BEFORE THE SECRETARY OF COMMERCE

PETITION TO REVISE THE CRITICAL HABITAT DESIGNATION FOR THE NORTH ATLANTIC RIGHT WHALE (*EUBALAENA GLACIALIS*) UNDER THE ENDANGERED SPECIES ACT

Photo courtesy of Marine Mammal Commission

CENTER FOR BIOLOGICAL DIVERSITY
DEFENDERS OF WILDLIFE
HUMANE SOCIETY OF THE UNITED STATES
OCEAN CONSERVANCY
WHALE AND DOLPHIN CONSERVATION SOCIETY

PETITIONERS

SEPTEMBER 16, 2009

NOTICE OF PETITION

Gary Locke
Secretary of Commerce
U.S. Department of Commerce
1401 Constitution Avenue, NW,
Room 5516
Washington, DC 20230
Email: glocke@doc.gov
Phone (202) 482-2112
Fax: (202) 482-2741

Dr. James W. Balsiger
Acting Assistant Administrator for
Fisheries
National Oceanic and Atmospheric
Administration
1315 East-West Highway
Silver Spring, MD 20910
Email: jim.balsiger@noaa.gov
Phone: (301) 713-2239
Fax: (301) 713-1940

Petitioners

Center for Biological Diversity
351 California Street, Suite 600
San Francisco, CA 94104
Tel: (415) 436-9682

Defenders of Wildlife
1130 17th Street NW
Washington, DC 20036
Tel: (202) 772-3274

Whale and Dolphin Conservation Society
7 Nelson Street
Plymouth, MA 02360
Tel: (508) 746-2522

The Humane Society of the United States
2100 L Street NW
Washington, DC 20037
Tel: (508) 833-0181

Ocean Conservancy
1300 19th Street NW, 8th Floor
Washington, DC 20036
Tel: (202) 351-0452

The Center for Biological Diversity ("the Center") is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 225,000 members and online activists throughout the United States. The Center and its members are concerned with the conservation of endangered species, including the North Atlantic right whale, and the effective implementation of the Endangered Species Act.

Defenders of Wildlife ("Defenders") is a national non-profit organization dedicated to the protection and restoration of all native wild animals and plants in their natural communities. Based in Washington, D.C., and with offices spanning from Florida to Alaska, Defenders has more than one million members and supporters across the nation. Defenders and its members have been actively involved in efforts to protect and recover the critically endangered North Atlantic right whale.

The Humane Society of the United States ("The HSUS") is a non-profit organization headquartered in Washington, D.C. The HSUS is the nation's largest animal protection

organization, with over 11 million members and constituents. The HSUS is committed to the goals of protecting, conserving, and enhancing the nation's wildlife and wildlands, and fostering the humane treatment of all animals. In furtherance of these goals and objectives, The HSUS and its members have a strong interest in the preservation, enhancement, and humane treatment of marine mammals, including the North Atlantic right whale.

Ocean Conservancy is the world's foremost advocate for the oceans. Through science-based advocacy, research, and public education, we inform, inspire and empower people to speak and act for the oceans. Ocean Conservancy is headquartered in Washington, D.C., and has offices in Florida, the Gulf of Mexico, and the Pacific, with support from more than half a million members and volunteers. Ocean Conservancy and its members seek healthy and vibrant oceans, including the recovery of the North Atlantic right whale.

The Whale and Dolphin Conservation Society (North America) Inc., ("WDCS") is the world's largest organization dedicated solely to the protection of whales, dolphins, porpoises and their environment. WDCS has offices in the U.K., U.S., Australia and Germany with over 70,000 supporters world-wide. WDCS and its supporters care about the preservation of the critically imperiled North Atlantic right whale and its habitat.

Action Requested

Pursuant to section 4(b)(3)(D) of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b)(3)(D), section 553(3) of the Administrative Procedure Act, 5 U.S.C. § 553(e), and 50 C.F.R. § 424.14(a), the Center for Biological Diversity, Defenders of Wildlife, the Humane Society of the United States, Ocean Conservancy, and the Whale and Dolphin Conservation Society (collectively "Petitioners") hereby petition the Secretary of Commerce, through the National Marine Fisheries Service ("NMFS") to revise the critical habitat designation for the North Atlantic right whale (*Eubalaena glacialis*), as codified at 50 C.F.R. § 226.203, to include marine waters along the East Coast of the United States that constitute essential foraging, breeding, calving, nursery, and migratory areas for this critically imperiled species.

This petition sets in motion a specific process, placing definite response requirements on NMFS. Specifically, NMFS must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the revision may be warranted." 16 U.S.C. § 1533(b)(3)(D)(i). NMFS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id*. Petitioners need not demonstrate that the proposed revision action is warranted, rather, Petitioners must only present information demonstrating that such action may be warranted. 16 U.S.C. § 1533(b)(3)(A). Within 12 months of receiving this petition, NMFS is required to determine how it will proceed with the requested revision, moving forward with a proposed rule to revise critical habitat for the North Atlantic right whale if it determines such action is warranted. 16 U.S.C. § 1533(b)(3)(B).

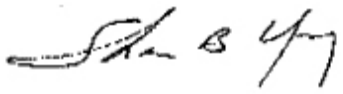
As described in this petition, the areas of the Atlantic Ocean we propose for critical habitat designation meet all the criteria for such designation as defined at 16 U.S.C. § 1532(5) and 50 C.F.R. §§ 424.02 & 424.12. In the event that NMFS determines that some portions of the requested critical habitat revision do not meet the criteria for such designation, we request, in the

alternative, that NMFS analyze whether some subset of this area should be designated as critical habitat.

Dated this 16th day of September, 2009

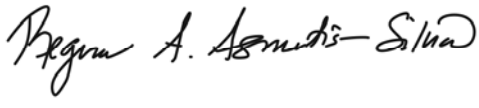
Andrea A. Treece
Center for Biological Diversity

Sierra B. Weaver
Defenders of Wildlife



Sharon B. Young
Humane Society of the United States

Vicki Cornish
Ocean Conservancy



Regina Asmutis-Silvia
Whale and Dolphin Conservation Society

TABLE OF CONTENTS

INTRODUCTION

Petitioners request that the existing critical habitat designation for the North Atlantic right whale (*Eubalaena glacialis*) under the Endangered Species Act be revised to include expanded areas in New England and the Southeast United States, as well as the species' mid-Atlantic migratory corridor. Although critical habitat was designated for the right whale in 1994, the original areas designated did not include areas now known to be of significance to right whales and, therefore, is not sufficient to provide for the conservation of the species. Right whale critical habitat must be expanded to reflect the best available science on right whale habitat requirements.

As the National Marine Fisheries Service ("NMFS") is well aware, North Atlantic right whales are critically endangered and face numerous threats to their continued existence. With less than 400 animals remaining in the population, significant threats from commercial fisheries and collisions with vessels, as well as emerging threats from military activities and the degradation of ocean habitat by chemical and noise pollution, climate change and ocean acidification, pose daunting obstacles to the species' survival and recovery. Although the agency has taken steps to begin to address these threats, expansion of critical habitat will provide an important layer of protection that has so far been lacking for much of the right whale's essential habitat.

Petitioners' requested amendments to the right whale's critical habitat designation will provide protection for habitats essential to the species' reproduction, feeding, sheltering, growth, and normal behavior. Scientific data accumulated over the 15 years since the original critical habitat designation have more directly tied the presence of right whales to the physical and biological constituent elements that make these habitats so important for the species, and which may require special management considerations or protection. Notably, much of this well accepted and widely used data has been produced or compiled by NMFS itself.

In particular, Petitioners request that NMFS: (1) expand right whale critical habitat in waters off the Northeast United States to include the Gulf of Maine and its associated Bays (e.g., Cape Cod and Massachusetts Bays) and the area northward of lines drawn diagonally from the southern corner of the current Great South Channel Critical Habitat (41.0° N latitude, 69.1° W longitude), northeastward to the Exclusive Economic Zone/Hague Line (42.2° N latitude, 67.2° W longitude) thence northerly along the Hague Line to the U.S.-Canadian border, to include State and Federal waters adjacent to the states of Maine, New Hampshire, and Massachusetts, and northwestward to the southern corner of Cape Cod, Massachusetts (approximately 41.55° N latitude, 70.0° W longitude) (Figure 1); 2) expand right whale critical habitat in the waters off the Southeast United States to include coastal waters from the shore out to 35 nautical miles off the coast of South Carolina, and waters off the coast of Georgia and Florida from approximately 32.0^{o} N latitude, 80.35^{o} W southward to approximately 28^{o} N latitude, 80.35° W longitude (Figure 2); 3) designate as right whale critical habitat coastal waters all waters along the migratory corridor of the mid-Atlantic from the shore out to 30 nautical miles, between the northern border of South Carolina (approximately 33.85° N latitude and 78.53° W longitude) northward to the southeastern corner of Cape Cod, Massachusetts (approximately 41.55^{o} N

latitude, 70.0^{o} W longitude), southeastward to the southern corner of the current Great South Channel Critical Habitat (41.0° N latitude and 69.1° W longitude) (Figure 3).

Figure 1. Proposed Critical Habitat for the Gulf of Maine-Northeast Region

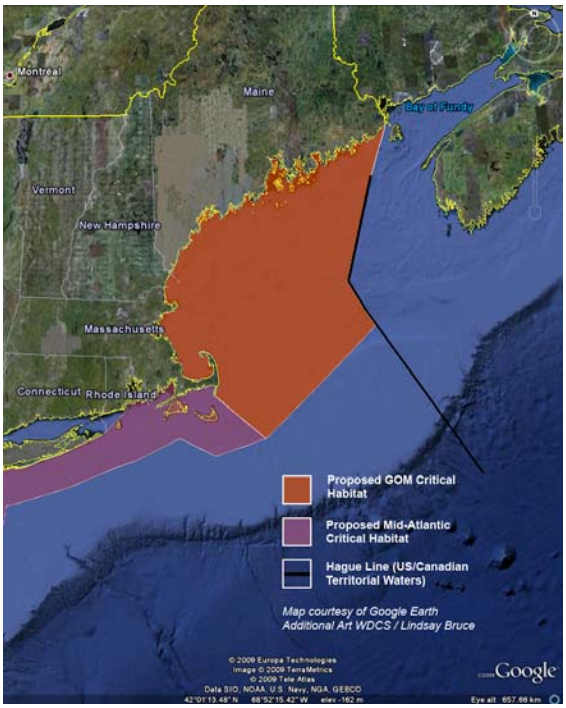


Figure 2. Proposed Critical Habitat for the Southeast Region

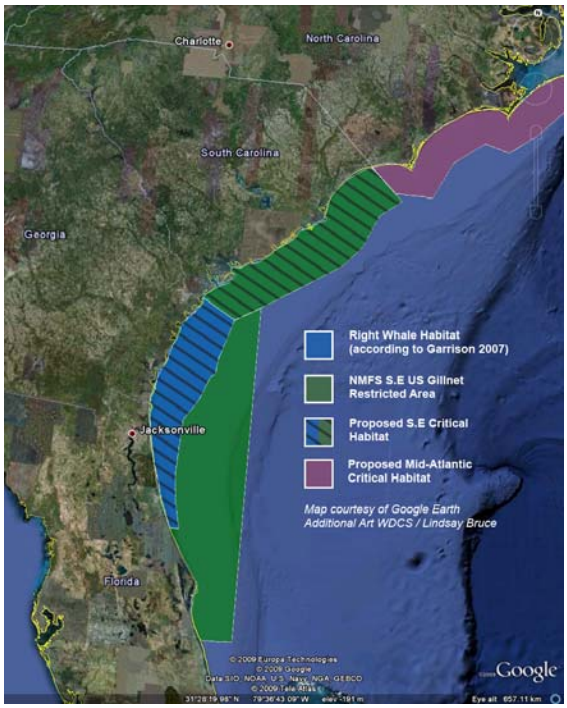
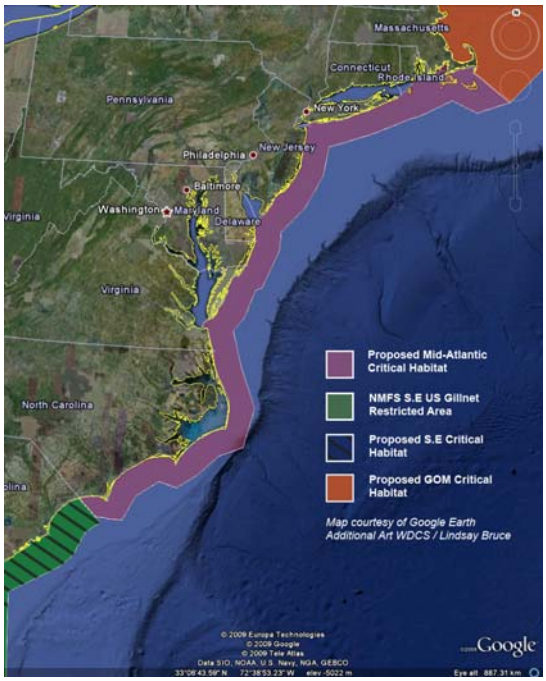


Figure 3. Proposed Critical Habitat for the Mid-Atlantic Region



I. Factual and Legal Background

A. The Importance of Critical Habitat under the Endangered Species Act

In 1973, Congress acknowledged the unprecedented loss of biodiversity taking place worldwide, and expressed its concern that "various species … have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation."[1] In recognition of the "aesthetic, ecological, educational, historical, recreational and scientific value to the Nation and its people" of these rapidly disappearing species, and the inadequacy of existing laws to protect them, the ESA was enacted "to provide a means whereby *the ecosystems upon which endangered species and threatened species depend* may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions" mentioned in the ESA.[2]

The legislative history of the ESA also shows Congress clearly recognized the importance of critical habitat designation in conserving listed species:

> [C]lassifying a species as endangered or threatened is only the first step in insuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence . . . . If the protection of endangered and threatened species depends in large measure on the preservation of the species' habitat, then the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat.[3]

The primary mechanism by which critical habitat protects a listed species is through the section 7 consultation process.[4] Section 7 requires federal agencies to ensure that no action they authorize, fund, or carry out is likely to "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical habitat]."[5] Importantly, the designation of critical habitat and its consideration in section 7 consultation must ensure not only the survival, but also the recovery of the species.[6]

In its 1983 proposed rule to designate critical habitat for the Atlantic population of the northern right whale, NMFS described the crucial role critical habitat designation plays in providing section 7 protections:

> A designation of critical habitat provides a clearer indication to Federal agencies as to when consultation under section 7 is required, particularly in cases where the action would not result in direct mortality or injury to individuals of a listed species.…The critical habitat designation, describing the essential features of the

[1] 16 U.S.C. § 1531(a)(1).
[2] 16 U.S.C. §§ 1531(a)(3); 1531(b) (emphasis added).
[3] H.R. Rep. No. 94-887 at 3 (1976).
[4] 16 U.S.C. § 1536(a)(2).
[5] *Id*.
[6] 16 U.S.C. § 1532(3) (definition of "conserve").

> habitat, also assists in determining which activities conducted outside the designated area are subject to section 7. . . . For example, disposal of waste material in water adjacent to a critical habitat area may affect an essential feature of the designated habitat (water quality) and would be subject to the provisions of section 7….[7]

NMFS also noted that critical habitat assists federal agencies in planning future actions because critical habitat establishes in advance those areas that will be given special consideration in section 7 consultations. The designation allows conflicts between development and listed species to be identified and avoided early in the planning process.[8]

Similarly, NMFS recognized that critical habitat provides a benefit to species by focusing federal, state, and private conservation and management efforts in areas designated as critical habitat. Recovery efforts can then address special considerations needed in critical habitat areas, including specifically tailored protective regulations. Finally, NMFS pointed out that there may be other federal, state, or local laws that provide special protection for areas designated as critical habitat.[9]

The ESA and implementing regulations require critical habitat to be defined to the maximum extent prudent and determinable.[10] Critical habitat consists of both a geographic area and elements such as plants or natural features within that area. The ESA defines critical habitat as "(i) the specific areas within the geographic area occupied by the species, at the time it is listed … on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed … upon a determination by the Secretary that such areas are essential for the conservation of the species."[11]

The "constituent elements" of critical habitat – which "shall be listed with the critical habitat description,"– may include (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally, (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.[12] NMFS regulations also specify that these elements "may include, but are not limited to, the following: roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dry land, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide, and specific soil types."[13] These features are also referred to as "primary constituent elements" ("PCEs").

