24 confirmed reports of North Atlantic right whales being entangled in fishing gear between 2004 and 2008 off the Atlantic coast of the U.S. and Maritime Provinces of Canada, three whales died of their wounds with one additional whale sustaining serious injuries (Glass et al., 2010).

Recent records show that from 2004-2008 there were five humpback whales killed and an additional 11 sustaining serious injuries from entanglement (Glass et al., 2010). Robbins and Mattila (2001) studied entanglement-related scarring on 134 individual humpback whales and concluded that between 48 and 65 percent had experienced entanglements. The authors also found that female humpbacks showing evidence of prior entanglements produced significantly fewer calves, suggesting entanglement may significantly reduce reproductive success in humpback whales (Robbins and Mattila, 2001).

Marine mammals probably consume at least as much fish as is harvested by humans (Kenney et al., 1985) so competition with humans for prey is a potential concern for large whales located in the action area (especially for humpback whales). Reductions in fish populations, whether natural or human-caused, may affect humpback whale recovery by altering their distribution. North Atlantic right whales feed almost exclusively on copepods and therefore are not in direct competition with human fishing operations occurring in the action area.

Ship Strikes and Other Vessel Interactions

In addition to noise effects described earlier, vessels operating in the action area adversely affect listed whales through direct ship strikes and/or other physical and behavioral disturbance. Large cetaceans are very vulnerable to ship strikes based on their size, swimming speeds, and locations that overlap areas with high boat traffic. From 2000-2004, there were 42 confirmed ship strikes on large whales in the North Atlantic with 21 confirmed deaths (Cole et al., 2006). Fin whales were the most frequently struck whale, although North Atlantic right and humpback whales were also commonly struck (Laist et al., 2001). Recent records show that from 2004-2008, there were 17 confirmed reports of North Atlantic right whales being struck with eight whales dying of their wounds and two additional right whales whales sustaining serious injuries (Glass et al., 2010). Results for for that same period listed 14 reports of humpbacks getting struck (including eight confirmed mortalities) (Glass et al., 2010). Deaths of females in and around the action area, in particular, are especially threatening the ability of the North Atlantic right whale population to recover.

In the North Atlantic, NMFS has several programs in place to help reduce ship strikes to whales. One of these measures is the implementation of new rules that limit vessel traffic of ships greater than 65 feet to speeds of 10 knots or less in areas when right whales are known to congregate. Other programs include the modification of shipping lanes from areas of high right whale concentrations. Although these efforts are targeted primarily to help conserve North Atlantic right whales, they are also beneficial to other whales which inhabit the same waters and are subject to similar threats. Despite these measures, the threat of ship strikes is expected to continue in the action area as commercial shipping lanes continue to cross important breeding habitats and may actually increase in the future as whale populations recover and individuals populate new areas or areas where they were previously extirpated (Swingle et al., 1993; Wiley et al., 1995).

In addition to serious injury or direct mortality through ship strikes, listed whales have also been shown to respond to the general presence of vessels by exhibiting avoidance behaviors and signs of increased stress including tail slapping, rolling, diving, separation of mothers and young and abandonment of resting areas, among others (Kovacs and Innes, 1990; Kruse, 1991; Wells and Scott, 1997; Samuels and Gifford, 1998; Bejder et al., 1999; Colburn, 1999; Cope et al., 1999; Mann et al., 2000; Samuels et al., 2000; Boren et al., 2001; Constantine, 2001; Nowacek et al., 2001). Vessel avoidance may cause whale individuals in the action area to move away from important feeding areas or potential mates, both of which can affect the ability of the species to recover and, in the case of North Atlantic right whales, may reduce the conservation value of designated critical habitat. Whale watching, a profitable and rapidly growing business with more than nine million participants in 80 countries and territories, may increase these types of disturbance and negatively affect listed species in the future (Hoyt, 2001).

Scientific Research

Large whales in the action area have been the subject of numerous scientific research activities (mostly non-lethal), as authorized by NMFS permits. Research activities for listed whales in the action area include close vessel and aircraft approaches, biopsy sampling, suction cup and implantable satellite tagging, the opportunistic collection of sloughed skin and fecal samples, and active acoustic experiments. There are currently 14 active permits authorizing research on North Atlantic right and/or humpback whales occurring in full or in part within the action area for the proposed action. **Table 2** below displays the current take numbers authorized over the next five years (2011-2016), including the additional numbers proposed for the research activities included in this consultation.

Table 2. Cumulative Take Numbers Authorized for Target Species from Active Scientific Research Permits Operating in or Around the Action Area (2011-2016)

Target Species	Level B Harassment Only[10]		Biopsy*		Suction Cup Tagging*		Implantable Satellite Tagging*		Active Acoustics (Sonar)*	
	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed
North Atlantic Right Whale	18,910	**300**	380 (170 calves)	0	450 (25 calves)	0	45	0	0	0
Hump back Whale	8,120	**50**	730 (40 calves)	0	263	0	45	0	1,800	0

* The proposed takes for biopsy sampling, tagging, and active acoustics would occur simultaneously with Level B activities. Additional take to be authorized by the proposed permits is in **bold**.

Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by the NMFS must also be reviewed for compliance with section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species. Authorized "takes" by harassment represent substantial research effort relative to species abundance in the action area with repeated disturbances of individuals likely to occur each year. However, all permits for marine mammals 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.

There is evidence that listed whales may be either sensitized by multiple approaches (Lundquist, 2007) which can increase their stress levels, and possibly exacerbate their reactions to biopsy sampling or tagging; however, whales have also been shown to become habituated to boats as a result of multiple approaches, possibly leading to a lesser reaction from other research activities performed on the whales as a result (Whitehead et al., 1990; Weinrich et al., 1991; Weinrich et al., 1992; Clapham and Mattila, 1993; Jahoda et al., 2003; Best et al., 2005; Richter et al., 2006). If whales are already in a stressful situation with a close approach, there is a good chance that the tagging or removal of the biopsy sample increases their stress response. It is clear that the approach itself may play a role in the extent to which a whale reacts to biopsying or tagging.

10 Level B harassment activities are defined as any activity that 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 but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

Whales that are biopsied following a fast approach may respond more intensely to the impact of the dart than if approached slowly (Whitehead et al., 1990; Brown et al., 1991; Weinrich et al., 1991; 1992; Jahoda et al., 2003). When approaches are conducted slowly, the whales tend to exhibit minimal responses that are short-lived (Clapham and Mattila, 1993). Researchers operating in the action area are required to approach whales slowly using a converging course technique that should minimize the stress response of the whales according to the literature.

The fact that multiple permitted "takes" of listed whales is already permitted and is expected to continue to be permitted in the future, means that short term behavioral harassment expected to listed whales from similar research activities has the ability to contribute to or even exacerbate the non-lethal stress responses generated from other threats occurring in the action area. The point at which this leads to a measurable cumulative impact on the survival and recovery, however, is uncertain. Our ability to detect long-term effects from research activities will depend on several factors including our ability to better detect sub-lethal effects from research actions as well as funding and prioritizing long-term studies investigating survival and reproductive abilities of listed species targeted by similar types of research in the past. This may lead to statistically significant trends showing whether or not repeated non-lethal disturbances by research activities are affecting the ability of listed whales to survive and recover in the wild to an appreciable degree. More information on anticipated effects from similar research actions is included in the *Effects of the Proposed Action* section of this Opinion.

Conservation and Management Efforts

Several conservation and management efforts have been undertaken for listed whales in the action area to aid in recovery efforts. NMFS implements conservation and management activities for these species through its Regional Offices and Fishery Science Centers in cooperation with states, conservation groups, the public, and other federal agencies.

In the North Atlantic, NMFS has several programs in place to help reduce ship strikes and reduce gear entanglement by listed whales. One of these measures is the implementation of new rules that limit vessel traffic of ships greater than 65 feet to speeds of 10 knots or less in areas when right whales are known to congregate. Other programs include the modification of shipping lanes away from areas of high right whale concentrations. Although these efforts are targeted primarily to help conserve North Atlantic right whales, they are also beneficial to other whales which inhabit the same areas and are subject to similar threats. Similarly, in an effort to reduce fishing gear entanglement by whales in the North Atlantic, NMFS developed the Atlantic Large Whale Take Reduction Plan. This plan has improved safety measures in fishing gear in order to reduce entanglements by whales. This plan also expanded restrictions on fishing grounds and prohibited gillnet fishing in restricted areas during the calving season. As a result of these efforts, modified gear has been employed in the southeastern U.S. to protect listed whale species (Jaquet et al., 2005). It is expected that ongoing conservation and management efforts have an overall positive effect to the species; although the extent

that these actions improve the species ability to survive and recover in the wild in the face of other stressors acting on these species in the action area remains uncertain.

EFFECTS OF THE PROPOSED ACTION

Pursuant to Section 7(a)(2) of the ESA, federal agencies are directed to insure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. In this section, we describe the potential physical, chemical, or biotic stressors associated with the proposed action, the probability of individuals of listed species being exposed to these stressors, and the probable responses of those individuals (given probable exposures) based on the best scientific and commercial evidence available. As described in the *Approach to the Assessment* section, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the listed species those populations represent. The purpose of this assessment is to determine if it is reasonable to expect the proposed research activites to have effects on listed species that could appreciably reduce their likelihood of surviving and recovering in the wild.

In the case of critical habitat, for any responses that are expected to reduce the quantity, quality, or availability of the primary or secondary constituent elements of the area of designated critical habitat (or physical, chemical, or biotic phenomena), we ask if those reductions are likely to be sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area. The purpose of this assessment is to determine if it is reasonable to expect the proposed research activites to have effects on listed species that could appreciably reduce their likelihood of surviving and recovering in the wild or whether effects to critical habitat would be sufficient to reduce the conservation value of the entire critical habitat designation.

For this consultation, we are particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences. The proposed permits would authorize non-lethal "takes" by harassment of listed species by way of aerial and vessel surveys. As stated earlier, we define harassment as an intentional or unintentional human act or omission that creates the probability of injury to an individual animal by disrupting one or more behavioral patterns that are essential to the animal's life history or its contribution to the population the animal represents.

Some forms of harassment, including close approaches by aerial and vessel surveys will occur in areas designated as critical habitat for North Atlantic right whales. Therefore, these activities also have the potential to reduce the conservation value of designated critical habitat for North Atlantic right whales in the southeastern calving grounds.

Potential Stressors

The stressors associated with the proposed research activities to be authorized under Dr. Hains's permit include noise and visual disturbance during aerial and vessel surveys and the potential for vessel strikes during transit.

Exposure Analysis

Exposure analyses identify the co-occurrence of ESA-listed species with the action's effects in space and time, and identify the nature of that co-occurrence. The exposure analysis identifies, as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent. For the exposure analysis conducted for this consultation, we estimated the number of individual whales likely to be exposed to the effects of the proposed research activities using the best information available to us including recent population estimates, expected growth rates over the life of the permits, the maximum survey effort expected from the researchers over the life of the permits, and past take numbers reported from permits authorizing similar types of research within or near the action area.

While annual reports detailing prior "takes" are useful in estimating exposure levels, it must be noted that the frequency, duration, area, and focus of research activities often vary on an annual basis due to factors such as weather, funding, opportunistic events, and evolving research goals and needs. Also, the threshold for reporting whether an actual "take" occurred has evolved over the years, thus possibly introducing some level of human error or bias into numbers reported in prior annual reports (e.g. some researchers may have reported a "take" only if the animal somehow reacted to an approach while other researchers may have assumed a "take" whether the animal exhibited a visible reaction or not). Thus, past annual reports introduce some level of uncertainty as to their accuracy for predicting future activities, levels of effort, and expected "takes" of listed species. Despite this uncertainty, annual reports remain one of the most valuable resources to the Endangered Species Division for estimating exposure levels of future permit actions and were thus utilized in this consultation. The Permits Division has made an effort to standardize reporting of "takes" resulting from research activities which should lead to more accurate and informative annual reports in future years and hopefully reduce the level of error and uncertainty associated with the number of "takes" reported.