---

[7] 58 Fed. Reg. 29186, 29187 (May 19, 1983).
[8] *Id.*
[9] *Id.*
[10] 16 U.S.C. § 1533(a)(3); 50 C.F.R. § 424.12(a).
[11] 16 U.S.C. § 1532 (5)(A); 50 C.F.R. § 424.12(b).
[12] 50 C.F.R. § 424.12(b).
[13] *Id.*

The ESA provides for revision of critical habitat designation as appropriate.[14] Any determination about a revision is to be made according to the same criteria as the original designation: on the basis of the best scientific evidence, taking into account economic and other impacts.[15]

The ESA allows individuals to petition for revision of critical habitat, in accordance with the Administrative Procedure Act, which provides that "each agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule."[16]

Finally, the ESA and its implementing regulations detail how petitions to revise critical habitat must be evaluated. Within 90 days, the Secretary "shall make a finding as to whether the petition presents substantial scientific information indicating that the revision may be warranted" and "shall promptly publish such finding in the Federal Register."[17] NMFS regulations also provide that the petitioner shall be notified of such determination.[18] If the evidence is "not sufficiently definitive," the Secretary may solicit comments and additional information.[19] Within 12 months, "the Secretary shall determine how he intends to proceed with the requested revision, and shall promptly publish notice of such intention in the Federal Register."[20]

B. Status of North Atlantic Right Whale

Eubalaena glacialis, the northern right whale, and *Eubalaena australis*, the southern right whale, were originally listed as endangered species in the early 1970s.[21] Subsequently, genetic studies established conclusively that the North Atlantic right whale (*E. glacialis*) is a separate species from the North Pacific right whale (*E. japonica*). Based on that science, the Center for Biological Diversity submitted a petition requesting that NMFS list the North Pacific right whale as a separate endangered species under the ESA.[22] NMFS agreed and, on April 7, 2008, *E. japonica* and *E. glacialis* were listed as separate endangered species.[23]

Eubalaena glacialis is considered to be one of the most endangered large whales in the world. The most recent NMFS stock assessment calculated that 345 individually recognized North Atlantic right whales were known to be alive during 2005 and stated that, with the exception of calves and uncatalogued individuals, this represents a nearly complete census.[24]

---

[14] 16 U.S.C. § 1533(a)(3)(b).
[15] *Id.* at § 1533(b)(2).
[16] *Id*. at § 1533(b)(3); 5 U.S.C. § 553(e).
[17] 16 U.S.C. § 1533(b)(3)(D)(I).
[18] 50 C.F.R. § 424.14(c)(1).
[19] *Id*. at. § 424.15(a).
[20] Id at § 424.14(c)(3); 16 U.S.C. § 1533(b)(3)(D)(ii); § 424.14(c)(3).
[21] *See discussion* at 71 Fed. Reg. 77704, 77706 (Dec. 27, 2006).
[22] Center for Biological Diversity, Petition to List the North Pacific Right Whale as an Endangered Species under the ESA (Aug. 16, 2005).
[23] 73 Fed. Reg. 12024 (March 6, 2008).
[24] NMFS 2009. North Atlantic right whale. Stock Assessment. Draft 2009 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2009_draft_all.pdf.

C. History of Critical Habitat for the North Atlantic Right Whale

In 1994, NMFS designated three areas of the Atlantic as critical habitat for northern right whales: the Great South Channel, Cape Cod Bay, and waters off the coast of Florida and Georgia.[25] These areas were determined to provide critical feeding, nursery, and calving habitat for right whales. The Great South Channel, a large, funnel-shaped bathymetric feature at the southern extreme of the Gulf of Maine between Georges Bank and Cape Cod, provides a feeding and nursery area for the majority of the population during spring and early summer. Thermal mixing in this area produces abundant zooplankton populations, including the copepod species relied upon by right whales. Cape Cod Bay provides feeding and nursery habitat for another portion of the population during late winter and spring. Waters off the southeast U.S. coast extending from Sebastian Inlet, Florida to the Altamaha River, Georgia provide a winter calving ground and nursery area. NMFS found that these areas were "essential for the reproduction, rest and refuge, health, continued survival, conservation and recovery of the northern right whale population."[26]

In 2002, The Ocean Conservancy formally petitioned NMFS to expand critical habitat for the North Atlantic right whale (*Eubalaena glacialis*).[27] In its petition, Ocean Conservancy relied on "extensive and expanded survey efforts in the southeast" that indicated "right whales occur farther offshore than previously known."[28] Although NMFS agreed with this assessment of its own data, it found that "more analyses of the sightings data and their environmental correlates are necessary to define and designate these areas as critical habitat."[29] NMFS ultimately found the petitioned action "not warranted" due to what it determined was the need to identify the "specific nature and location of the physical or biological features of the habitat that are essential to the conservation of the species."[30] NMFS stated that it intended to continue with planned research activities and "evaluate new information to determine whether physical and biological features essential to the conservation of the species exist that may warrant a revision of critical habitat."[31]

D. Why Revision of Critical Habitat is Necessary

While the current critical habitat designation helps protect certain feeding, calving, and nursery areas for the right whale, it does not protect more recently identified key wintering, foraging, calving and migratory areas. With an estimated population of only 345 animals, the survival and recovery of the North Atlantic right whale depends on the protection of its essential habitat areas. Amending the current critical habitat designation to include the three areas proposed in this petition would greatly benefit the species and help provide a better chance at achieving its recovery.

---

[25] 59 Fed. Reg. 28793 (June 3, 1994) (Final Rule Designating Critical Habitat for *Eubalaena glacialis*).
[26] *Id*.
[27] 68 Fed. Reg. 51758 (Aug. 28, 2003) (NMFS' Response to Ocean Conservancy petition).
[28] *Id*. at 51760.
[29] *Id*.
[30] *Id*. at 51762.
[31] *Id*. at 51763.

First, with regard to the need to protect broader areas in the Northeast that are outside of the boundaries of currently designated critical habitat, NMFS itself has stated that virtually the entire Gulf of Maine is vital to the survival of the species. The area possesses the food resource necessary to meet the right whales' energetic demands as well as the critical recharge areas in which their planktonic prey are overwintering.[32]

Second, with regard to calving habitat in the Southeast, NMFS asserted in 1994 that "the environmental features that have been correlated with distribution of northern [sic] right whales throughout the [southeast U.S.] include water depth, water temperature and the distribution of right whale cow/calf pairs and the distance from shore…."[33] Since the time that critical habitat boundaries were designated in 1994, substantial new information indicates that these key features that constitute the PCEs of the calving habitat are more widely available to the north and east of the current critical habitat boundaries and that right whale mothers and their calves are heavily dependent on this larger area for successful calving and nursing.[34]

This petition also proposes designating a migratory corridor as part of right whale critical habitat. The regular transit of right whales through the shallow nearshore waters of the mid-Atlantic (i.e., waters within 30 nautical miles ("nm") of shore) place them at risk of death and injury in the heavily trafficked area.[35] There is no other route between their northern feeding areas and their southern calving ground that meets the conditions available in the corridor currently used (i.e, shallow, minimal slope, nearshore). Designating a migratory corridor as critical habitat is key to assuring the safety of all whales transiting this route, but especially mothers and calves, which are both the most vulnerable members of the species, and the most important for its survival and recovery.

In its 2005 recovery plan for the North Atlantic Right Whale, NMFS prioritized the identification and protection of right whale habitat as essential to the species' recovery. Because of the species' extremely low numbers, NMFS identified the reduction or elimination of human-caused deaths and injuries as the species' most urgent need.[36] Nevertheless, NMFS recognized that habitat protection was a high priority management need:

---

[32] Pace, RM III and R. Merrick. 2008. Northwest Atlantic Ocean Habitats Important to the Conservation of North Atlantic Right Whales (Eubalaena glacialis). NEFSC Ref. Doc. 08-07. *Available at*: http://www.nefsc.noaa.gov/publications/crd/crd0807/index.html.

[33] 59 Fed. Reg. 28793.

[34] Garrison, L.P. 2007. Defining the North Atlantic Right Whale Calving Habitat in the Southeastern United States: An Application of a Habitat Model. NOAA Technical Memorandum NOAA NMFS-SEFSC-553: 66 p.; Taylor, D.R., W. Mclellan, A. Glass, M. Zani and A. Pabst. 2007. Right Whale Sightings in the Mid-Atlantic and Southeast Atlantic Bight from 2001-2007. In: Abstracts 2007 Right Whale Consortium, C. Kahn and C. Taylor. Monitoring North Atlantic Right Whales off the Coasts of South Carolina and Northern Georgia, 2006-2007; *see also* 72 Fed. Reg. 34632, 34636 (June 25, 2007) (NMFS characterizing the Southeast gillnet restricted area, which extends to the southern border of North Carolina, as a "substantial and core portion of the right whale calving area").

[35] NMFS 2008. Final Environmental Impact Statement ("FEIS") to Implement the Vessel Operational Measures to Reduce Ship Strikes to the North Atlantic Right Whale. August 2008. *Available at*: http://www.nmfs.noaa.gov/pr/shipstrike/eis.htm.

[36] NMFS 2005, Recovery Plan for the North Atlantic Right Whale (May 26, 2005) at II. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/recovery/whale_right_northatlantic.pdf

> Secondary, but still high priority, needs involve other actions of importance to the species' management, including characterization and monitoring of important habitat, and protection of this habitat; and identification and monitoring of the status, trends, distribution and health of the species. Habitat-related actions include characterization and monitoring of habitat; the use of GIS to analyze whale and vessel occurrence and distribution (including the patterns of strandings), and to prepare predictive models of whale occurrence; analysis and revision, if supported, of critical habitat; and studies on food requirements and resources.[37]

A recovery plan is "supposed to be a basic road map to recovery," which lays out the "process that stops or reverses the decline of a species and neutralizes threats to its existence" and provides a "means for achieving the species' long-term survival in nature."[38] If implemented, a valid recovery plan provides the means by which a species recovers to the point that its listing under the ESA is no longer warranted.[39]

The information presented in this petition builds on that presented by The Ocean Conservancy in 2002 and responds to NMFS' previous concerns regarding the need for further data and specificity regarding right whale use of certain areas. Although we do not agree that NMFS' "not warranted" decision was appropriate at that time, we believe that any deficiencies NMFS previously identified are clearly overcome by the current weight of the best available science. As detailed below, the best scientific information currently available shows that the addition of the proposed critical habitat areas is both warranted and necessary to ensure the survival of the species.

II. Natural History of the North Atlantic Right Whale

A. Taxonomy and Description of the North Atlantic Right Whale

Right whales are in the Order Cetacea, in the Family Balaenidae. Adults are typically between 45 to 55 feet (13.7-16.7 m) in length, weighing up to 70 tons (63.5 mt). They are somewhat dimorphic, with females larger than males. At birth, calves are approximately 13-15 feet (4-4.5 m) in length.[40]

With a robust body form and overall black color, right whales are distinguished as a species by roughened patches of skin on their heads, called callosities. The normally dark callosities appear lighter in color as a result of infestation with a cyamid parasite (commonly known as whale lice). As is the case with other baleen whales, right whales have a row of baleen plates hanging from each side of their upper jaw. Their baleen plates are up to 10 feet (3m) in length and dark in color, with a fine fringing that enables them to filter zooplankton prey from

[37] *Id. See also id.* at IVA-6 (recommending further research on habitat needs and possible revision of critical habitat).
[38] *Fund for Animals v. Babbitt*, 903 F. Supp. 96, 103 (D.D.C. 1995).
[39] *Id.*
[40] NMFS Protected Resources Website on North Atlantic Right Whales. *Available at*: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/rightwhale_northatlantic.htm.

the water as they swim forward with their mouths open, skimming prey from the water. Unlike other baleen whales, right whales lack a dorsal fin. Their tail is broad and distinctly notched. It is black on both the dorsal and ventral surface and has a smooth trailing edge. As a result of the position of their nostrils, their exhaled breath (or "blow") has a marked V-shape.[41]

Although it is difficult to determine exact life expectancy, NMFS estimates that right whales live at least 50 years. The oldest documented match to the North American right whale catalog is right whale #1045 at over 60 years of age.[42] There is evidence indicating that bowhead whales, a closely related species, may live over 100 years. [43]

B. Abundance and Population Trends

Although no reliable estimate of pre-exploitation size exists, it appears that the North Atlantic right whale population was already significantly reduced by the late 1600's. Reeves et al (1992) concluded that right whales in the Northwest Atlantic existed in at least the hundreds at that time and calculated a population size that was likely at least 1,000 right whales during the early to mid-1600's.[44] By 1935, when international whaling prohibitions came into effect, the population may have dwindled to less than 100 individuals.[45] The recovery history of the population from that time until the latter part of the 20th century is not well documented.

An International Whaling Commission workshop in 1999 came to the conclusion that, although North Atlantic right whale populations had increased slowly during the 20th century, survival probabilities declined in the 1990's. The workshop further concluded that the mean calving interval had increased from an average interval of 3.67 years to a 5 year interval.[46] This conclusion was reiterated by a NMFS workshop in 2002.[47] This decline in survival probability may have been a result of an increase in anthropogenic mortality.[48] Population growth appeared to be reduced by approximately 10% per year, in part because females and calves were disproportionately affected by fishery entanglements and collisions with vessels.[49]

---

[41] *Id.*

[42] North Atlantic Right Whale Consortium, unpublished. Whale Facts: Identification. *Available at* http://www.rightwhaleweb.org/index.php?mc=2&p=12 (last accessed on 1 September 2009).

[43] George, J., J. Bada, J. Zeh, L. Scott, S. Brown. 1999. Age and Growth Estimates of Bowhead Whales (*Balaena mysticetus*) Via Aspartic Acid Racemization. Canadian Journal of Zoology 77: 571-580.

[44] Reeves, R., J. Breiwick and E. Mitchell. 1992 Pre-exploitation abundance of right whales off the eastern United States. P. 5-7 in J. Hain (ed.) The right whale in the western North Atlantic: A science and management workshop. 14-15 April 1992. Silver Spring Md. NEFSC Ref. Document 92-05 cited in NMFS 2008 Stock Assessment for the North Atlantic Right Whale. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2008whnr-w.pdf.

[45] *Id.*

[46] Kraus, S.D., P.K. Hamilton, R.D. Kenny, A. Knowlton, and C. K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. J. Cetacean Res. Manage. (Special Issue) 2:231-236.

[47] Clapham, P. (ed). 2002. Report of the working group on survival estimation for North Atlantic right whales. NOAA/NEFSC. Woods Hole, MA.

[48] Kraus, S., M. Brown, H. Caswell, C. Clark, M. Fujiwara, P. Hamilton, R. Kenny, A, Knowlton, S. Landry, C.Mayo, W. McLellan, M. Moore, D. Nowacek, D. Pabst, A. Read, and R. Rolland. 2005. North Atlantic right whales in Crisis. Science. 309 (5734) p. 561-562.

[49] *Id.*

Since the time of these publications, NMFS has evaluated the individual sightings database and calculated that, as of October 2007, for the years 1990-2004, there had been a positive trend in numbers.[50] Despite the fact that losses in population appeared to exceed the gains during the late 1990's, NMFS calculated a growth rate for this 14 year period of 1.9%.

C. Distribution and Migration

Historically, right whales appear to have ranged from the eastern coast of the United States across the Atlantic to Greenland in the area of Cape Farewell Ground, as well as Iceland and Norway, which were major hunting areas.[51] There are some reports that they were also sighted in an area west of the Azores, an area experts theorize may have been a second calving ground.[52] At this point in time, the North Atlantic right whale's range is considerably constricted.[53]

Currently, North Atlantic right whales are distributed at least seasonally in waters off the entire the eastern United States to eastern Canada. Their wintering and calving grounds are generally described as being in the nearshore waters of the southeastern U.S.[54] During the summer, the majority of the population can be found in feeding and nursery areas from New England northward to the Bay of Fundy and the Scotian Shelf.[55] Most right whales migrate seasonally between these two areas, with a southward migration taking place in the fall and a northward migration in the spring. During the two seasonal migrations approximately 90% of all right whale sightings occur within 30 nautical miles (55.6 km) of the coast.[56] As they migrate, they travel offshore of the some of most densely populated portions of the U.S. and through some of its busiest port waters.