Our exposure analysis considered the number of listed whale individuals expected to occur along the pre-determined transect lines based on survey data submitted under the previous permit. To account for the variability in research effort from year to year, we calculated, to the extent possible, the mean North Atlantic right whale sightings observed per aerial survey from past monitoring reports submitted by the applicant. We first counted the number of times an aerial survey (both by blimp and AirCam aircraft) resulted in an encounter of North Atlantic right whales and then calculated the mean number of animals observed per encounter event. Then, using the maximum possible survey effort expected from the research applicants in their current application (3-4 surveys per week for 16 weeks each year), we estimated the maximum amount of whale encounters likely to be exposed each year over the life of the proposed permits. Based on

the data, the applicants also reported that for all right whale encounters, about five percent resulted in an observed response by the whale and was subsequently counted as a "take" in the monitoring report as a form of harassment. Therefore, the likely amount of "take" resulting from the proposed aerial surveys are also reflected in the numbers below using this five percent estimate. Finally, using a standard distribution, we estimated likely exposures and "take" estimates out to 4 standard deviations to account for more than 99% of the annual levels of "take" possible as well as to account for variability in annual research effort and population growth over the life of the proposed permits.

Table 3 below identifies the expected number and ages of listed whales reasonably expected to be exposed annually to the stressors associated with permit No. 13927. NMFS expects that in any given year, not all proposed "takes" would occur and no individual is expected to be taken more than three times in a given day.

Table 3. Exposure Analysis for Permit No. 13927 (2011-2016)

Species	Life Stage	Sex	Maximum Annual Encounters*	Annual Encounters Resulting in a Take	Research Method	Procedures
North Atlantic right whale	Adult/ Juvenile	Male and female	485	25	Aerial surveys	Count/Survey; Photo-id
North Atlantic right whale	Calf	Male and female	106	6	Aerial surveys	Passive Acoustics Recording; Count/Survey; Behaviorial Observations; Photo-id
North Atlantic right whale	Adult/ Juvenile	Male and female	7	7	Vessel surveys	Count/Survey; Photo-id
North Atlantic right whale	Calf	Male and female	3	3	Vessel surveys	Passive Acoustics Recording; Count/Survey; Behaviorial Observations; Photo-id
Humpback whale	All	Male and female	10	10	Aerial/ Vessel surveys	Incidental harassment, Photo-id

*Encounters equate to the maximum number of whales sighted during aerial and blimp surveys each year while the estimates of "take" equate to the number of encounters that is expected to cause a reaction to the whales in the form of short term behavioral harassment

Estimates of right whale calf encounters were estimated based on the ratios reported in the prior monitoring reports and also by incorporating data on calf production expected over the life of the permit. For example, for years where calves were reported separately on the monitoring reports we calculated how many of the average encounters were reported as calves rather than adults and adjusted our estimates of encounters and "take"

accordingly. We also projected the average annual calf production based on quarterly reports published for the North Atlantic Right Whale Consortium (NARWC) on calf production during the years 2001-2010 and incorporated this into our estimates as well. For consistency, we assumed that calves would react to the aerial surveys at the same levels as observed for adults based on the prior survey data (five percent of encounter events resulting in a "take").

The research applicants expect vessel surveys to be used with less regularity and would only be utilized on occasions when the whales are too distant from shore for useful shore-based photographs and if aircraft is not available. Due to the difficulty in estimating exposure of North Atlantic right whales from vessel surveys based on the variable nature of this research effort, NMFS assessed exposure of North Atlantic right whales at the proposed levels and assumed "take" in the form of harassment when approaches did occur as a "worst-case scenario" for the species. Future monitoring reports will better inform this analysis both in terms of research effort, as well as actual levels of "take" observed. Right whale calf "take" estimates for vessel surveys were estimated from the the ratios expected for aerial surveys.

Similar to vessel surveys, the exposure of humpback whales to both aerial and vessel surveys is highly variable since it would only be done on an opportunistic basis when the situation presented itself. Therefore, due to the difficulty in assessing exposure based on the highly variable level of research effort, NMFS assessed the exposure at the proposed levels and assumed "take" for each encounter event. The numbers will be further informed by monitoring reports submitted by the applicant.

Response Analysis

As discussed in the *Approach to the Assessment* section of this Opinion, response analyses determine how listed resources are likely to respond after being exposed to an action's effects on the environment or directly on listed animals themselves. For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal, physiological or behavioral responses that might reduce the fitness of individuals. Ideally, response analyses would consider and weigh evidence of adverse consequences as well as evidence suggesting the absence of such consequences.

Responses to Aerial Surveys

Aerial surveys (both by AirCam aircraft and by blimp) to be authorized by the proposed permits would be flown at altitudes between 700 and 1200 feet. When survey aircraft fly below certain altitudes (about 500 meters or 1600 feet), they have caused marine mammals to exhibit behavioral responses that might constitute a significant disruption of their normal behavioral patterns (Perry, 1998; Patenaude et al., 2002). For instance, about 14 percent of bowhead whales approached during aerial surveys exhibited short-term behavioral reactions (Patenaude et al., 2002), and gray whale cow-calf pairs have shown to react sensitively to aircraft with calves swimming beneath their mothers (Moore and Clark, 2002). Richter et al. (2006) noted that sperm whales had a small reaction to whale-watching aircraft and that there was a difference in reactions between transient and resident whales. While North Atlantic right and humpback whales exposed to aerial

surveys may exhibit similar short-term behavioral reactions to approaching aircraft, the effects appear to be short term with no long term fitness consequences expected. In the monitoring reports submitted by the applicant, some whales dove upon the aircraft approaching the whales, but the researchers noted that behavioral response was short in duration (ten minutes) and the animal resumed normal behavior shortly after responding. Also, conditions in the permits require that the aircraft retreat to higher altitudes if a whale exhibits an adverse reaction to the aircraft. Therefore, it is expected the aerial surveys conducted during the proposed research activites would result in only mild short-term behavioral reactions and would not result in any long term behavioral changes or reduce the fitness of individuals within the action area.