NMFS has previously identified six major habitats or congregation areas, including the 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.[57] However, new data indicate regular use of broader areas in both the Northeast and Southeast, and it is clear that right whales roam widely, and outside of these areas which are the only areas subject to fairly regular systematic surveys.

---

[50] NMFS 2009 Draft SAR, *supra*, note 24.
[51] Reeves, R., E. Josephson and T. Smith. 2004. Putative historical occurrence of North Atlantic right whales in mid-latitude offshore waters: Maury's smear is likely apocryphal. Marine Ecology Progress Series. 282. -. 295-305. *Available at*: http://archive.wcs.org/media/file/m282p295.pdf.
[52] *Id*.
[53] Kenny, R., P. Hamilton, T. Frasier and R. Pace. 2008. Trends in minimum number alive: Are Gulf of Maine right whales approaching carrying capacity? Abstract in North Atlantic Right Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford, Ma. November 2008.
[54] NMFS 2009 Draft SAR, *supra* note 24.
[55] *Id.*
[56] NMFS 2008. Final Rule to Implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic Right Whales. 73 Fed. Reg. 60173 (Oct. 10, 2008). *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr73-60173.pdf
[57] NMFS 2009 Draft SAR, *supra*, note 24; Brown, M.W., Brault, S., Hamilton, P.K., Kenny, R.D., Knowlton, A.R., Marx, K., Mayo, C.A., Slay, C.K. and Kraus, S.D. 2001. Sighting heterogeneity of right whales in the western North Atlantic: 1980-1992. J. Cetacean Res. Manage. (special issue) 2:245-50.

There have been a number of sightings and acoustic detections of right whales as far east as Greenland, Norway and the Azores.[58] In the southeastern U.S., sightings have been reported into the Gulf of Mexico.[59] The winter location of much of the population is unknown.[60] Some individuals seen in the Southeast in the winter have been documented to swim to the waters of New England and back. In 2004-2005, two individuals (right whales dubbed Kingfisher and Yellowfin) were seen free of fishing gear in the Southeast in the winter and subsequently became entangled in fishing gear set in Maine prior to a return trip to the Southeast where they were seen carrying the entangling gear.[61] These periodic trips from south to north and back occur with some regularity. In another instance, the NMFS Stock Assessment documents a whale sighted in Florida on January 12, 2000 who then was seen by a survey team 11 days later in Cape Cod Bay and, less than a month later, was seen again off Georgia on February 16. This whale then returned where it was again seen in Cape Cod Bay near the end of March.[62] Right whales have also journeyed on occasion around Florida into the Gulf of Mexico as far as Texas,[63] with one mother/calf pair sighted in Corpus Christi Bay, Texas, in January 2006, where markings on the calf were first identified as wounds from a possible ship strike.[64]

It is not clear whether excursions up and down the coast and into areas not thought of as "normal" areas of use (e.g., Norway, Texas) may represent forays into areas that were once part of the range of the species when its numbers were much larger. It is well known that as a species declines, its range contracts.[65] But it has also been theorized that with regard to exploited marine species, the extant range of a depleted species may not be the optimal core, but may instead reflect the degree and location of the exploitation that reduced the population in what were once higher density areas.[66] It is clear that, as species struggle to recover, these areas must be both identified and protected.

Because of limits on the time and area of systematic surveys for right whales, variability in the temporal and spatial use of their range generally go undocumented. However, as sighting effort expands, additional areas of significant use are documented. For example, in recent years systematic surveys have sighted mothers and newborn calves during the winter as far north as the coast of North Carolina, suggesting the calving grounds may extend as far north as Cape Fear in

---

[58] NMFS 2008 Ship Speed Rule, *supra*, note 56; NOAA Press Release, May 20, 2009, "NOAA Expedition Hears Endangered North Atlantic Right Whales off Greenland." *Available at*: http://www.noaanews.noaa.gov/stories2009/20090520_rightwhales.html; NEAq Right Whale Aerial Survey Blog, Jan. 8, 2009. *Available at*: http://www.neaq.org/education_and_activities/blogs_webcams_videos_and_more/blogs/right_whale_aerial_survey/2009/01/exciting-right-whale-sighting-in-azores.php

[59] *Id*.

[60] *Id.*

[61] Smith, J., K. Koyama and J. Kenny. 2006. Atlantic Large Whale Entanglement and Ship Strike Report 2004 and 2005. NOAA/NMFS Gloucester, MA.

[62] NMFS 2009 Draft SAR, *supra* note 24.

[63] Moore, J.C. and E. Clark. 1963. Discovery of Right Whales in the Gulf of Mexico. Science, New Series. Vol. 141, Issue 3577 (July 19, 1963), 269.

[64] Marine Resources Council 2006. Right Whale Volunteer News, Summer 2006. *Available at*: http://www.mrcirl.org/whale/whalenews0806/Summer2006lowres.pdf.

[65] Shackell, N., K. Frank and D. Brickman. 2005 Range Contraction May Not Always Predict Core Areas: An Example from Marine Fish. Ecological Applications. 15(4) 1440-1449. *Available at*: http://oceanography.dal.ca/publications/files/shackell_Frank_Brick_ecap05.pdf

[66] *Id.*

southern North Carolina.[67] Four of the eight calves seen in 2001 and 2002 had not been sighted by surveys in the waters further to the south, which are traditionally thought of as the calving grounds.[68] Further, NMFS surveys have recently documented the winter use of Jordan Basin in the northeastern U.S. as a winter breeding area for the species.[69]

In addition, limited satellite tagging has documented summer and fall journeys outside of the Bay of Fundy and Gulf of Maine into southern New England and even as far south as New Jersey.[70] Further, vessel-related collisions have been documented in times and areas where right whales are not normally expected.[71] Passive acoustic buoys have also documented distribution of right whales virtually year round in the waters off Massachusetts.[72]

It appears that although there is some seasonality to the movements of the majority of the population between summer high latitude feeding and nursery areas and winter calving grounds in the Southeast, right whale individuals range broadly outside of these areas and times. As we document herein, increased effort directed to sighting and acoustic detection has documented right whales well outside of the current boundaries for critical habitat, demonstrating that their high use areas are much more extensive than believed at the time that critical habitat was originally designated in 1994. The current boundaries do not include areas that may be critical for the conservation of the species.

D. Feeding and Prey Selection

Right whales feed primarily on zooplanktons, including copepods, cyprids, and euphausiids.[73] They feed by skimming prey from the water as they swim with mouths open through dense aggregations of preferred prey.[74] Their primary prey are copepods, including Calanus, Pseudocalanus, and Centropages, with *Calanus finmarchicus* as their major prey.[75]

The presence of dense patches of zooplankton, particularly Calanus copepods, is a primary characteristic of spring, summer and fall right whale habitats.[76] NMFS has found that the occurrence of dense copepod patches is the most important component of right whale habitat in New England waters.[77]

---

[67] NMFS 2009 Draft SAR, *supra* note 24.
[68] *Id.*
[69] *See* NOAA Press Release, Dec. 31, 2008, "High Numbers of Right Whales Seen in Gulf of Maine: NOAA Researchers Identify Wintering Ground and Potential Breeding Ground." *Available at*: http://www.nmfs.noaa.gov/mediacenter/docs/right_whale_newwinteringgrounds_12_08.pdf.
[70] Baumgartner, M. and Mate. B. 2003. Summertime foraging ecology of North Atlantic right whales. Marine Ecology Progress Series. 264:123-135
[71] Jensen, A. and G. Silber. 2004. Large Whale Ship Strike Database. NOAA Tech. Memo NMFS-OPR-25. 37pp. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/lwssdata.pdf.
[72] NOAA 2007 and 2008 Right Whale Sightings Advisory System. *Available at*: http://whale.wheelock.edu/whalenet-stuff/reportsRW_NE/.
[73] NMFS 2005 Recovery Plan, *supra*, note 36.
[74] *Id.*
[75] *Id.*
[76] Kenny, R. M. Hyman, R. Owen, G. Scott, and H. Winn. 1986. Estimation of Prey Densities Required by Western North Atlantic Right Whales. Marine Mammal Science. V. 2 (1) p. 1-13.
[77] Pace and Merrick 2008, *supra*, note 32.

Although right whales often feed on dense copepod aggregations at the surface, they more frequently appear to forage at depth in the water column, where copepod densities are highest.[78] Though dense patches will trigger foraging in right whales, the precise density that is an optimal threshold is subject to debate.[79] What is not subject to debate is that right whales require dense patches of copepods to survive.[80] These patches appear to be concentrated by oceanographic features such as water depth, current, and mixing fronts.[81] In at least one telemetry study, right whales were found in areas where the bottom mixed layer forced discrete layers of *Calanus finmarchicu*s to be shallower in the water column.[82]

Furthermore, current research efforts have indicated that zooplankton concentrations, on which right whales depend, may themselves depend on the formation of internal waves and bores.[83] The formation of these waves is largely dependent on benthic features such as changes in water depth.[84]

While it has been suggested that there is a potential for competition for prey with sei whales and planktivorous fish, this has not been proven.[85]

E. Reproduction

The only known calving ground for North Atlantic right whales is in the southeastern U.S., where right whales give birth generally between December and March in shallow coastal waters.[86] Right whales first give birth at an average age of nine to ten years and have a gestation period of approximately one year.[87] Calves are weaned at between eight and seventeen months of age.[88] At the current rate of reproduction, a female may give birth to between 5 and 6 calves over the course of her lifetime.[89]

Between 1980 and 1992, 145 calves were born to 65 identified females, at a rate of 5 to 17 per year.[90] Between 1987 and 1992, the pool of reproductively active females was only

---

[78] *Id*.
[79] *Id*.
[80] *Id*.
[81] *Id*.
[82] Baumgartner and Mate 2003, *supra* note 70..
[83] Pineda, J., 2009. Plankton distribution in internal waves and bores. Benthic Ecology and Nearshore Oceanography Lab's webpage at the Woods Hole Oceanographic Institution. *Available at*: http://science.whoi.edu/labs/pinedalab/Subpages/PLanktonDistributionInISW.html.
[84] Stellwagen Bank National Marine Sanctuary webpage on Physical Oceanography. *Available at*: http://stellwagen.noaa.gov/about/sitereport/oceanog.html.
[85] *Id*.; Payne, P.M., D. Wiley. S. Young, S. Pittman, P. Clapham and J. Jossi 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fisheries Bulletin. 88(4) 687-696.
[86] NMFS 2005 Recovery Plan, *supra*, note 36.
[87] *Id*.
[88] Hamilton, P. and M.K. Marx. 1995. Weaning in North Atlantic Right Whales, 11(3) Marine Mammal Science
[89] NMFS 2008 Ship Speed FEIS, *supra*, note 35.
[90] NMFS 2009 Draft SAR, *supra* note 24.

approximately 50 individuals.[91] The mean calving interval increased from 3.67 years during 1980-1992, to 5 years during 1993-1998; a statistically significant trend.[92]

This finding was confirmed by an International Whaling Commission workshop, which found that while the calving interval had increased, the reproductive rate of North Atlantic right whales was only half that of southern right whales (*Eubalaena australis*).[93] A variety of factors have been considered contributors to this reduced reproduction, including contaminants, biotoxins, limitations on food/nutrition, diseases and problems related to inbreeding in a small population.[94]

Between 1993 and 2007, 235 calves were born with a mean annual calf production of 15.6.[95] The annual production of calves during this fifteen year period ranged from 1 to 31 calves.[96] The number of reproductively active females in 2005 was 92, and by 2005, the mean calving interval decreased to just over three years.[97]

Fluctuations in availability of food resources, and resultant effects on body condition, have been linked to right whale reproductive success.[98] Several studies have linked the temperature fluctuations associated with the North Atlantic Oscillation ("NAO") with years of reduced reproduction.[99] Under this theory, *Calanus finmarchicus*, the primary copepod prey of right whales, track fluctuations in ocean temperatures. When the NAO is in its positive state the waters of the Northwest Atlantic are colder. When the NAO is in a negative state, the waters are warmer. After a winter of positive NAO conditions, the warmer saltier waters in deeper portions of the Gulf of Maine lead to higher abundance of copepods. After a negative NAO, these waters are colder and fresher and less productive of copepod prey. Right whales suffered poor reproduction in 1999 and 2000 following a change in the NAO in 1996 and subsequent decline

---

[91] *Id.*

[92] Kraus, S.D., R.M. Pace and T.R. Frasier 2007. High investment, low return: the strange case of reproduction in *Eubalaena glacialis*. Pages 172-199 in: S. D. Kraus and R. M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

[93] Best, P., J. Bannister, R. Brownell and G. Donovan, eds. 2001 Right Whales: Worldwide Status. Journal of Cetacean Research and Management (Special Issue) 2: 309.

[94] Reeves R., R. Rolland, P. Clapham (eds). 2001. Causes of Reproductive Failure in North Atlantic Right Whales: New Avenues of Research. Report of a Workshop Held 26-28 April 2000. NEFSC Ref. Doc. 01-16. 46 p. *Available at*: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0116/0116.htm

[95] NMFS 2009 Draft SAR, *supra* note 24.

[96] *Id.*

[97] Kraus et al. 2007, *supra* note 92.

[98] Angell, C. 2005. Blubber thickness in Atlantic E. glacialis and E. australis. PhD. Thesis. Boston University. Page 304 In: S. D. Kraus and R. M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA; Mayo, C.A., E.G. Lyman and A. DeLorenzo. 2000. Monitoring the Habitat of the North Atlantic Right Whale in Cape Cod Bay in 2000 and Comparison of Seasonal Caloric Availability in Cape Cod Bay with North Atlantic Right Whale Calving Rates: 1984 – 2000. Final report submitted to the Division of Marine Fisheries, Commonwealth of Massachusetts, Boston, MA. October 2000. Contract No. SCFWE3000-8365027 and to the Massachusetts Environmental Trust.

[99] Green, C., A. Pershing, R. Kenny and J. Jossi. 2003. Impact of Climate Variability on the Recovery of Endangered North Atlantic Right Whales. Oceanography. *Available at*: http://www.geo.cornell.edu/pershing/papers/docs/Ocean03.pdf; Greene, C and A. Pershing. 2005. Climate and the Conservation Biology of North Atlantic Right Whale: Being a Right Whale at the Wrong Time?" 2004 Frontiers in Ecology and the Environment. *Available at*: http://www.geo.cornell.edu/pershing/papers/docs/FEE04.pdf.

of copepods in 1998. When the NAO returned to positive conditions in 1997-2000, there was a resultant increase in copepods and increased calf production in 2001.[100]

The age structure of the population is skewed, with a smaller proportion of juveniles that would be expected.[101] NMFS concluded that this may reflect lowered recruitment and/or high juvenile mortality.[102] It is also possible that a reduced reproductive rate is due to unstable age structure in the population or reproductive senescence on the part of females in the population.[103]

As noted previously, females and calves have been disproportionately affected by anthropogenic mortality. In the 2004-2005 calving season alone, three pregnant adult females and their near-term calves were found dead as a result of collisions with vessels in the mid-Atlantic.[104]

III. Threats to the North Atlantic Right Whale

A. Collisions with Vessels

According to NMFS, vessel strikes are the leading cause of mortality to North Atlantic right whales.[105] Reducing the risk of ship strikes is, therefore, essential to prevent the extinction of this endangered species.

More than half (10 out of 14) of the post-mortem findings for right whales that died from significant trauma in the northwest Atlantic between 1970 and 2002 indicated that vessel collisions were a contributing cause of death (in the cases where presumed cause of death could be determined).[106] These data are likely to grossly underestimate the actual number of animals struck, as animals struck but not recovered, or not thoroughly examined, cannot be accounted for.[107]

Although fatal collisions are most significant, non-fatal collisions - which can also cause serious injury - are also a noteworthy concern. These injuries may ultimately result in the death of the whale as long as several years after the collision. In at least one known case, a pregnant, adult North Atlantic right whale is believed to have died as a result of an infection consequent to ship strike wounds she obtained years earlier as a calf.[108]

---

[100] *Id.*
[101] Best et al., *supra* note 93.
[102] NMFS 2009 Draft SAR, *supra* note 24.
[103] *Id.*
[104] *Id.*
[105] NMFS 2005 Recovery Plan, *supra* note 36.
[106] Moore, M. J., A.R. Knowlton, S.D. Kraus, W.A. McLellan, and R.K. Bonde. 2004. Morphometry, gross morphology and available histopathology in North Atlantic right whale (*Eubalena glacialis*) mortalities (1970-2002). Journal of Cetacean Research and Management 6:199-214.
[107] Reeves, R.A., J. Read, L. Lowry, S.K. Katona, and D.J. Boness. 2007. Report of the North Atlantic right whale program review-prepared for the Marine Mammal Commission. 13–17 March 2006, Woods Hole, Massachusetts. 69pp.
[108] Right Whale News, 2005. The Publication of the Southeast United States Right Whale Recovery Plan Implementation Team and the Northeast Implementation Team. May 2005. Vol. 12, Num. 2.

While incident reporting and awareness has certainly increased, the problem has also intensified in the last half century due to a significant rise both in the number of vessels on our seas and waterways, and their size and speed.[109] The speed of the vessel during a collision with a whale is a major factor determining the fate of the animal. Research indicates that the risk of fatality from a collision significantly decreases the vessel is traveling at a speed of less than 12 knots.[110] Given that some of the latest models indicate fast ferry vessels are capable of reaching speeds in excess of 40 knots (74 km) per hour,[111] the potential for fatal injuries from vessel collisions is evident.

Between 2004 and April 2009, at least 24 North Atlantic right whales are known to have died and an additional whale is believed to have died as a result of vessel collisions (Table 1). In the 18 cases where carcasses were examined, ship strikes were implicated in almost half the cases (8 out of 18). Of those eight, six are known to be female and three of those were pregnant with near full term calves at the time of their death.[112]

Additionally, ship strikes could not be ruled out as a cause of death for the five additional carcasses, which were located but not retrieved. Four other animals were initially reportedly to have survived vessel strikes during that same time period, though their long-term survival is not currently known.

The amount of time spent at or near the surface is an important factor when assessing the probability of an individual whale being struck by a ship. Time spent at the surface may be dictated by surface prey density. Studies by Baumgartner et al. (2003) indicate that the vertical migration of plankton results in dense patches of copepods at or near the surface at night. [113] As a result, right whales may be more susceptible to ship strikes at night, spending more time at or near the surface where they are less likely to be detected by passing vessels in the dark.[114] Anthropogenic impacts are of particular concern to newborn calves, older calves, and juveniles. Collision victims are often calves or juveniles, or mothers with newborn calves. For example, 75% (6 out of 8) North Atlantic right whales struck off the U.S. Atlantic coast between 1975 and 1996 were calves or juveniles.[115]

---

[109] Knowlton, A. and M. Brown. 2007. Running the Gauntlet: Right Whales and Vessels Strikes. In: Kraus, S.D. and Rolland, R.M. (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

[110] Vanderlaan, A.S.M. and C.T. Taggart. 2007. Vessel collisions with whales: the probability of lethal injury based on vessel speed. Marine Mammal Science. 23:144-156.

[111] *See generally*, website for Hornblower Marine Services High Speed Vessels. *Available at*: http://www.hornblowermarine.com/highspeed.html.

[112] Moore, M.J., W.A. Mclellan, P.Y. Daoust, R.K. Bonde, A.R. Knowlton. 2007. Right Whale Mortality: A Message from the Dead to the Living. In: Kraus, S.D. and Rolland, R.M. (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

[113] Baumgartner, M.F., T.V.N. Cole, R.G. Campbell, G.J. Teegarden and E.G. Durbin. 2003. Associations between North Atlantic right whales and their prey, *Calanus finmarchicus*, over diel and tidal time scales. Marine Ecology Progress Series. 264:155-166.

[114] Kraus, S.D. 1990. Rates and potential causes of mortality in North Atlantic right whales (*Eubalaena glacialis*). Mar. Mammal Sci. 6(4):278-91.

[115] Stevick, P. T. 1999. Age-length relationships in humpback whales: A comparison of strandings in the western North Atlantic with commercial catches. Marine Mammal Science 15:725-737.

Most collisions occur over the continental shelf, reflecting high usage by both vessels and cetaceans. Of 58 collision accounts examined by Laist et al. (2001), over 90% of incidents (53 accounts) occurred either over the continental shelf or shelf slope.[116] In general, the cetacean populations which are most frequently struck are those living on or near busy vessel routes (particularly shipping or ferry routes); or where there is an unusual concentration of vessels in a shallow, confined area. This is the case for the North Atlantic right whale off the east coast of the U.S. Calving and nursery areas are particularly vulnerable.[117]

Table 1. Summary of 2004 through August 2009 North Atlantic Right Whale Mortality and Serious Injury Incidents.

Compiled using data obtained from by the National Marine Fisheries Service Office of Protected Resources' Marine Mammal Health and Stranding Response Program, Northeast Regional Office, and Southeast Regional Office with Assistance from the Provincetown Center for Coastal Studies, New England Aquarium and Woods Hole Oceanographic Institution.
Information Current as of August 2009.

	Sex	Date	Location	Alive or Dead	Cause of Death
1	Male (calf)	2/3/04	FL	Dead	Unknown
2	Female (adult; pregnant)	2/7/04	NC	Dead	Vessel Strike
3	Female (adult; pregnant)	11/24/04	NC	Dead	Vessel Strike
4	Unknown	12/9/04	MA	Dead	Carcass not retrieved*
5	Female (adult)	1/9/05	MA	Dead	Carcass not retrieved*
6	Female (adult; pregnant)	1/12/05	GA	Dead	Infection from previous vessel strike
7	Female (adult)	3/3/05	VA	Dead	Entanglement
8	Female (adult)	3/10/05	GA	Injured Likely dead	Vessel Strike
9	Female (9 years old)	4/28/05	MA	Dead	Vessel Strike

[116] Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science. 17(1):35-75.
[117] Garrison, L. 2007. The Big Picture: Modeling Right Whales in Space and Time. In: Kraus, S.D. and Rolland, R.M. (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

10	Unknown	7/13/05	MA	Alive-Strike	Vessel Strike
11	Male (calf)	1/10/06	FL	Dead	Vessel strike
12	Female (Calf)	1/22/06	FL	Dead	Fishing Gear Entanglement
13	Male (one year old)	3/11/06	GA	Alive-Strike	Vessel Strike- not resighted
14	Female (sub adult)	5/18/06	NY	Dead	Carcass was not retrieved*
15	Female (Calf of year)	7/24/06	NB (Canada)	Dead	Vessel Strike
16	Female	9/03/06	NS (Canada)	Dead	Vessel Strike.
17	Male (2005 calf)	12/30/06	GA	Dead	Vessel Strike
18	Male (neonate)	1/25/07	FL	Dead	Birth Trauma
19	2 Years old	2/12/07	MA	Alive-Strike	Vessel strike
20	Male (adult)	3/25/07	CAN	Dead	Carcass not retrieved.* Entangled since 2002.
21	Male (calf)	3/31/07	NC	Dead	COD not determined but signs of entanglement were evident.
22	Male (neonate)	1/25/08	FL	Dead	Birth Trauma
23	Neonate	2/15/08	FL	Dead	Birth Trauma
24	Perinate	12/16/08	NC	Euthanized	Birth Trauma
25	Unknown (2007 calf)	1/26/09	NC	Euthanized	Likely Entanglement
26	Unknown (calf)	2/17/09	FL	Dead	Birth Defect
27	Female (8 year old)	2/25/09	MA	Dead	Carcass not retrieved*
28	Unknown	4/7/09	SC	Alive-Strike	Blood in water, damage to vessel, not resighted
29	Female	4/19/09	MA	Alive-Strike	Prop cuts to ventral fluke
30	Unknown	8/18/09	NJ	Dead	Carcass not retrieved*

*Carcass not retrieved but vessel strike cannot be ruled out.

Studies by Nowacek et al. (2004) indicate that right whales do not respond to vessel sounds and, as a result, are unlikely to avoid vessels.[118] Therefore, mitigation depends on the operation of the vessel. In the past several years, steps have been taken in an attempt to reduce

[118] Nowacek, D.P., M.P. Johnson, and P.L. Tyack, 2004. Right whales ignore ships but respond to alarm stimuli. Proceedings of the Royal Society B: Biological Sciences, 271, 227-231.

the threat of ship strikes to North Atlantic right whales including shifting and narrowing Traffic Separation Schemes (TSS), designating areas to be avoided (ATBA) and seasonal speed reductions for vessels in known right whale habitat. These include:

- July 1, 2003: TSS in the Bay of Fundy was modified to reduce the risk of strikes to North Atlantic right whales in the Canadian Maritime.
- November 2006: Recommended shipping routes were established in the Southeastern U.S.[119]
- July 1, 2007: Boston TSS was shifted 12 degrees to reduce likelihood of collisions.
- May 2008: Roseway Basin, in the Bay of Fundy, was declared an ATBA from June 1 through December 31.
- December 8, 2008: Seasonal speed restrictions of 10 kts or less were mandated for all vessels greater than or equal to 20m (65 ft), in specific right whale habitats along the east coast of the U.S.

The current NMFS rule regulating vessel operations in order to reduce ship strikes to North Atlantic right whale includes a five year sunset clause such that the rule will no longer be in effect after December 2013. At that time, NMFS will determine what further steps will be required regarding the rule.[120] In addition to this sunset provision, the rule has several shortcomings that could limit its effectiveness at addressing the threat of ship strikes to right whales.

First among these deficiencies is that the ship strike rule does not apply in key areas known to be important habitat for right whales. For example, it did not include regulatory measures for the northern Gulf of Maine, which includes Jordan Basin, an area considered by NMFS to be a winter breeding habitat for the species. In the mid-Atlantic migratory corridor, the measures apply only out to 20nm. A recent analysis by Schick et al. (2009) looked at sightings and telemetry data, and found that some females transit even further offshore than previously thought, with one tracked female going 37 miles offshore.[121] These analyses suggest that habitat suitability for migrating right whales extends farther offshore than previously thought.

Of additional concern is that regulatory measures do not apply to vessels of under 20 meters. In April of 2009, two vessels smaller than 20m struck right whales off the coast of South Carolina and Massachusetts.[122] In neither instance was the animal re-sighted, making it impossible to determine whether either whale survived. In March of 2005, a vessel of less than

[119] *See* NMFS Protected Resources Website on Recommended Shipping Routes to Reduce Ship Strikes to North Atlantic Right Whales. *Available at*: http://www.nmfs.noaa.gov/pr/shipstrike/routes.htm.
[120] NMFS 2008 Speed Rule, *supra* note 56.
[121] Schick, R.S., P.N. Halpin, A.J. Read, C.K. Slay, S.D. Kraus, B.R. Mate, M.F. Baumgartner, J.J. Roberts, B.D. Best, C.P. Good, S.R. Loarie, and J.S. Clark. 2009. Striking the right balance in right whale conservation. Can. J. Fish. Aquat. Sci. 66(9): 1399–1403. *Abstract Available at*: http://rparticle.web-p.cisti.nrc.ca/rparticle/AbstractTemplateServlet?journal=cjfas&volume=66&year=2009&issue=9&msno=f09-115&calyLang=eng.
[122] Right Whale News, May 2009. Vol. 17 Num. 2. *Available at*: http://www.rightwhaleweb.org/pdf/rwhale_news_may09.pdf.

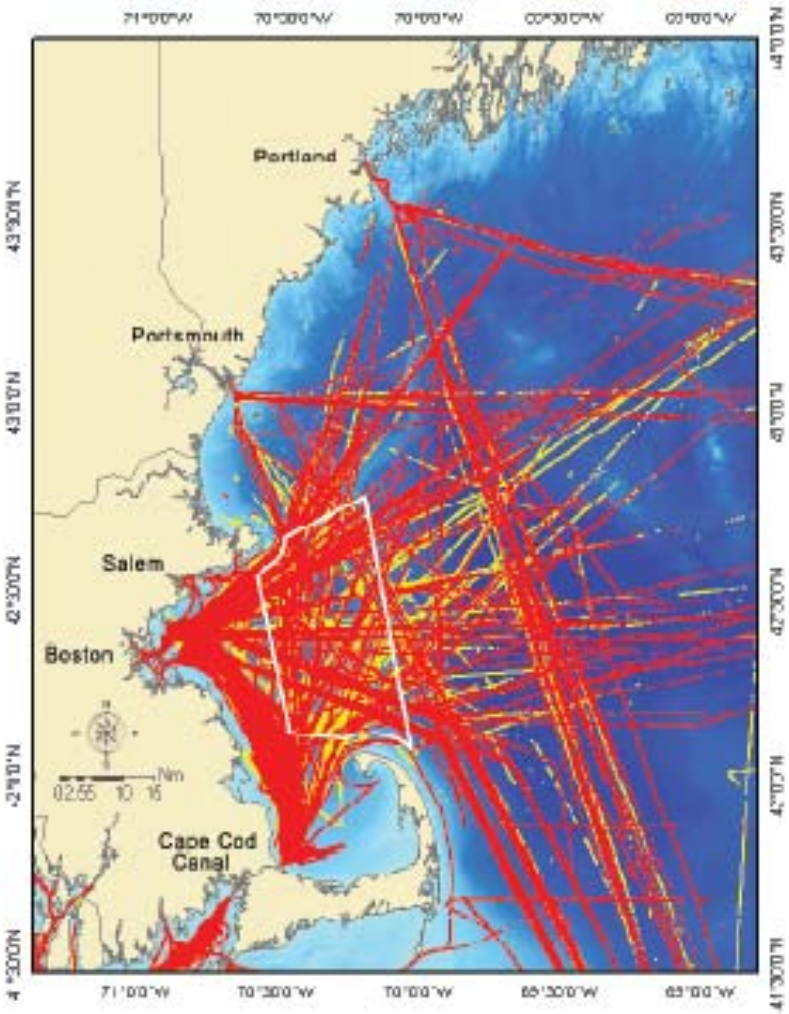
20m seriously injured a right whale off the coast of Georgia. The whale is believed to have died as a result of the strike.[123]

Finally, current regulatory measures exempt Federal vessels from the speed restrictions, despite the fact that the NMFS ship strike database reflects a disproportionately high number of ship strikes attributable to Federal vessels (i.e., the U.S. Coast Guard and the Navy).[124] While NMFS states that there may be a high reporting rate by those agencies relative to other mariners and vessels, rather than a higher incidence of right whale ship strikes by Federal agency vessels, the current exemption is overly broad and relies on the ESA section 7 consultation process to prescribe mitigation measures to prevent ship strikes.

While these measures are positive steps, for the reasons outlined above they are, in and of themselves, insufficient to adequately reduce the threat of vessel strikes. The Boston and Bay of Fundy TSS and the SE recommended routes provide recommended routing for large ships, but vessels are not required to transit through them. Depending on the destination of the vessel, some operators may choose to alternate routes, as can be seen by vessel tracks off the east coast of the U.S. (Figure 3) where vessels heading to more northerly destinations do not stay within the TSS. Similarly, ATBAs are also not mandatory and vessels are not required to avoid these areas.

[123] Right Whale News, Feb. 2005. Vol. 12 Num.1. *Available at*: http://graysreef.noaa.gov/rtwh/rwfeb05.pdf.
[124] *See generally* 73 Fed. Reg. at 60174.

Figure 4. Ship tracks in the Stellwagen Bank sanctuary and western GoM for the months of April and May 2006. Derived from the USCG AIS. In: U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Marine Sanctuary Program. 2008. Stellwagen Bank National Marine Sanctuary Draft Management Plan / Draft Environmental Assessment. Silver Spring, MD.