For aerial surveys conducted in critical habitat designated for the North Atlantic right whale, we considered the effects that AirCam aircraft and blimp surveys would have on the quantity, quality, and availability of the essential features of the habitat (specifically behavioral reactions that could cause whales to abandon important calving areas thereby reducing the availability of these essential features). NMFS expects that the approach techniques employed by the researchers should minimize the time that aerial surveys are circling right whale cow-calf pairs in the southeastern U.S. critical habitat (less than 15 minutes for an approach below 1,000 feet). Also, while temporary changes in whale behavior may occur as the whale reacts to the circling aircraft, past monitoring reports submitted by the researchers suggested these reactions were short in duration and that the whales resumed normal behavior once the aircraft returned to higher altitudes.

Furthermore, aerial surveys would not affect topographic or oceanographic characteristics, water depth, water temperature, or distance of the critical habitat areas from shore nor would they affect the population ecology or population dynamics of prey species, predators, or competitors of right whales. Therefore, it is expected the aerial surveys conducted during the proposed research activites would result in only mild short-term behavioral reactions and would not result in any changes to the quantity, quality, and availability of essential features of the southeastern U.S. critical habitat designted for North Atlantic right whales.

Responses to Vessel Surveys including Close Vessel Approaches and Aerostat Observations

Vessel approaches have the potential to disturb listed whale species and induce behavioral and possibly physiological stress to whales targeted by the approach as well as other whales in the vicinity of the vessel. Whales may respond differently to vessel surveys depending on what behavior the animals are engaged in before the vessel approaches (Würsig et al., 1998; Hooker et al., 2001; Jahoda et al., 2003) and the degree to which they become accustomed to vessel traffic (Lusseau, 2004; Richter et al., 2006). Reactions include little to no observable change in behavior to momentary changes in swimming speed, pattern, orientation, diving and time spent submerged, foraging, respiratory patterns, and also may include aerial displays like breaching and lobtailing (Watkins et al., 1981; Bauer, 1986; Brown et al., 1991; Clapham and Mattila, 1993; Jahoda et al., 2003; Best et al., 2005). Reactions to vessel noise have been observed when engines are started at distances of 3,000 feet or less (Malme et al., 1983;

Richardson et al., 1995), suggesting that some level of disturbance may result even if the vessel does not undergo a close approach. In addition, changes in whale behavior have also been reported to correspond to vessel speed, size, and distance from the whale, as well as the number of vessels operating in the proximity (Baker et al., 1988; Koehler, 2006). Several studies identify immediate responses of specific baleen whale species involved in the proposed research activities. These studies are described in detail below.

For humpback whales, studies on summering grounds as summarized by Baker and Herman (1989) and Baker et al. (1983), and on wintering grounds as summarized by Bauer (1986), found patterns of disturbance in response to vessel activity that indicate such approaches are probably stressful to some individuals, but the consequences of this stress remains unknown. Baker et al. (1983) described two responses of whales to vessels, including: (1) "horizontal avoidance" of vessels 2,000 to 4,000 meters away characterized by faster swimming and fewer long dives; and (2) "vertical avoidance" of vessels from 0 to 2,000 meters away during which whales swam more slowly, but spent more time submerged. Hall (1982) reported that humpback whales closely approached by survey vessels in Prince William Sound, Alaska, often reacted by diving and surfacing further from the vessel or with an altered direction of travel. The author noted that whale feeding activity and social behavior did not appear to be disturbed by the approaches; however, cow-calf pairs appeared to be wary and avoided the vessel. Other studies have found that humpbacks respond to the presence of boats by increasing swimming speed (e.g., Au and Green, 2000; Scheidat et al., 2004; Koehler, 2006), with some evidence that swimming speed then decreased after boats left the area.

The slow and careful approach to humpback whales is important and is supported by studies conducted by Clapham and Mattila (1993) on the reactions of humpback whales to close approaches for biopsy sampling in Caribbean breeding areas. The investigators concluded that the way a vessel approached a group of whales had a major influence on the whale's response to the approach, particularly for cow-calf pairs. Smaller pods and pods with calves also seem more responsive to approaching vessels (Bauer, 1986; Bauer and Herman, 1986). Based on their experiments with different approach strategies, researchers concluded that experienced, trained personnel approaching humpback whales slowly would result in fewer whales exhibiting responses that might indicate stress.

Best et al. (2005) conducted a study on the responses of southern right whale adults and calves (including neonates) to close approaches for the purposes of biopsy sampling off South Africa and found no evidence that these approaches affected calf survival, caused whales to emigrate outside the area, or curtailed reproduction in females; however, the authors note the power of the statistical tests for this conclusion was low. The study also assessed short-term behavioral reactions to close approaches for biopsy sampling and found that calves had reactions indistinguishable from those of adult same sex groupings of two. The authors conducted repeat approaches on 20 cow-calf pairs and were unable to detect a trend of increased or decreased sensitivity of calves to the approach and that resightings of approached whales that underwent sampling have been documented and so far provide no evidence of any long-term effects (Best et al., 2005).