B. Entanglement in Fishing Gear

Entanglement in commercial fishing gear is considered to be the other greatest threat to the survival of North Atlantic right whales.[125] More than 72% of right whales display entanglement scars and up to 33% of the population interacts with fishing gear annually.[126]

[125] NMFS 2005 Recovery Plan, *supra* note 36.
[126] Knowlton, A.R., M.K. Marx, H.M. Pettis, P.K. Hamilton and S.D. Kraus. 2008. Scarification analysis of North Atlantic right whales (*Eubalaena glacialis*): monitoring rates of entanglement interaction. Report to NMFS. *Available from*: New England Aquarium, Central Wharf, Boston, MA 02110.

As described in detail above, right whales migrate seasonally along the East Coast to feed in the colder waters off New England and Canada and calve off the Southeast U.S. These areas are often the sites of commercially important fishing grounds. Some fisheries utilize fixed gear, which is retrieved hours or days after being set. Floating buoys are attached to vertical lines connected to the gear. Sometimes, multiple nets or traps are fished together and lines are used to connect them (called "groundline"), allowing the gear to be hauled simultaneously. These numerous horizontal and vertical lines floating in the water column can present a virtual maze through which whales must navigate.

Large whales, such as North Atlantic right whales, that become entangled are often strong enough to drag gear off with them. However, the entangling gear significantly impacts their ability to swim, dive, and feed.[127] In some cases, the gear becomes embedded in the animal's soft tissue, leading to infection and sometimes fatal septicemia. For example, North Atlantic right whale #2301 was first reported entangled (but alive) on September 6, 2004. She was subsequently found dead on March 3, 2005. The cause of death was believed to be due to a chronic lesion in her left flipper as a result of the entanglement.[128]

According to Moore et al. (2007), 47 entanglements of right whales have been documented between 1970 and July 2007.[129] Of these, 32% (15 out of 47) resulted in mortalities with an additional 6% presumed dead. However, this is likely a gross underestimate since entangled animals may continue to be mobile, but compromised, resulting in emaciation. Unlike healthy right whales, emaciated animals sink when dead; therefore, the probability of detecting a carcass of an entangled right whales is low. Additionally, compromised animals are likely more susceptible to other threats, including vessel strikes.[130]

Studies show that as few as 3% of whale entanglements are reported, and disentangling an animal does not guarantee its survival.[131] According to the study, long-term impacts from entanglement may result in reduced reproductive success for the individual even if gear is removed.

Under the Marine Mammal Protection Act (MMPA), take reduction measures must be enacted if fishery-related mortality and serious injury of a marine mammal stock exceeds the Potential Biological Removal rate (PBR) (i.e., the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population).[132]

NMFS established the Atlantic Large Whale Take Reduction Team in 1996 to develop a plan to reduce the incidental serious injury and mortality of right whales and other endangered

---

[127] *Id*.
[128] Moore, M.J., A. Bogomolni, R. Bowman, P. Hamilton, C. Harry, A. Knowlton, S. Landry, D. Rotstein, and K. Touhey. 2006. Fatally entangled right whales can die extremely slowly. Oceans '06 MTS/IEEE-Boston, MA, September 18-21, 2006 - ISBN: 1-4244-0115-1.:3 pp.
[129] Moore et al 2007, *supra* note 112.
[130] *Id*.
[131] Robbins, J. and Mattila, D. 2000. Gulf of Maine humpback whale entanglement scar monitoring results 1997-1999. NOAA Contract No. 40ENNF900253. 24 p.
[132] 16 U.S.C. § 1387(f).

whales in the South Atlantic shark gillnet fishery, the Gulf of Maine and Mid-Atlantic lobster trap/pot fishery, the Mid-Atlantic gillnet fishery, and the Gulf of Maine sink gillnet fishery. Although NMFS issued the Atlantic Large Whale TRP in 1999, and has amended the plan several times since then, mortality and serious injury of North Atlantic right whales continues to exceed PBR.[133]

Current management measures include**:**

- Seasonal fishing restrictions and closures
- Regulation of net mesh size and gear length
- Inclusion of weak links on buoy lines
- Broad-scale use of sinking ground line for bottom gear

The requirement for broad-scale use of sinking ground line went into effect in April of 2009. The requirement does not apply in all areas where whales are known to become entangled, including the coast of Maine, where 71% of State waters are exempted from the rule.[134] Furthermore, restrictions on vertical (buoy) lines were not included in the newly implemented regulations, even though they may be of equal or greater risk to right whales than groundlines.[135]

Between November 2007 and April 2009, ten new entanglement cases were reported, with an additional five cases where animals continued to carry gear for months to years.[136]

Given that areas of known right whale entanglement are not included in the current mitigation measures, measures to address the risk from vertical line are lacking, and the PBR for right whales of zero has consistently been exceeded, the current risk to this species from entanglement is substantial. Current mitigation measures are inadequate to address this risk and ensure recovery of the species.

C. Ocean Noise

The oceans are increasingly noisy and this may have significant adverse effects on marine mammals, including the North Atlantic right whale.[137] In addition to natural sources of noise (e.g., earthquakes, storms, cracking ice), anthropogenic sources are increasingly adding to the din of background noise. Some of these sources include vessels and other transport craft,

---

[133] NMFS 2005 Recovery Plan, *supra* note 36.
[134] *See generally*, 72 Fed. Reg. 57104 (Oct. 5, 2007) (Final Rule implementing Atlantic Large Whale Take Reduction Plan).
[135] Johnson, A., G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry and P. Clapham. 2005. Fishing gear involved in entanglements of right and humpback whales. Marine Mammal Science 21 (4): 635-645.
[136] Pettis, Heather. 2009. North Atlantic Right Whale Consortium Annual Report Card (01 Nov. 2007 – 30 April 2009). International Whaling Commission Scientific Committee Meeting, 2009 SC/61/BRG11. *Available at*: http://www.iwcoffice.org/_documents/sci_com/SC61docs/SC-61-BRG11.pdf.
[137] *See generally*, NRC 2003. Summary: Ocean Noise and Marine Mammals. Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals, National Research Council. 204 pgs; NAS, 2003, In Summary: Ocean Noise and Marine Mammals. *Available at*: http://books.nap.edu/html/ocean_noise/reportbrief.pdf; National Academies Press, 2003, Ocean Noise and Marine Mammals. *Available at* http://www.nap.edu/openbook.php?record_id=10564&page=1.

dredging and construction, oil drilling and production, geophysical surveys, explosive detonations, and ocean research (including seismology, acoustic propagation, etc).[138]

Various forms of sound generation can be heard over long distances, in part because sound travels five times faster underwater than in air. The U.S. Navy estimates that its Low Frequency Active Sonar ("SURTASS LFA"), which is used in the detection of submarines, could significantly affect marine life over hundreds of thousands of square kilometers and can be heard over much greater distances.[139] Further, noise from a single seismic survey can flood a region of almost 300,000 square kilometers, raising noise levels 100 times higher than normal for days at a time.[140] Seismic noise from activities in eastern Canada measured 3,000 km away in the central Atlantic was the loudest background noise heard underwater.[141] A Committee of the International Whaling Commission found that "[r]epeated and persistent acoustic insults [over] a large area…should be considered enough to cause population level impacts."[142] These sorts of broad impacts may be difficult to detect, given the difficulty of monitoring free-ranging cetaceans.

Noise has also been responsible for strandings of marine mammals. While strandings of beaked whales are generally the focal concern with regard to impacts of noise (particularly that of intense Naval SONAR), mysticete whales have been affected as well. Minke whales were stranded in the well-publicized 2000 incident involving U.S. Navy mid-frequency sonar exercises in the Bahamas and adult humpback whales stranded in 2002 in Brazil consequent to seismic exploration.[143]

Sub-lethal effects of anthropogenic noise can also be harmful to mysticete whales. They can be displaced from key feeding, calving or migratory areas by loud, episodic noise. Gray whales were displaced for more than five years from a breeding lagoon when exposed to loud industrial sounds, returning only several years after activities ceased.[144] Critically endangered western gray whales were displaced from a primary feeding area by seismic surveys off Sakhalin Island, Russia and only returned days after cessation of the activities.[145] One study found that

---

[138] *Id.*

[139] ASOC 2003. Marine Acoustic Technology and the Antarctic Environment. Information Paper by the Antarctic and Southern Ocean Coalition XXVI ATCM Information Paper. Madrid Spain 9/20/03. IP-073-ASOC. *Available at*: http://www.asoc.org/Portals/0/IP-73acoustics.pdf.

[140] IWC. 2004. International Whaling Commission Scientific Committee. Annex K of the 2004 Scientific Committee Report: Report of the Standing Working Group on Environmental Concerns. Annual IWC meeting. Sorrento, Italy. 29 June- 10 July 2005. 56 pp.
Available at http://www.iwcoffice.org/_documents/sci_com/SCRepFiles2009/Annex%20K%20-%20Final-sq.pdf

[141] Nieukirk, S., K. Stafford, D. Mellinger, R Dziak, C.Fox. 2004. Low Frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. J. Acoustic Society of America. 115 (4) 1832-1843.
Available at http://www.awionline.org/ht/a/GetDocumentAction/i/10170

[142] IWC 2004, *supra* note 140.

[143] Engle, M., M. Marcondes, C. Martins, F. Luna, R. Lima and A. Campos. 2004. Are seismic surveys responsible for cetacean strandings? An unusual mortality of adult humpback whales in Abrolos Bank, Northeastern coast of Brazil. Report to the International Whaling Commission Scientific Committee Meeting. 2004. SC/56/E28. *Available at*: http://www.marineconnection.org/docs/humpback_stranding.pdf.

[144] Jones, M., S. Swartz, M. Dalheim. 1994. Census of Gray Whale Abundance in San Ignacio Lagoon: A Follow-up Study in Response to Low Whale Counts Recorded During Acoustic Playback Study of Noise Effects on Gray Whales. Report to the U.S. Marine Mammal Commission. Washington, DC, NTIS PB94195062. 32 pp.

[145] IWC 2004, *supra* note 140.

the length of humpback whale mating songs increased in response to low frequency active sonar, perhaps to compensate for interference.[146] Humpback whale mothers and calves in key habitat avoided seismic air guns at 140-143 dB.[147] Bowhead whales, a species similar to right whales, were found to avoid seismic air gun noise at received levels of 120-130 dB during their fall migrations but, when feeding, avoided only at levels of 158-170 dB (levels 10,000 times more intense), thereby subjecting themselves to greater potential for harm while engaged in a primal survival activity.[148]

The observation that animals often remain in their traditional habitat during intense noise does not mean that they are not affected. They may have a strong motivation to stay in areas with key forage or breeding habitat, particularly if only sub-optimal areas are available as alternatives. Indeed, animals with low energy reserves (such as baleen whales who fast in the winter) or no alternative habitat cannot afford to flee repeatedly from disturbance and thus may be judged less affected than they are in reality.[149] The fact that an animal does not flee or that its behavior does not change in an immediately obvious manner does not mean that it is not seriously impacted (e.g, with impacts to hearing, increased corticosteroid levels that affect reproduction, etc).

Right whales are subjected to a variety of potentially harmful noise sources. For example, the U.S. Navy has training ranges and operations areas approved all along the U.S. eastern seaboard in areas used by right whales.[150] Three examples are the Boston Complex (gunnery exercises, anti-submarine warfare exercises) in the areas of the Northeast in which right whales are known to feed during the summer; Cherry Point Operations Area off North Carolina and South Carolina (surface and subsurface training exercises) encompassing their migratory corridor and adjacent to a known calving area; and the Jacksonville Complex, just offshore of, and including, their only known calving area (target exercise with surface and missile exercises and a large proposed undersea warfare training range know as the USWTR). The Navy uses SURTASS LFA along the eastern seaboard. Further, the Atlantic Fleet Active Sonar Training Range ("AFAST") overlaps, or is adjacent to, all five marine sanctuaries along the east coast as well as right whale critical habitat in the Southeast.[151]

---

[146] Miller, P., N. Biasson, A. Samuels and P. Tyack. 2000. Whale songs lengthen in response to sonar. Nature 405. 903. *Abstract available at*: http://www.nature.com/nature/journal/v405/n6789/full/405903a0.html.

[147] McCauley, R., J. Fewtrell, A. Duncan, C. Jenner, M-N. Jenner, J. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K. McCabe. 2000. Marine seismic surveys—A study of environmental implications. APPEA J. 40: 692-708. *Available at*: http://cwr.org.au/publications/appea2000.pdf.

[148] Richardson, W., G. Miller, and C. Greene. 1999. Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea. J. Acoustic Society of America. 106: 2281 *Abstract avail. at*: http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=JASMAN000106000004002281000003&idtype=cvips&gifs=yes.

[149] Gill, J., K. Norris, and W. Sutherland. 2001. Why behavioural responses may not reflect the population consequences of human disturbance. Biological Conservation. 97: 265-268. *Abstract available at*: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V5X-41MJ18J-G&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=989433686&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=10cfdf69041c8650e628c927f3431cd9.

[150] *See* http://www.globalsecurity.org/military/facility/range-navy.htm (featuring maps of Navy test and training ranges in right whale habitat).

[151] *See* Final Atlantic Fleet Active Sonar Training Environmental Impact Statement, Dec. 2008. *Executive Summary available at*: http://afasteis.gcsaic.com/docs/FinalOEIS/Executive%20Summary.pdf.

In addition to noise from Naval exercises and training ranges, exploration for oil and gas was approved by the outgoing Bush administration and may be undertaken in portions of the range of right whales in the Northeast both in the United States and Canada.[152] Exploration would involve significant use of high intensity seismic arrays.

Marine construction is also being considered within normal patterns of travel for right whales. An industrial wind energy facility is planned for Nantucket Sound that would involve months of pile-driving to install supports for the more than 130 large wind turbines.[153] An additional wind energy facility involving 96 turbines has been proposed for installation within 20 miles of the New Jersey coast, along the migratory corridor for right whales.[154] Several possible sites are under consideration for wind energy plants off the coast of Georgia just outside of currently designated critical habitat, including a site just outside of state waters off Jekyll Island and others along the Georgia/South Carolina border off Tybee Island just outside of state waters.[155] Installation of these facilities will involve intense noise from pile driving. Once installed, the effect on right whale mothers and calves of a maze of turbines in calving and nursing habitat or along their migratory route is unknown. Any habitat displacement could be disastrous to the species.

All of these higher intensity, often episodic, acoustic insults are overlain on ambient noise levels. Though their effects are not well studied, the possible additive or synergistic effects of these intense sources of sound when combined with ambient noise are even more poorly studied. Moreover, the report of a 2004 NOAA workshop citing a study off California found "ambient noise levels in a frequency band consistent with sounds produced by large vessels have increased (along with vessel concentrations) at a rate of approximately 3 decibels (dB) per decade over the past thirty years."[156] The potential for shipping noise to impact whales by elevating ambient noise levels to the point of "masking" biologically important signals has been identified by the National Research Council as an important consideration.[157]

Some effects of ambient noise may be obvious, but others are more subtle. Studies have documented effects resulting from overall elevation in ambient noise levels due to human activities. A NOAA report found "changes in the local acoustic environment may result in reduced communication ranges for breeding marine mammals using sounds in reproductive interactions, interference with predator/prey detection relying on active or passive biosonar (and

---

[152] *See generally,* "Congress to Ban Georges Bank oil and gas exploration while Canada moves toward lifting moratorium on drilling for Oil," Cape Cod Today Blog entry for Feb. 4, 2009. *Available at*: http://www.capecodtoday.com/blogs/index.php/2009/02/04/georges-bank-preservation-act?blog=53.

[153] *See generally,* Cape Wind website on Project Construction. *Available at*: http://www.capewind.org/article20.htm.

[154] *See* Belson, Ken, "New Jersey Grants Right to Build a Wind Farm About 20 Miles Offshore," New York Times, Oct. 3, 2008. *Available at*: http://www.nytimes.com/2008/10/04/nyregion/04wind.html.

[155] *See* Philpot, Liz, and Mary Hallisey Hunt, "Southern Winds" Offshore Project Summary for the Georgia Winds Working Group, Dec. 3, 2007. *Available at*: http://www.gawwg.org/images/Talking_points_December_2007_compressed_rev.pdf.