Given the information available and recognizing the conditions of the proposed permit, we provisionally assume that the proposed vessel surveys would result in a short- to mid-term stress response that generate no long-term behavioral changes that might result in fitness consequences for individual whales in the action area.
Detection of vessel noise is dependent on several factors, including weather, vessel engine type and size, habituation, and other ambient noise. All vessels to be used are below 50 feet in length, so the sound generated is expected to be at higher frequencies than larger vessels like supply ships, container/cargo ships, and cruise vessels operating in the action area (OSPAR, 2009). Since large cetaceans tend to hear and vocalize at lower frequencies, the contribution of marine ambient noise generated by the research vessels is expected to be minimal and would not adversely affect listed whales' ability to hear mates and other conspecifics. Therefore, the threat of vessel noise to listed whales that hear and vocalize at lower frequencies is sufficiently low and therefore discountable.

The probability of a vessel collision during transit and actual vessel surveys depends, in part, on the size and speed of the vessel. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. According to Jensen and Silber (2003) the majority (79 percent) of records of vessels striking large whales occurred when the vessel was traveling at speeds of 13 knots or greater with 18.6 knots representing the average speed that resulted in serious injury or death. Although background information contained in the *Status of the Species* and *Environmental Baseline* sections suggest that vessel strikes are a major threat to North Atlantic right and humpback whales, given the procedures to be followed in the proposed research activities (e.g. slow transit speeds and slow, converging course technique during close approaches), we expect that the probability of whales being struck by research vessels is extremely unlikely and, therefore, discountable.

For vessel surveys conducted in critical habitat designated for the North Atlantic right whale, we considered the effects that vessel approaches and aerostat observations would have on the quantity, quality, and availability of the essential features of the habitat (specifically behavioral reactions that could cause whales to abandon important calving areas thereby reducing the availability of these essential features). NMFS expects that the slow converging course technique employed by the researchers should minimize the stress response of the approached whales for purposes of photographs taken from the deck or for aerostat observations from the deployed tethered baloon. Also, while temporary changes in whale behavior may occur as the whale reacts to the approaching vessel, the literature suggests these reactions are expected to be short in duration and that the whales would resume normal behavior after the approach (Watkins et al., 1981; Bauer, 1986; Brown et al., 1991; Clapham and Mattila, 1993; Jahoda et al., 2003; Best et al., 2005). Furthermore, vessel surveys would not affect topographic or oceanographic characteristics, water depth, water temperature, or distance of the critical habitat areas from shore nor would they affect the population ecology or population dynamics of prey species, predators, or competitors of right whales. Therefore, it is expected the vessel surveys conducted during the proposed research activites would result in only mild short-term behavioral reactions and would not result in any changes to the quantity, quality,

and availability of essential features of the southeastern U.S. critical habitat designted for North Atlantic right whales.

Responses to Passive Acoustic Recording
Passive acoustic recordings allow researchers to associate whale calls with particular observed behaviors. Occasionally, during vessel surveys to be authorized in Dr. Hain's permit, researchers would drop a hydrophone into the water to listen for right whale calls associated with particular behaviors. These recordings would be done while the vessel is shut down and would generally last no more than an hour. As a passive system, the hydrophone would not emit any sounds or signals into the water column. Passive acoustic recordings are not expected to result in a response to right whale individuals beyond the mild, short-term reactions seen during the normal course of vessel surveys. Also, passive and active acoustic activities occurring in designated critical habitat are not expected to affect the physical, chemical, or biologic features that give the habitat conservation value to North Atlantic right whales.

Risk Analysis
Our risk analyses reflect relationships between listed species, the populations that comprise that species, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise. For analyses of critical habitat, we determine if an action is expected to reduce the quality, quantity, or availability of constituent elements or essential physical, chemical, or biological features at a level sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area. In this step of our assessment, we combine information about the contribution of constituent elements (or other essential features) to the conservation value of those areas of critical habitat that occur in the action area, given the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area. If the conservation value of designated critical habitat in an action area is reduced, the final step of our analyses asks if those reductions are likely to be sufficient to reduce the conservation value of the entire critical habitat designation.

Based on a review of available information, we would expect listed whales exposed to aerial and vessel surveys under the proposed permit to exhibit either no visible response or short-term behavioral responses similar to those seen for predator avoidance. These responses may result in interruptions of essential behavior and physiological processes such as feeding, mating, nursing, resting, digestion etc., which can result in stress, injury and increased susceptibility to disease and predation (Frid and Dill, 2002; Romero, 2004; Walker et al., 2006). We assume aerial and vessel surveys conducted under the proposed permit might be stressful for some individuals, and might temporarily interrupt behaviors such as foraging, but evidence in the literature (Watkins et al., 1981; Bauer, 1986; Brown et al., 1991; Clapham and Mattila, 1993; Jahoda et al., 2003; Best et al., 2005) for similar actions suggests that responses are expected to be short-lived. Assuming an animal is no

longer disturbed after it returns to pre-approach behavior, we do not expect long-term fitness consequences for North Atlantic right or humpback whales as a result of the proposed research activities nor do we expect North Atlantic right whales to permanently abandon areas designated as critical habitat.

Gill et al., (2001) noted that changes in animal behavior do not necessarily reflect consequences of disturbance at the population level. Therefore, we can not definitively know whether such short-term behavioral responses have long-term consequences, as such consequences would be primarily sub-lethal for individual animals (that is, they would affect their growth, health, or reproductive success), and the associated consequences on whale populations would be delayed in time and concealed by any imprecision in population estimates. However, Glockner-Ferrari and Ferrari (2006) noted several female humpback whales that had been subjected to close vessel approaches multiple times during the last 20 years were resighted in the same area and were known to have reproduced several times during this period. This information indicates the close vessel approaches on these whales did not affect survival or prevent reproduction in these individuals. In addition, Best et al. (2005) conducted repeat approaches on 20 North Atlantic right whale cow-calf pairs and were unable to detect a trend of increased or decreased sensitivity of calves to the approach and that resightings of approached whales that underwent sampling have been documented and so far provide no evidence of any long-term effects.