[156] NOAA 2004. Final Report of the NOAA International Symposium: Shipping Noise and Marine Mammals: A Forum for Science, Management and Technology." May 2004, Arlington VA. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/acoustics/shipping_noise.pdf.

[157] *Id.*

the use of sound for biological purposes), or, in extreme cases, habitat avoidance."[158] Further, "calculations of detection zones in various conditions for some marine mammals demonstrate the potential for masking to substantially limit acoustic communications."[159] One estimate indicates that, as a result of anthropogenic sounds, right whale acoustic detection may be reduced by 90% compared to a hundred years ago.[160] Research by Parks (2003) indicates that right whales shift the frequency of calls in areas of increased noise from vessel traffic, which results in an increased energy expenditure and reduced sound transmission from the animal.[161]

Shipping noise is one of the most significant sources of underwater noise.[162] Moreover, most of the acoustic energy radiated from large commercial vessels is at frequencies below 1 kHz. Mysticete whales, including right whales, produce and receive sounds in this range of frequencies that serve critical biological functions. Noises in this range have the greatest potential for masking the sounds the whales use to communicate with on another.[163]

There is some evidence from modeling that this elevation in noise levels may already be adversely affecting North Atlantic right whales. Mayo et al. (2008) investigated the fact that, despite apparently abundant zooplankton resources, indicators of population health suggest that the right whale population may be in a compromised physiological condition.[164] The authors examined the various impacts on right whale nutritional intake, including patch-density, decreased zooplankton biomass, and sensory limitations, and modeled the food consumption of 42 right whales in the Great South Channel. The Great South Channel is part of currently designated critical habitat for right whales, yet is subject to high levels of ship traffic.[165] Mayo and his co-authors modeled over 150 hours of foraging and found that manipulations of patch density had a lesser impact than variations in sensory range. Variations in the whales' sensory range (probably hearing) profoundly impacted the searching behavior, distribution, and, importantly, caloric intake of right whales. The model results showed that varying the sensory range above 4 km had little effect on foraging success. However, when sensory capacity was decreased to 0.5 – 2 km to experimentally mimic the effects of a degraded acoustic environment, whale whales exhibited reduced aggregative behavior and a profoundly depressed caloric capture rate that reached values below their estimated energetic requirements. The study's authors found that at reduced sensory distances the modeled whales' failure to consistently locate suitable feeding habitat resulted in a net energy deficit and the likelihood of decreased fitness. They

---

[158] *Id.*
[159] *Id.*
[160] Parks, S.E. and C.W. Clark. 2007. Social Sounds and the Potential Impacts of Noise. In: Kraus S.D. and Rolland R.M., (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.
[161] Parks, S.E. 2003. Acoustic communication in the North Atlantic right whale (Eubalaena glacialis). Ph.D. Thesis. MIT-WHOI Joint Program in Oceanography. Woods Hole, MA. *Abstract available at*: https://darchive.mblwhoilibrary.org/handle/1912/2453.
[162] *Id.*
[163] NOAA 2004, *supra* note 156.
[164] Mayo, C.S., M. Page, D. Osterberg, and A. Pershing. 2008. On the path to starvation: the effects of anthropogenic noise on right whale foraging success. North Atlantic Right Whale Consortium. Abstracts of the Annual Meeting. New Bedford, MA, Nov. 2008.
[165] Ward-Geiger, L. G. Silber, R. Baumstark, and T. Pulfer. 2005. Characterization of Ship Traffic in Right Whale Critical Habitat. Coastal Management. 33:263-278. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/critical_habitat_traffic.pdf.

speculated that this may, in part, explain differences in body condition and function among populations of right whales in different ocean basins that have varying degrees of anthropogenic acoustic contamination.[166] Dr. Charles Mayo, one of the study authors, has speculated that this decrease in ability to find food may be a result of diminished ability to hear other feeding and foraging whales, thus preventing individuals from effectively locating optimal foraging areas.[167]

Right whales roam some of the busiest coastline in the United States. As ship traffic increases, it is likely that ambient noise is increasing to the detriment of the species. They are also subjected to intense sources of noise generation that have resulted in other species being subjected to chronic stress and/or have resulted in temporary or long-term abandonment of key habitat.

D. Offshore Energy Development

The threat of both traditional and renewable energy development in right whale habitat poses numerous types of risks to right whales, including direct risk from collisions and significant habitat degradation, as well as indirect threats resulting from displacement from normal habitat or effects on prey resources. The expansion of direct extraction and offshore ports throughout right whale habitat is possible as energy needs increase in the United States. Any of these activities has a potential to adversely affect this fragile species.

The waters off the Atlantic coast of the U.S. have been considered for additional exploration for oil and gas reserves. In 2005, the Bush administration overturned a 20-year drilling ban, and then authorized specific tracts for exploration only a week before leaving office. As a result, a bill was introduced in Congress in 2009 to prevent exploration and extraction on Georges Bank, but the bill has not yet passed.[168] The Georges Bank area is an area traversed by right whales and is adjacent to their currently designated critical habitat in the Great South Channel. It is estimated the reserves contain close to 123 million barrels over the life of a 20-year lease (sufficient to provide the U.S. with only about one week's supply of oil) and/or 870 billion cubic feet of natural gas.[169]

At the same time that the U.S. is debating re-opening offshore oil and gas exploration and extraction, the Canadian government is pursuing a plan to develop oil and gas reserves off Nova Scotia, Canada. While the exact area to be opened is not yet known, it cannot be assumed that it will not include or abut critical right whale habitat off Nova Scotia near Roseway Basin. Canada considers there to be "substantial oil and gas reserves" offshore of Nova Scotia and Newfoundland.[170] A high pressure gas line is being developed to bring natural gas into the U.S. with additional undersea pipelines being planned for construction including drilling for

---

[166] *Id.*
[167] C. Mayo, personal communication.
[168] Cape Cod Today, *supra*, note 152.
[169] For the historic context of this ongoing battle, *see generally*, Time Magazine, Nov. 26, 1979. "Environment: Georges Bank: Fish or Fuel." *Available at*: http://www.time.com/time/magazine/article/0,9171,946407,00.html.
[170] *See* Ball, Ken, "Atlantic Canada Changing New England's Energy Outlook," Pollution Equipment News. *Available at*: http://www.rimbach.com/scripts/Article/PEN/Number.idc?Number=33.

additional reserves on both the Scotian Shelf (used by right whales) and in deeper waters of the Scotian Slope.[171]

The risk of these oil extraction activities is two-fold. First, a catastrophic release of pollutants from oil and gas drilling could kill or sicken right whales as well as adversely affect their forage base.[172] Second, chronic discharges could occur in day-to-day production and transport.[173] Moreover, ancillary seismic exploration activities or offshore construction activities may displace animals from key habitat. Additional risk of collisions may result from increased construction and transport vessel traffic, as described above.[174]

There is also ongoing development that will increase delivery of liquified natural gas ("LNG") to New England. Neptune LNG, LLC has constructed pipelines and an offloading port to enable delivery of LNG. This deep water port is located in Massachusetts Bay, just to the west of the Stellwagen Bank National Marine Sanctuary. Because of concerns about vessels striking right whales, the operator agreed to install passive acoustic buoys to monitor for the presence of vocalizing right whales. Another port was also authorized to Gateway (Excellerate) Energy which is likewise delivering LNG to the same general area.[175] The passive acoustic listening buoys that were installed have detected right whales in virtually all months of the year.[176] To date, no known collisions have occurred.

Finally, renewable energy resource development in key habitat areas also poses significant threats. Underwater noise resulting from the construction of offshore wind farms may have deleterious impacts to endangered right whales. Underwater noise impacts on cetaceans can include confusion, disruption of social cohesion, separation, alteration of travel, masking vocalizations, and/or stranding. A report by the Danish Institute for Fisheries Research (2000) indicated that it "is very likely that during the construction period of both the windmills and the cable trace many of the fish species as well as marine mammals will be disturbed."[177] This same report stated that marine mammals and fish will likely disappear from the area during construction due to turbidity of the water, noise, and other sea bottom activities. Furthermore, maintenance activities may increase the risk of vessel strikes to right whales. The service and maintenance required of offshore wind farms results in a substantial increase in vessel traffic. The Horns Rev wind farm, off the coast of Denmark, calculated the need for maintenance at a

[171] *Id.*
[172] NMFS 2005 Recovery Plan, *supra*, note 36, at IVB-25 and 26.
[173] *Id.* at IVB-26.
[174] *Id*. at IVB-25; *see also* discussion above.
[175] *See generally*, Maritime Administration webpage on Deepwater Port Licensing Program, Approved Applications and Operational Facilities. *Available at*: http://www.marad.dot.gov/ports_landing_page/deepwater_port_licensing/dwp_current_ports/dwp_current_ports.htm.
[176] *See* NOAA and NMFS Right Whale Sighting Advisory System, *supra* note 72; *see also* Cohen, Nancy, "Whale Detection Buoys Will Help LNG Ships Avoid Right Whales," WNPR Connecticut Public Radio. *Available at*: http://www.cpbn.org/whale-detection-buoys-will-help-lng-ships-avoid-right-whales.
[177] Danish Institute for Fisheries Research. 2000. Effects of marine windfarms on the distribution of fish, shellfish and marine mammals in the Horns Rev area. Report to ELSAMPORJECKT A/S. 42pp.

minimum of 150 days per year using vessels and helicopters.[178] It is important to consider that these trips are in addition to ongoing vessel traffic and, therefore, increase risk.

E. Global Warming and Ocean Acidification

1. Global Warming

Any reasonable debate about whether global warming is occurring and whether it is caused by anthropogenic greenhouse gas emissions has long been put to rest.[179] The Fourth Assessment Report of the Intergovernmental Panel on Climate Change ("IPCC")[180], released in 2007, states atmospheric concentration of carbon dioxide has increased by 36% since 1750 to a level not exceeded during the past 650,000 years and likely not in the past 20 million years.[181] As of March 2006, the atmospheric carbon dioxide concentration was 381 ppm and rising at over 2 ppm per year.[182] Global average temperature have risen by approximately 0.74° C ± 0.18° C (1.33° F ± 0.32° F) during the past 100 years.[183] Past anthropogenic greenhouse gas emissions have altered the energy balance of the earth by 0.85 ± 0.15 watts per square meter.[184] Due to the lag time in the climate system, this energy imbalance commits the earth to additional warming of 0.6° C (1° F) that is already "in the pipeline," even absent additional greenhouse gas emissions.[185] Because greenhouse gas emissions are continuing to increase, warming is projected to accelerate. Based on differing scenarios of future greenhouse gas emissions and the world's leading climate models, the IPCC has projected 1.1 to 6.4°C (2° -11.5° F) of additional warming by the end of this century.[186] The higher the level of greenhouse gas emissions, the

---

[178] Noer, H., T.J. Christensen, I. Clausager & I.K. Petersen. 2000. Effects on birds of an offshore wind park at Horns Rev: Environmental impact assessment. NERI Report 2000. 112pp.

[179] *See, e.g.* D.L. Albritton et al., *In: Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom and New York 2001. *Available at* http://www.picc.ch/.

[180] The IPCC was established by the World Meteorological Organization and the United Nations Environment Programme in 1988 (IPCC 2001a). The IPCC's mission is to assess available scientific and socio-economic information on climate change and its impacts and the options for mitigating climate change and to provide, on request, scientific and technical advice to the Conference of the Parties to the United Nations Framework Convention on Climate Change (IPCC 2001a). Since 1990, the IPCC has produced a series of reports, papers, methodologies, and other products that have become the standard works of reference on climate change (IPCC 2001a). The IPCC's comprehensive Assessment Reports are produced approximately every seven years and build upon and expand past IPCC products.

[181] K.L. Denman et al., *2007: Couplings Between Changes in the Climate System and Biogeochemistry, in: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA, 2007.

[182] Shukman, D. 2006. Sharp rise in CO2 levels recorded. in. BBC News, March 14, 2006. *Available at* http://news.bbc.co.uk/1/hi/sci/tech/4803460.stm.

[183] K.E. Trenberth et al., 2007: Observations: Surface and Atmospheric Climate Change. in Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA, 2007.

[184] Hansen, J. et al. 2005. Earth's Energy Imbalance: Confirmation and Implications. *Science* 308: 1431-1435.

[185] *Id*.

[186] Solomon, S., D. Qin, M. Manning, R. B. Alley, T. Bentsen, N. L. Bindoff, Z. Chen, A. Chidthaisong, J. M. Gregory, G. C. Hegerl, M. Heimann, B. Hewitson, B. J. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, T.

more the world will warm and the greater the adverse consequences on the North Atlantic right whale.

Warming ocean waters are already having measurable effects on the marine ecosystem. Water temperature is an important factor determining habitat ranges and physiological functioning of marine organisms, and even minor changes are seriously disruptive. Global ocean temperatures have increased by 0.31 °C on average in the upper 300 m during the past 60 years (1948-1998),[187] and locally, some ocean regions are experiencing even greater warming.[188] Global ocean temperatures have increased by 0.10 °C in the upper 700 m between 1961-2003[189] and by 0.037 °C in the upper 3000 m.[190] Notably, the largest increases in global ocean temperature have occurred in the upper ocean where primary production is concentrated and appears to be affecting global ocean productivity.[191] Significant global declines in net primary production between 1997 and 2005 were attributed to reduced nutrient enhancement due to ocean surface warming.[192]

Global warming represents a significant long-term threat to the survival of the North Atlantic right whale. Climate change may impact the survival of right whales through the distribution of toxins and disease-causing organisms as well as impacting forage species and potential reproductive success.[193] As we document below, the temperature ranges that are necessary for successful calving by right whales are quite distinct (i.e., 13-15° C) and constitute a primary constituent element defining critical habitat in the Southeastern U.S.[194] Changes in the ocean temperature and/or alterations in the temperature or location of the flow of the Gulf Stream as a result of global warming are likely to cause right whales to re-distribute in order to calve in areas with temperatures suitable for calf survival. Should the necessary bathymetry

---

Matsuno, M. Molina, N. Nicholls, J. Overpeck, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, R. Somerville, T. F. Stocker, P. Whetton, R. A. Wood, and D. Wratt. 2007. 2007: Technical Summary. in S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, editors. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA.

[187] Levitus, S., J. I. Antonov, T. P. Boyer, and C. Stephens. 2000. Warming of the world ocean. Science 287:2225-2229.

[188] Bindoff, N. L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C. K. Shum, L. D. Talley, and A. Unnikrishnan. 2007. 2007: Observations: Oceanic Climate Change and Sea Level. in S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, editors. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[189] *Id*.

[190] Levitus, S., J. Antonov, and T. Boyer. 2005. Warming of the world ocean, 1955-2003. Geophysical Research Letters 32.

[191] Behrenfeld, M. J., R. T. O'Malley, D. A. Siegel, C. R. McClain, J. L. Sarmiento, G. C. Feldman, A. J. Milligan, P. G. Falkowski, R. M. Letelier, and E. S. Boss. 2006. Climate-driven trends in contemporary ocean productivity. Nature 444:752-755.

[192] *Id*.

[193] Kenny, R.D. 2007. Right Whales and Climate Change. In: Kraus, S.D. and R.M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

[194] Garrison 2007, Urban Whale, *supra* note 117.

described by Garrison not be available in an area where there are suitable temperatures for successful calving, reproductive failure may ensue.[195]

In addition, the plankton species necessary for right whale foraging are in the northeastern United States and Canada.[196] Recent research indicates that changes in ocean temperatures in the North Atlantic have resulted in redistribution of a variety of Calanoid copepod species in the eastern North Atlantic, including a northward extension of more than 10 degrees latitude of warm water species, and that this was associated with a decrease in the number of colder-water species.[197] Of particular concern, *Calanus finmarchicus* (a favored right whale prey) is distinctly affected by the North Atlantic Oscillation ("NAO"). This species overwinters at depth and is strongly influenced by oceanographic circulation patterns.[198] In fact, success of reproduction in right whales seems to be linked to the cycles in the NAO.[199] While there appears to be no research similar to that in the eastern North Atlantic that has documented on-going re-distribution of copepods, similar processes may well be at work in the western North Atlantic. Should the increase in oceanic temperatures result in a decrease in colder water copepods along with a northerly extension of the range of warmer water species, this could drastically affect prey availability for right whales and result in reduced reproductive fitness.

2. Ocean Acidification

Ocean acidification poses an ever-increasing risk to the North Atlantic right whale because of its deleterious effects on the zooplankton species that the right whale depends on for food. In the past few decades, the oceans have absorbed approximately 30% of carbon dioxide released by human activities.[200] The world's oceans, in fact, store about 50 times more carbon dioxide than the atmosphere,[201] and most carbon dioxide released into the atmosphere from the burning of fossil fuels will eventually be absorbed by the ocean.[202] As the ocean absorbs carbon dioxide from the atmosphere, it changes the chemistry of the sea water by lowering its pH. The oceans' uptake of these excess anthropogenic carbon dioxide emissions, therefore, is causing ocean acidification.[203]

Surface ocean pH has already dropped by about 0.1 units on the pH scale from 1750-1994, equating to a rise in acidity of about 30%.[204] The pH of the ocean is currently changing

---

[195] *Id.*
[196] Pace and Merrick 2008, *supra*, note 32.
[197] Beaugrand, G., P. Reid, F. Idanex, J.A. Lindley, and M. Edwards. 2002. Reorganization of North Atlantic Marine Copepod Biodiversity and Climate. Science. 31 May 2002. 296 (5573. pp. 1692-1694. *Abstract available at*: http://www.sciencemag.org/cgi/content/abstract/296/5573/1692
[198] Pace and Merrick 2008, *supra* note 32, see also discussion above.
[199] Green et al 2003, *supra* note 99.
[200] Feely, R.A., C.L. Sabine, K. Lee, W. Berelson, J. Kleypas, V. Fabry, F.J. Millero. 2004. Impact of Anthropogenic CO_2 on the $CaCO_3$ System in the Oceans. Science. 16 July 2004. pp. 362-66.
[201] WBGU. 2006. The future of oceans -- warming up, rising high, turning sour. German Advisory Council on Global Climate Change, Special Report, March 2006, *Available at* www.wbgu.de.
[202] Caldeira, K. and M.E.Wickett. 2003. Ocean model predictions of chemistry changes from carbon dioxide emissions to the atmosphere and ocean. Journal of Geophysical Research. 110: 1-12.
[203] WBGU 2006, *supra* note 201.
[204] Orr, J. et al. 2005. Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature. 29 September 2005. 437: 681-86.

rapidly and may drop by another 0.3 or 0.4 units (equating to a 100 to 150% increase in the concentration of H+ ions) by the end of this century.[205] If carbon dioxide emissions continue unabated, resulting changes in ocean acidity could exceed anything experienced in the past 300 million years.[206] Even if carbon dioxide emissions stopped immediately, the ocean would continue to absorb the excess carbon dioxide in the atmosphere, resulting in further acidification until the planet's carbon budget returned to equilibrium.

Ocean acidification from unabated anthropogenic carbon dioxide emissions poses a profound threat to marine ecosystems because it affects the physiology of numerous marine organisms, causing detrimental impacts that may ripple up the food chain.[207] Changes that have been observed in laboratory experiments include impacts to the photosynthesis of phytoplankton, metabolic rates of zooplankton and fish, oxygen supply of squid, reproduction of clams, nitrification by microorganisms, and the uptake of metals.[208] Of particular importance to the right whale, studies indicate that crustaceans including krill and copepods experience higher mortality rates with increasing CO_2 levels and decreasing pH, and copepod egg hatching success decreases with increasing CO_2.[209] Fish and other marine species are also affected when increases in the ocean's CO_2 concentration result in the accumulation of carbon dioxide in tissues and fluids, called hypercapnia, which leads to an increase in internal acidity.[210] Hypercapnia can impact acid-base regulation, metabolic activity, respiration, and ion exchange, leading to impairment of growth and higher mortality rates.[211]

Importantly, increasing ocean acidity also reduces the availability of carbonate ions that many marine plants and animals rely on to build their shells and skeletons.[212] Marine organisms including phytoplankton (coccolithophores and foraminifera), coralline algae, corals, echinoderms (sea urchins and starfish), and mollusks (snails, clams, oysters, and squid) are impaired in producing their shells with increasing ocean acidity.[213] Normally, ocean waters are saturated with carbonate ions that marine organisms use to build skeletons.[214] However, the acidification of the oceans shifts the water chemistry to favor bicarbonate, thus reducing the availability of carbonate to marine organisms.[215] Acidic waters also dissolve existing protective

---

[205] *Id.*; Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper,I.G. Watterson, A.J. Weaver and Z.-C. Zhao, 2007: Global Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S.,D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[206] Caldeira and Wickett 2003, *supra* note 202.

[207] Fabry, V, B.A. Seibel, R.A. Feely, J.C. Orr. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. ICES Journal of Marine Science. 65: 414-32.

[208] WBGU 2006, *supra* note 201.

[209] Fabry et al. 2008, *supra* note 207, Table 1.

[210] *Id*.

[211] *Id.*

[212] Feely et al. 2004, *supra* note 200; Orr et al. 2005, *supra* note 204; Fabry et al. 2008, *supra* note 207.

[213] Kleypas, J.A., R.A. Feely, V.J. Fabry, C. Langdon, C.L. Sabine, L.L. Robbins. 2006. Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers; A Guide to Future Research. Report of Workshop Sponsored by NSF, NOAA, and USGS.

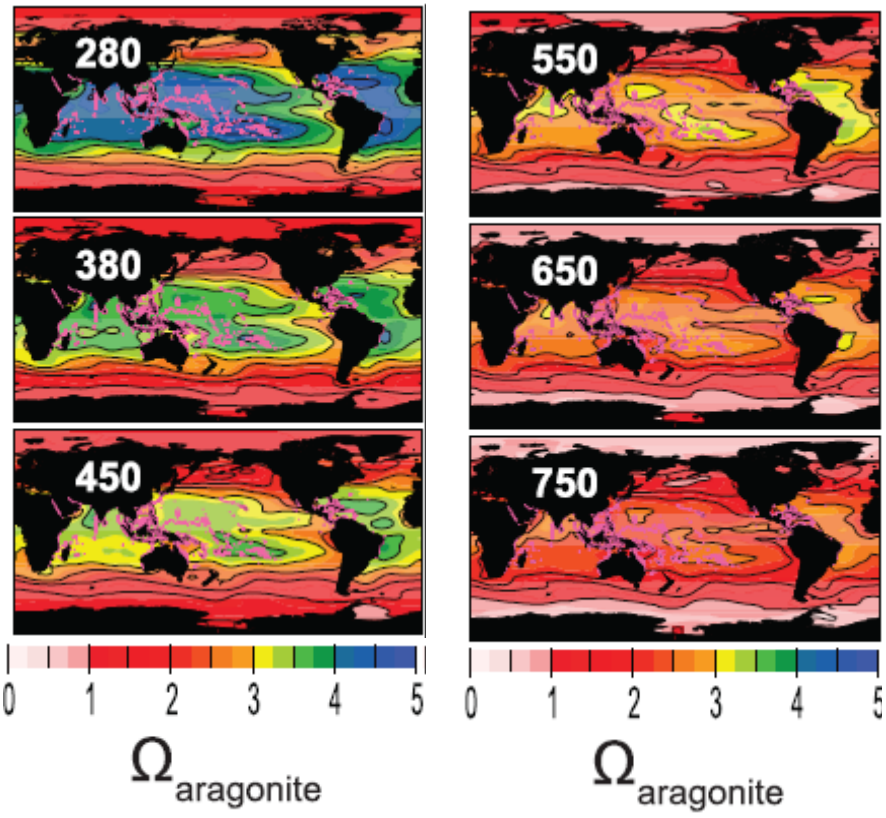
[214] WBGU 2006, *supra* note 201..

[215] *Id.*

carbonate skeletons and shells.[216] Because calcifying organisms are at the base of the food web, negative impacts on these organisms will have a cascading effect on other species that rely on these organisms. Crustaceans are thought to be a particularly vulnerable group because of their dependence on the availability of calcium and bicarbonate ions for the mineralization of their exoskeleton after molting.[217]

Ocean acidification and its impacts on marine biota will worsen in this century due to the continuing rise in atmospheric carbon dioxide concentrations. An analysis of acidification in the North Atlantic over the years 1985-2008 found that surface pH has decreased at a rate that is 50% faster than at subtropical monitoring stations. The authors suggest that, as a result, large areas of the benthos are undergoing rapid transition from being underexposed with supersaturated water to waters that are undersaturated with buffering minerals such as aragonite, and recommend urgent research on the effects of these changes on the benthic ecosystem and carbonate forming biota.[218]

Figure 5. Maps of model-predicted aragonite saturation states at different atmospheric CO_2 stabilization concentrations (ppm) [plotted over existing shallow-water coral reef locations (shown as magenta dots)].
Source: Adapted from Cao and Caldeira (2008): Figure 1.

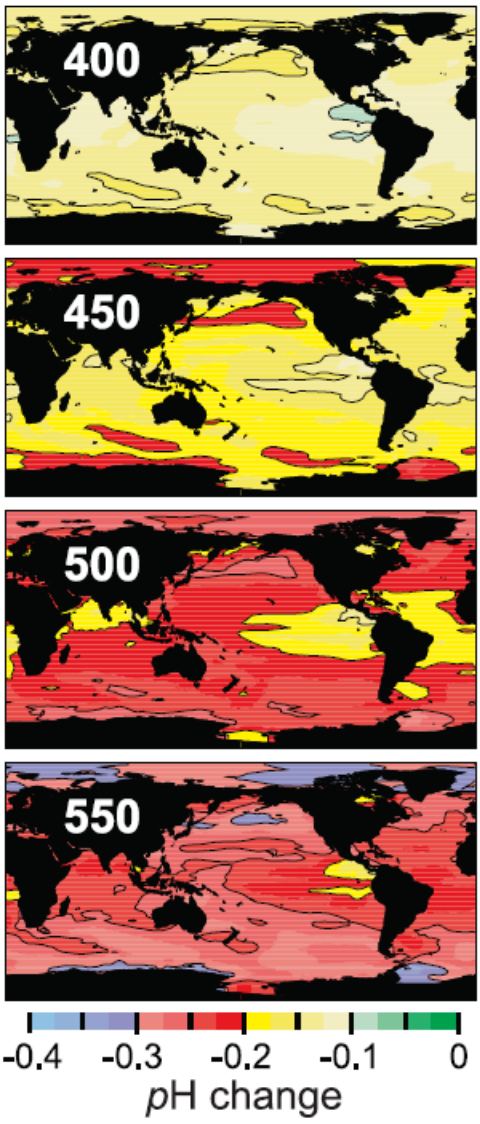


[216] Orr et al. 2005, *supra* note 204.
[217] Royal Society. 2005. Ocean acidification due to increasing atmospheric carbon dioxide. Policy document 12/05.
[218] Olafsson, J., S. Olafsdottir, A. BenoitpCattin, M. Danielson, TS. Arnarson, and T. Takahashi. 2009. Rate of Iceland Sea acidification from time series measurements. Biogeosciences Discussions. 6. 5252-5270. *Available at*: http://www.biogeosciences-discuss.net/6/5251/2009/bgd-6-5251-2009-print.pdf.

Cao and Caldeira (2008) found that increasing atmospheric CO_2 concentrations over the past two centuries have already caused a 0.1 unit decrease in average pH for the global surface ocean, corresponding to a 30% increase in acidity, consistent with previous studies. When atmospheric CO_2 is stabilized at levels at low as 450 ppm, large regions of the North Atlantic comprising the North Atlantic right whale's range experience a pH decrease of 0.1 to 0.2 units or more (Figure 6). When atmospheric CO_2 is stabilized at 550 ppm, most of the surface ocean, including the North Atlantic right whale's range, experiences a pH decrease of more than 0.2 units. This violates the criteria set forth by the U.S. Environmental Protection Agency [1976] that ''for open ocean waters. . .the pH should not be changed more than 0.2 units from the naturally occurring variation'' and the ''guard rail'' by the German Advisory Council on Global Change.[219]

[219] Cao, L. and K. Caldeira. 2008. Atmospheric CO2 stabilization and ocean acidification. pp. 1-18.

Figure 6. Ocean pH change. Changes in surface ocean pH relative to pre-industrial values for different atmospheric CO_2 stabilization levels.
Source: Cao and Caldeira (2008).



Finally, an additional threat posed by ocean acidification is that it will dramatically increase ocean noise pollution levels within the auditory range of 0.01–10 kHz, which could impact the North Atlantic right whale, as described above. Hester et al. (2008) found that the decrease in ocean pH of -0.12 pH units from the pre-industrial era through the 1990s has already resulted in a reduction in sound absorption at 0.44 kHz by 12-20% to depths of approximately 250m in the Pacific Ocean at 50°N latitude. In addition, a decrease in ocean pH of 0.3 units (e.g. a change predicted by Cao and Caldeira (2008) for some North Atlantic waters at a stabilization target of 550 ppm CO_2) would dramatically reduce sound absorption at 0.1 to 1 kHz by almost

40%.[220] Furthermore, Hester et al. (2008) found that rising ocean temperatures have the effect of decreasing sound absorption in the lower frequency range even more. For example, a temperature increase of 3°C would decreases pH by a further 5-10%.[221] Sources of underwater anthropogenic noise in the 0.1-1 kHz band come from shipping, explosives, seismic surveying sources, aircraft sonic booms, construction, industrial activities, and naval surveillance sonar, while noise from nearby ships and seismic air-guns can extend up into the 1-10 kHz band. Reduced absorption of low-frequency noise in the 0.01–10 kHz range from shipping and oil and gas development due to ocean increasing ocean acidification will almost certainly increase the negative impacts to the North Atlantic right whale from these activities. Overall, Hester et al. (2008) concluded:

> The waters in the upper ocean are now undergoing an extraordinary transition in their fundamental chemical state and at a rate not seen on Earth for millions of years, and the effects are being felt not only in biological impacts but also on basic geophysical properties including ocean acoustics.[222]

In sum, unless carbon dioxide emissions are significantly reduced in the near-term future, global warming and the related threat of ocean acidification are likely to pose a serious threat to the continued survival of numerous marine species, including the already critically endangered North Atlantic right whale.

F. Contaminants

Little is known about either the levels of, or effects of, contaminants on right whales. It is well known that sufficient contaminant loads can cause adverse reproductive effects in marine mammals.[223] While the NMFS believes that organic chemical contaminants are less significant for mysticetes than odontocetes, it also acknowledges that this conclusion, which is based on blubber sampling, ignores non-halogenated aromatic hydrocarbons from crude oil and combusted fossil fuels that do not bioaccumulate and thus are insufficiently bioassayed in blubber biopsies.[224] NMFS has acknowledged that documented loads of PCBs in the range of 80 to 1,000 parts per billion have been found in right whales.[225] The effect of this level on the immune function or reproductive system of right whales is not known.

There are nonetheless concerns with effects of chemical contaminants on right whales. An international conference of marine mammal scientists concluded that "right whales are

---

[220] Hester, K.C., E.T. Peltzer, W.J. Kirkwood, P.G. Brewer. 2008. Unanticipated consequences of ocean acidification: A noisier ocean at lower pH. Geophysical Research Letters. 35: 1-5.
[221] *Id.*
[222] *Id.*
[223] Reeves R., R. Rolland, and P. Clapham (eds.). 2001. Causes of Reproductive Failure in North Atlantic Right Whales: New Avenues of Research. Report of a Workshop Held 26-28 April 2000. Northeast Fisheries Science Center Reference Document 01-16. 46 p. *Available at*: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0116/0116.htm.
[224] NMFS 2005 Recovery Plan, *supra* note 36.
[225] *Id.*

routinely exposed to a wide array of xenobiotic chemicals, some of which generate toxic effects on mammalian reproductive and immune systems."[226]

The same NMFS-sponsored workshop found that right whales are often foraging downstream of a large metropolis (i.e. Boston) that dumps sewage treatment effluent into nearby waters, thus creating a high probability of exposure to estrogenic chemicals and other pharmaceuticals.[227] The proximity of shipping lanes to feeding right whales also exposes them to aromatic hydrocarbons from oil leaks and discharges and to chemical biofoulants leaching from ship hulls. Further, as right whales migrate to the waters of the Southeast to calve, they swim through waters contaminated with effluent from paper mills.[228]

The workshop concluded that, "though most of the fat-soluble persistent compounds usually associated with reproductive dysfunction and impaired immuno-competence seem to occur at relatively low levels in right whales, chemical contamination may be partly responsible for the observed reproductive problems in the stock." Additional research was recommended.