Therefore, based on the best scientific information available, we expect that responses to aerial and vessel surveys by the proposed research are not likely to cause a reduction in growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness) and would not have an appreciable effect on the extinction risk of the population(s) these individuals represent or the species those populations comprise. We also expect that short term behavioral responses would not reduce the conservation value of the critical habitat designated in the action area nor would it reduce the conservation value of the designation as a whole for North Atlantic right whales.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions, including research authorized under ESA Section 10(a)1(A), that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Future cumulative effects from these and other types of federal actions will be investigated in future consultations, most notably in the *Status of the Species* and *Environmental Baseline* sections of Opinions which inform the effects analyses for specific federal actions. Other possible effects that may be acting in conjunction with federal actions and could possibly contribute to a cumulative impact on listed species are described below.

NMFS expects the natural phenomena in the action area (e.g., oceanographic features, storms, natural mortality) will continue to influence listed species as well as the

conservation value of designated critical habitat for North Atlantic right whales as described in the *Environmental Baseline* section of this Opinion. Climatic variability has the potential to affect listed species in the action area in the future; however, the prediction of any specific effects leading to a decision on the future survival and recovery of listed species is currently speculative. Nevertheless, possible effects of climatic variability for listed whales include the alteration of community composition and structure, changes to migration patterns or community structure, changes to species abundance, increased susceptibility to disease and contaminants, alterations to prey composition and altered timing of breeding (MacLeod et al., 2005; Robinson et al., 2005; Kintisch, 2006; Learmonth et al., 2006; McMahon and Hays, 2006). In addition, increases in ocean temperature may cause dramatic shifts in the reproductive rate of North Atlantic right whales (Drinkwater et al., 2003; Greene et al., 2003) and possibly a northward shift in the location of right whale calving areas currently designated in the southeast U.S. (Kenney, 2007).

We also expect anthropogenic effects described in the *Environmental Baseline* will continue, including habitat degradation, vessel traffic and risk of ship strikes, interactions with fishing gear, and tourism activities. Expected increases in vessel traffic would further increase collision risks for large whales by the increased traffic itself and/or through habituation of whales to the sounds of oncoming traffic making them more prone to being struck. The number of vessels and tonnage of goods shipped by the U.S. fleet are increasing (e.g. there has been nearly a 30 percent increase in volume between 1980 and 2000) (NRC, 2003) and will lead to more vessel traffic throughout the action area in the future. The primary concern of increased levels of shipping noise expected from increased vessel traffic is not related to acute exposures, but rather to the general increase in continuous background ambient noise and the potential masking of marine animals' communication systems, their ability to hear mating calls, and their ability to pick up acoustic environmental cues that animals use to navigate and/or sense their surroundings, including sounds that are used to detect predators (OSPAR, 2009). Expanded use of commercial sonars is also expected to increase, further exacerbating these effects (NRC, 2003).

Due to insufficient information on future management regimes associated with commercial and recreational fisheries, we cannot estimate the probability of future injuries or deaths of listed whales due to interactions with these fisheries. However, given whale interactions with fisheries in the action area during the recent past, such interactions remain a major threat to the survival and recovery of listed whale species in the action area.

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

Additionally, unrelated factors may be acting together to affect listed species and/or the conservation value of designated critical habitat. For example, vessel effects combined with the stresses of reduced prey availability or increased contaminant loads may reduce foraging success and lead to chronic energy imbalances and poorer reproductive success which all may work to lower an animal's ability to suppress disease (Williams et al., 2002; NMFS, 2008). The net effect of these disturbances is dependent on the size and percentage of the population affected, the ecological importance of the disturbed area to the animals, the parameters that influence an animal's sensitivity to disturbance or the accommodation time in response to prolonged disturbance (Geraci and St. Aubin, 1980). More studies need to be done to identify the long term effects to listed whales and critical habitat from current stressors as well as the potential additive effect that multiple stressors acting in conjunction over time will have on the survival and recovery of listed whales.

After reviewing the available information, NMFS is not aware of any additional future non-federal activities or potential stressors acting in the action area that would not require federal authorization or funding and are reasonably certain to occur during the foreseeable future and could contribute to a cumulative impact on listed species or designated critical habitat.

INTEGRATION AND SYNTHESIS OF EFFECTS

The following text integrates and synthesizes the *Description of the Action, Approach to the Assessment, Status of the Species, Environmental Baseline, Effects of the Proposed Action, and Cumulative Effects* sections of this Biological Opinion as corrected. This information, in addition to any known or expected cumulative effects, was used to assess the risk the proposed research activities pose to the future survival and recovery of North Atlantic right and humpback whales as well as the conservation value of North Atlantic right whale critical habitat designated in the action area.

As explained in the *Approach to the Assessment* section, risks to listed individuals are measured using changes to an individual's "fitness." When listed plants or animals exposed to an action's effects are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). When individuals of listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions can reduce the abundance, reproduction, or growth rates of the populations that those individuals represent (see Stearns, 1992). If we determine that reductions in individual plants' or animals' fitness reduce a population's viability, we consider all available information to determine whether these reductions are likely to appreciably reduce the viability of the species as a whole.

Destruction or adverse modification determinations must be based on an action's effects on the conservation value of habitat that has been designated as critical to threatened or endangered species. If an area encompassed in a critical habitat designation is likely to

be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary or secondary constituent elements included in the designation (if there are any) or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species are likely to respond to that exposure. If responses are expected, we ask if those responses are likely to be sufficient to reduce the quantity, quality, or availability of those constituent elements or physical, chemical, or biotic phenomena, and if so, whether they are likely to be sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area and finally the conservation value of the entire critical habitat designation.

The Permits Division proposes to issuance permit No. 13927 to Dr. James Hain that would authorize "takes" of North Atlantic right and humpback whales during aerial and vessel surveys conducted in the southeastern U.S. off Georgia and Florida including the southeast U.S. calving grounds designated as critical habitat for North Atlantic right whales. The objectives of the proposed research are to monitor the distribution of North Atlantic right whales in the portion of the southeastern U.S. critical habitat south of St. Augustine, Florida, to improve knowledge of right whale habitat utilization, to monitor reproductive success, to contribute to the photo-identification catalog for both North Atlantic right and humpback whales, and to explore linkages between right whale vocalizations and behavior as well as to evaluate the efficacy of a passive acoustic monitoring system. Aerial surveys would be conducted using a twin engine AirCam aircraft as well as blimps while small vessels may be used opportunistically if aircraft are not available or if whales are located too distant from shore for shore-based photographs. An aerostat tethered balloon would also be utilized aboard vessels to record whale behavior and hydrophones would also be utilized to conduct passive acoustic recordings. The permits would be valid for five years and would exempt “take” of listed whales by way of i harassment during close approaches as well as noise disturbance during transit. No direct mortality of listed species is authorized or expected.

North Atlantic right and humpback whales were heavily reduced by whaling up to the late 19th century. Other factors currently threatening the survival and recovery of these species include entrapment and entanglement in commercial fishing gear, ship strikes, habitat issues such as pollutants and noise, subsistence harvest, scientific whaling and research, and commercial and private whale watching. Recent increases in North Atlantic right whale calving may indicate that the calving interval for the species is decreasing, although other anthropogenic sources of mortality such as ship strikes and entanglement in fishing gear continue to threaten the species and slow its ability to recover. Numbers for humpback whales appear to be increasing in the North Atlantic and Southern Hemisphere stocks; however, their resilience to anthropogenic stressors is less clear.

Critical habitat designated for the North Atlantic right whale encompasses three primary feeding and nursery habitats in the United States used by right whales during their annual migration. The physical, chemical, and biotic features that form right whale critical habitat include the composition of zooplankton in feeding areas, the topographic and seasonal oceanographic characteristics conducive to zooplankton growth; and water

depth, water temperatures, and distance from shore for calving and nursery areas (59 FR 28793; June 3, 1994). Threats affecting the status and conservation value of North Atlantic right whale critical habitat are similar to threats affecting North Atlantic right whale individuals and populations occurring within these areas (e.g. vessel noise, fishing gear, etc.); however, additional threats to the conservation value of North Atlantic right whale critical habitat include variations in the NAO index affecting the abundance of zooplankton and possible shifts in the location of right whale calving areas (Kenney, 2007), the presence of commercial and recreational vessels interrupting feeding or nursing behavior, and habitat contamination and pollution from land based sources. These threats are expected to continue to affect the conservation value of foraging grounds and/or calving areas for North Atlantic right whales and remain a significant threat to the recovery of the species as a whole.

Taken together, the components of the environmental baseline for the action area include sources of natural mortality – such as predation, disease, and parasites – as well as influences from natural oceanographic and climatic features. Circulation and productivity patterns may influence prey distribution and habitat quality for listed whale species as well as possibly affect the conservation value of designated critical habitat for North Atlantic right whales at present and in the future. The baseline also includes human activities resulting in disturbance, injury, or mortality of individuals. These activities include the direct commercial harvest of whales, which significantly lowered population levels of North Atlantic right and humpback whales in the past, habitat degradation (e.g., due to contaminants and noise), vessel traffic and risk of ship strikes, entrapment or entanglement in fishing gear, and harassment from other permitted scientific research activities. Conservation and management efforts are ongoing and have a positive effect on the status of listed species and critical habitat found within the action area.

The assessment for this consultation identified several possible stressors as a result of the proposed research activities that would be measured and evaluated against the stressors already occurring in the *Environmental Baseline* section. These stressors included noise and visual disturbance during aerial and vessel surveys as well as possible ship strikes during transit.

For the exposure analysis conducted for this consultation, we estimated the number of individual whales likely to be exposed to the effects of the proposed research activities using the best information available to us including recent population estimates, expected growth rates over the life of the permits, the maximum survey effort expected from the researchers over the life of the permits, and past take numbers reported from permits authorizing similar types of research within or near the action area. NMFS expects that aerial surveys would result in 25 takes of adult and/or juvenile North Atlantic right whales and 6 right whale calves each year while vessel surveys are expected to result in 7 takes of adult/juveniles and 3 takes of right whale calves. The expected take levels from aerial surveys were based on the average encounter events expected as well as the amount of encounters likely to result in an actual take (reaction by the whale in the form of harassment) using prior survey data. Vessel surveys are expected to be more variable in

terms of effort each year compared to aerial surveys so exposure from vessel surveys were assessed at proposed levels. Similarly, exposure of humpback whales from aerial or vessel surveys is also expected to be highly variable so NMFS assessed exposure of humpback whales at the proposed levels as well as a "worst-case scenario" for the affected species.

Our response analysis evaluated expected responses given the exposure to the identified stressors using the best available information. While North Atlantic right and humpback whales exposed to aerial surveys may exhibit similar short-term behavioral reactions to approaching aircraft, the effects appear to be short term with no long term fitness consequences expected. In the monitoring reports submitted by the applicant, some whales dove upon the aircraft approaching the whales, but the researchers noted that behavioral response was short in duration (ten minutes) and the animal resumed normal behavior shortly after responding. Also, conditions in the permits require that the aircraft retreat to higher altitudes if a whale exhibits an adverse reaction to the aircraft. Therefore, it is expected the aerial surveys conducted during the proposed research activites would result in only mild short-term behavioral reactions and would not result in any long term behavioral changes or reduce the fitness of individuals within the action area.

Vessel approaches have the potential to disturb listed whale species and induce behavioral and possibly physiological stress to whales targeted by the approach as well as other whales in the vicinity of the vessel. Whales may respond differently to vessel surveys depending on what behavior the animals are engaged in before the vessel approaches (Würsig et al., 1998; Hooker et al., 2001; Jahoda et al., 2003) and the degree to which they become accustomed to vessel traffic (Lusseau, 2004; Richter et al., 2006). Reactions include little to no observable change in behavior to momentary changes in swimming speed, pattern, orientation, diving and time spent submerged, foraging, respiratory patterns, and also may include aerial displays like breaching and lobtailing (Watkins et al., 1981; Bauer, 1986; Brown et al., 1991; Clapham and Mattila, 1993; Jahoda et al., 2003; Best et al., 2005). Given the information available and recognizing the conditions of the proposed permit, we assume the close approaches by research vessels to result in short- to mid-term stress responses that generate no long-term behavioral changes that might result in fitness consequences for individual whales. Also, given the procedures to be followed in the proposed research activities (e.g. slow transit speeds and slow, converging course technique during close approaches), it's expected that the probability of whales being struck by research vessels is extremely unlikely and, therefore, discountable.

For aerial and vessel surveys conducted in critical habitat designated for North Atlantic right whales (i.e. southeastern U.S. calving grounds), we considered the effects that these surveys would have on the quantity, quality, and availability of the essential features of the habitat (specifically behavioral responses that may cause whales to abandon calving areas thereby reducing the availability of the essential features). While temporary changes in whale behavior may occur as the whale reacts to the approaching aircraft or vessel, the literature suggests these reactions are expected to be short in duration and that

the whales would resume normal behavior after the approach (Watkins et al., 1981; Bauer, 1986; Brown et al., 1991; Clapham and Mattila, 1993; Jahoda et al., 2003; Best et al., 2005). Furthermore, aerial and vessel surveys would not affect topographic or oceanographic characteristics, water depth, water temperature, or distance of the critical habitat areas from shore nor would they affect the population ecology or population dynamics of prey species, predators, or competitors of right whales. Therefore, it is expected that aerial and vessel surveys conducted during the proposed research activites would would not result in any changes to the quantity, quality, and availability of essential features of the southeastern U.S. critical habitat designted for North Atlantic right whales.

Assuming an animal is no longer disturbed after it returns to pre-approach behavior, we do not expect long-term fitness consequences for North Atlantic right or humpback whales as a result of the proposed research activities nor do we expect North Atlantic right whales to permanently abandon areas designated as critical habitat. For limited research that has been done on long term trends, whales that had been subjected to multiple approaches were resighted and were known to have reproduced several times during the study period suggesting that repeated approaches had not resulted in a long term adverse affect to the study species (Best et al., 2005; Glockner-Ferrari and Ferrari, 2006). Therefore, based on the best scientific information available, we expect that responses to aerial and vessel surveys by the proposed research are not likely to cause a reduction in growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness) and would not have an appreciable effect on the extinction risk of the population(s) these individuals represent or the species those populations comprise. We also expect that short term behavioral responses would not reduce the conservation value of the critical habitat designated in the action area nor would it reduce the conservation value of the designation as a whole for North Atlantic right whales.

NMFS expects the natural phenomena in the action area (e.g., oceanographic features, storms, natural mortality) will continue to influence listed species and designated critical habitat in the action area as described in the *Environmental Baseline* section. Climatic variability has the potential to affect listed species in the action area through alteration of community composition and structure, changes to migration patterns or community structure, changes to species abundance, increased susceptibility to disease and contaminants, alterations to prey composition and altered timing of breeding (MacLeod et al., 2005; Robinson et al., 2005; Kintisch, 2006; Learmonth et al., 2006; McMahon and Hays, 2006).

We also expect anthropogenic effects described in the *Environmental Baseline* will continue, including habitat degradation, vessel traffic and risk of ship strikes, increases in background ocean noise levels, interactions with fishing gear, and tourism activities. The net effect of these disturbances is dependent on the size and percentage of the population affected, the ecological importance of the disturbed area to the animals, the parameters that influence an animal's sensitivity to disturbance, or the accommodation time in response to the prolonged disturbance (Geraci and St. Aubin, 1980). More studies need to be done to identify the long term effects to listed whales from current stressors as well

as the potential additive effect that multiple stressors acting in conjunction over time have on the survival and recovery of listed whales in the action area.

CONCLUSION

After reviewing the current status of species, the environmental baseline for the action area, the anticipated effects of the proposed activities and the possible cumulative effects, it is the Endangered Species Division's opinion that the Permits Division's proposed action of issuing permit No. 13927 to Dr. James Hain, as proposed, is not likely to jeopardize the continued existence of North Atlantic right or humpback whales and is not likely to destroy or adversely modify critical habitat for North Atlantic right whales under NMFS' authority.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the "take" of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. However, as discussed in the accompanying Opinion, only the species targeted by the proposed research activities will be significantly harassed as part of the intended purpose of the proposed action. Therefore, NMFS does not expect the proposed action will incidentally take threatened or endangered species.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information.

We recommend the following conservation recommendations, which would provide information for future consultations involving the issuance of permits that may affect listed whales and/or sea turtles as well as reduce harassment related to the authorized activities:

1. *Approaching Cow-Calf Pairs that Appear in Poor Health.* The Permits Division should include a permit condition that prohibits researchers from approaching

North Atlantic right whale cows with their calves regardless of age when either appear unusually thin or emaciated. Further stress from approach or attempts to biopsy sample a cow or her calf in poor health may cause injury or even death of a whale.

2. *Estimation of Actual Levels of "Take."* The Permits Division should continue to review all annual and final reports submitted by investigators that have conducted whale and sea turtle research as well as any data and results that can be obtained from the permit holders. This should be used to estimate the amount of harassment that occurs given the level of research effort, and how the harassment affects the life history of individual animals. The results should be provided to NMFS Office of Protected Resource – Endangered Species Division for use in future consultations.

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

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

REINITIATION NOTICE

This concludes formal consultation on the proposal to issue scientific research permit No. 13927 for research on listed cetaceans within waters off southeast coast of Georgia and Florida. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of proposed take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, NMFS Office of Protected Resources – Permits, Conservation, and Education Division must immediately request reinitiation of section 7 consultation.

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