Right whales are also exposed to biotoxins that may be neurotoxic, including saxitoxins and domoic acid. Dinoflagellates, which produce saxitoxin, bloom in July and August, concurrent with the presence of right whales in the Gulf of Maine and the Bay of Fundy. Ingestion of saxitoxons would be via trophic transfer from copepod prey.[229] While these biotoxins have been fatal in humpback whales,[230] their effect on right whales has not been documented. Fecal testing indicates that right whales in the Bay of Fundy have been exposed to domoic acid and to the toxic organisms responsible for paralytic shellfish poisoning and, to date, right whales have the highest rates of infection of *Giardia* and *Cryptosporidium* of any marine mammal tested.[231]

IV. Requested Revision of Critical Habitat

A. Revision is Required to Support the Survival and Recovery of the Species

As noted above, despite receiving the protections of the ESA, MMPA, international treaties, and various other protection measures, the North Atlantic right whale remains highly imperiled. We request that the critical habitat designation for the North Atlantic right whale be revised to include a broad area that encompasses waters of the Southeast U.S. used for calving, including the waters of northern Florida, Georgia and South Carolina; Northeast U.S. waters used for foraging and nursery grounds, including the majority of the Gulf of Maine; and the

[226] Reeves et al. 2001, *supra* note 223.
[227] *Id.*
[228] *Id.*
[229] *Id.*
[230] Geraci, G., D.Anderson, R. Timeri, D. St. Aubin, G. Early, J. Prescott, and C.Mayo. 1989. Humpback Whales (*Megaptera noavaeangliae*) Fatally Poisoned by Dinoglagellate Toxin. Canadian Journal of Fisheries and Aquatic Science. 46: 1895-1898. *Available at*: http://www.whoi.edu/cms/files/Geraci_etal_1989_Humpbacks-PSP_30824.pdf.
[231] Rolland, R.M., K.E. Hunt, G.J. Doucette, L.G. Rickard, and S.K. Wasser. 2007. The inner whale: hormones, biotoxins and parasites. In: Kraus S.D. and R.M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

migratory corridor off the mid-Atlantic from the South Carolina-North Carolina border to the Great South Channel. The requested expansion is necessary to bring the North Atlantic right whale's outdated and insufficient critical habitat designation into compliance with both the letter and the intent of the ESA and help promote the recovery of this species.

1. Northeast U.S. Waters

In 2008, NMFS published an evaluation of habitat important to the conservation of North Atlantic right whales.[232] The NMFS authors of this study acknowledge that, in its original designation of critical habitat in the northeastern U.S. waters, NMFS relied in large measure on the right whale sightings in feeding areas and stated that "while the critical habitat designation was based largely on sightings of right whales, it was recognized that prey abundance was a primary constituent element for right whales in northeastern U.S. waters."[233] Indeed, these sightings continue to serve as a proxy for copepod prey abundance, which is a feature essential to right whale survival and recovery.

As a basis for their 2008 analysis, the authors used sightings of right whales between the years 1970 and 2005. These sightings of groups of 3 or more right whales were used to trigger so-called Dynamic Area Management ("DAM") of fisheries. Additional sightings since that time were not used in the analysis, but have only confirmed the high use areas identified by the authors as seasonal foraging areas "essential to the conservation of right whales."

While right whales consume a variety of zooplankton, their principal prey is adult copepods, specifically *Calanus finmarchicus*, which occur in dense patches.[234] These dense aggregations are the most important biological feature of right whale critical habitat in northeastern U.S. waters,[235] as these dense aggregations of copepods trigger foraging. A variety of authors have speculated on the density of copepod aggregations that trigger foraging activity in right whales.[236] While there is variability in estimates of key density thresholds ranging from 4,000 zooplankters/m^3 for right whales feeding in Cape Cod Bay to observations of 330,000 organisms/m^3, all studies acknowledge that dense patches of adult copepods are necessary to right whale survival.[237]

The formation of these dense copepod aggregations is dependent on a variety of oceanographic features, including water depth and the structure of the bottom mixed layers in the water column that concentrate copepods in stratified layers created by differences in turbidity, temperature and salinity.[238] Both biological oceanographic features (i.e., specific areas containing significant numbers and density of adult copepods) and physical oceanographic features (i.e., hydrographic processes that concentrate the zooplankton at accessible and optimal foraging densities) are therefore key features of critical habitat in the northeastern United States.

---

[232] Pace and Merrick 2008, *supra*, note 32.
[233] *Id* at 1.
[234] *Id.*
[235] *Id*.
[236] Baumgartner and Mate 2003, *supra* note 70; NMFS 2009 Draft SAR, *supra*, note 24.
[237] Pace and Merrick 2008, *supra*, note 32.
[238] *Id*.; Baumgartner and Mate 2003, *supra*, note 70. Pace and Merrick 2008, *supra*, note 32.

In the Pace and Merrick report, NMFS concluded that, in addition to demonstrable foraging areas, other areas essential to conservation of the species are source areas that supply copepod prey. These include, within the Gulf of Maine, the advection of copepods into the Gulf of Maine via the Northeast Channel and the redistribution of overwintering copepods to shallower depths from the deep-water Gulf of Maine basins. The authors concluded that "source habitats within US waters may be essential to the development of suitable right whale prey concentrations, even if these are located outside the primary foraging areas."[239]

NMFS concluded that most of the area north of Cape Cod Bay and the Great South Channel on Georges Bank was used at least seasonally for foraging. The authors summarized:

> This region include[s] seasonal foraging subareas generally identified as Cape Cod Bay, Great South Channel, Northern Edge of Georges Bank, Western Gulf of Maine, Wilkinson Basin, and Jordan Basin. Wilkinson and Jordan Basins are also considered essential to the conservation of right whales because these two basins are the source areas for the dense copepod concentrations upon which right whales prey in the U.S. Northwest Atlantic waters.[240]

Further, although many mothers and calves are seen in the Southeast calving grounds in the winter, little is known about the whereabouts of most right whales in the winter. Recent research indicates that the waters of Jordan Basin may be a key wintering and breeding area for right whales.[241]

This foraging and potential breeding area, as described by Pace and Merrick, encompasses approximately 19,200 square nautical miles. We agree with this NMFS analysis of key areas and petition the agency to designate as critical habitat the Gulf of Maine, inclusive of the areas identified by the authors but extending northerly along the Hague Line to the U.S.-Canadian border, to include State and Federal waters adjacent to the states of Maine, New Hampshire, and Massachusetts. This includes areas within the Gulf of Maine and its associated Bays (e.g., Cape Cod and Massachusetts Bays) and are northward of lines drawn diagonally from the southern corner of the current Great South Channel Critical Habitat (41.0° N latitude, 69.1° W longitude), northeastward to the Exclusive Economic Zone/Hague Line (42.2° N latitude, 67.2° W longitude) thence northerly along the Hague Line to the U.S.-Canadian border (again, to include State and Federal waters adjacent to the states of Maine, New Hampshire, and Massachusetts), and northwestward to the southern corner of Cape Cod, Massachusetts (approximately 41.55° N latitude, 70.0° W longitude) (Figure 1). The location of these habitat areas is documented in Figure 5 of Pace and Merrick 2008.

---

[239] Pace and Merrick 2008, *supra*, note 32, at 2.
[240] *Id* at iv.
[241] NOAA Press Release, Jan. 2, 2009. "High Number of Right Whales Seen In Gulf of Maine: NOAA Researchers identify wintering ground and potential breeding ground: *Available at* : http://www.eurekalert.org/pub_releases/2009-01/nnmf-hno010209.php.

2. Southeast U.S. Waters

The waters off the southeastern coast of the United States represent the only known calving area for North Atlantic right whales.[242] Females arrive in the region during November and early December after migrating to the area from feeding grounds in the northern latitudes. They give birth and remain there with their calves through March, generally departing by mid-April.[243]

In designating critical habitat for right whales in 1994, NMFS considered habitat features in the Southeast that distinguished the nearshore continental shelf off Florida and Georgia as calving habitat.[244] At that time, NMFS found that right whales preferred calving habitat close to shore in shallow water. This habitat provides protection from wind and wave action that may disturb calves or increase the likelihood that calves could become separated from their mothers. The rule also examined the thermal structure of the region, noting at that time that the offshore portions of the area were dominated by high water temperatures (>20º C) resulting from the Gulf Stream. The nearshore waters were cooler and right whale sightings were found at that time to be highest in water temperatures ranging from 10-13º C.[245]

The correlation of habitat features with right whale sightings resulted in critical habitat boundaries that covered the nearshore waters between 31º 15' N and 30º 15' N extending 15 nautical miles from the shoreline. The area to the south narrowed to within 5 nautical miles of the shore south to 28º 00' N. This narrowing was a consequence of both the narrowing of the continental shelf and the warmer waters of the Gulf Stream that approach closer to shore at this point.

A 2007 NOAA Technical Memorandum notes that since the time of the initial critical habitat designation there has been a significant increase in data gathered from aerial surveys and environmental sampling.[246] Aerial survey data, which has been gathered since 1992, has expanded in scope to encompass waters further from shore and further to the north than surveys at the time of the original designation, and acoustic monitoring has also detected regular right whale calls in areas outside the current boundaries of critical habitat.[247] In fact, right whales have been sighted with newborn calves as far north as Cape Fear North Carolina.[248] These additional sightings and expanded environmental sampling data were evaluated by Garrison (2007), who produced a model "for use in evaluating possible revision to critical habitat boundaries."[249]

The model developed by Garrison confirmed NMFS' 1994 finding that sea surface temperature and water depth are significant predictors of calving right whale distribution.

[242] NMFS 2005 Recovery Plan, *supra*, note 36.
[243] Garrison 2007 Calving Habitat, *supra* note 34.
[244] 59 Fed. Reg. 28793 (June 3, 1994), *supra* note 25.
[245] *Id.*
[246] Garrison 2007 Calving Habitat, *supra* note 34.
[247] *Id.* at 27.
[248] NMFS 2009 Draft SAR, *supra* note 24.
[249] Garrison 2007 Calving Habitat, *supra* note 34, at 4.

Garrison found peak sighting rates occurring at water temperatures from 13-15º C and water depths from 10-20 meters. Garrison concluded:

> These habitat features may be used to describe critical habitat off the coast of Georgia and Florida. The model also predicts that areas outside of the currently defined critical habitat are important for calving right whales. *Recent surveys indicate that waters off South Carolina and North Carolina are also frequently used by calving right whales, and the habitat features identified in the current analysis are also present in these regions*.[250]

The reason these warm shallow waters are so critical to right whales is in part due to the fact that calves lack the thick insulating blubber layer of adults and do not tolerate cold temperatures as easily. Furthermore, because calves are weaker swimmers than adults, they would be more likely to become separated from their mother in the waters found at higher latitudes, as these areas are prone to greater wind speeds and wave heights and greater storm frequency.[251] Even a short separation can be fatal to a newborn calf.[252] Garrison also pointed to shallow waters as providing greater protection to mothers and calves from both predators and the possibility of interactions with aggressive males, as the shallow depth limits avenues of approach.[253]

In this Technical Memorandum, NMFS defined water temperature and bathymetry as Primary Constituent Elements ("PCEs") of right whale habitat, stating:

> The PCEs that define calving habitat for the North Atlantic right whale and the predicted geographic extent of the optimal calving area were assessed using a habitat modeling approach. Habitat modeling focuses on evaluating the 'species-environment' relationships which model the occurrence of individuals as a function of various habitat characteristics.[254]

In modeling the boundaries of critical habitat, the author used aerial survey data from 1991 through the 2000/2001 calving season. During that time a total of 545 cow-calf pairs or pregnant females (which he then refers to as 'calving right whales') were used in the analysis. He then matched sightings to what he called the "key habitat features [which] included sea surface temperature and bathymetric slope/depth." We note that this analysis was limited in scope by the limits on the area being surveyed. That is, during that time, funding and other constraints generally limited the areas being surveyed with a lesser frequency of flights outside the existing boundaries of critical habitat.[255] Since that time (i.e., after 2001), sighting surveys and acoustic detection have further expanded in time and space.

---

[250] *Id.* at iii (emphasis added).
[251] *Id.* at 5.
[252] *Id*.
[253] *Id.* at 6.
[254] *Id.* at 12.
[255] Keller, C., L. Ward-Geiger, W. Brooks, C. Slay, C. Taylor and B. Zoodsma. 2006. North Atlantic Right Whale Distribution in Relation to Sea-Surface Temperature in the Southeastern United States Calving Ground. Marine Mammal Science, 22(2) 426-445, at Fig.1.

The NMFS analysis concludes:

> [W]ater temperature and depth are significant predictors of right whale spatial distribution in the SEUS calving region. Peak predicted and observed calving right whale sightings rates occur within the relatively narrow environmental ranges of 10-20m water depths and 13-15º C. The model results indicate that these environmental ranges describe the habitat requirements for calving right whales.[256]

The NMFS analysis further states that

> sea surface temperature is the critical spatial variable and its spatial distribution fluctuates on seasonal and annual time scales. [Further,] the distinction between 'habitat' and 'not habitat' implies a clear boundary or binary characteristic of the environment. In terrestrial environments, landscape features can often be defined by some clear and fixed boundary, for example the edges of a stream or flood plain. However, in the current case, habitat is best represented as a spatial gradient between the most suitable and least suitable environments.[257]

In choosing an appropriate boundary based on the sightings per unit of effort (SPUE), Garrison opines that the boundary may err either on the side of selecting a larger area, which may not always be used; or a smaller area that is frequently used but may not capture all the suitable habitat in which animals can successfully calve in years when the Gulf Stream and nearby temperatures fluctuate or into which range expansion can occur as the population recovers and requires suitable calving habitat outside of the contracted range typical of a dramatically reduced population. The author provides two examples of boundaries. In the first only the highest 5% of predicted sightings occur, which would encompass only 44% (less than half) of historic sightings of calving right whales. The second includes larger area that is based on the 75th percentile of predicted sightings and extends further to the north and further offshore of the coast of Georgia and Florida. This larger area includes a northern boundary at the Georgia/South Carolina border and would encompass 91% of all historic sightings.[258] In either case, NMFS concludes, "based on [the] results, it appears that the *currently defined critical habitat should be expanded to include areas further offshore and generally further north off the coast of Georgia*."[259]

It is clear from NMFS' own analysis that the current boundaries of critical habitat in the Southeast are inadequate to protect right whales and their vital calving habitat. In the NMFS analysis, the PCEs were identified as water temperatures between 13-15º C and water depths of 10-20 meters. However, even the larger of the two areas outlined in Garrison's report (with a northern boundary at the Georgia/South Carolina border) is not sufficiently protective.

---

[256] Garrison 2007 Calving Habitat, *supra* note 34, at 24.
[257] *Id*.
[258] *Id.* at 26 and Fig. 19.
[259] *Id*. (emphasis added).

Indeed, based largely on Garrison's analysis, NMFS published an emergency rule in 2006 and a final rule in 2007 prohibiting gillnetting in what it termed the "core right whale calving area."[260] In the 2006 emergency rule, NMFS stated that mothers and calves have been observed in Georgia, Florida, and South Carolina, noting that right whales occur in the area from South Carolina to Florida from mid-November through mid-April. The agency concluded in this emergency rule:

> the core right whale calving area requiring emergency gillnet prohibitions is the Atlantic Ocean waters west of 80º 00' W longitude between 29º 00' N lat (just south of New Smyrna Beach Florida) and 32.00' N. lat (the area of the state boundary between Georgia and South Carolina) and the Atlantic Ocean waters within 35 nm of the South Carolina coast." [261]

This finding caused NMFS to extend the northern boundary of the restricted area to the southern border of North Carolina. NMFS also consulted the Right Whale Sightings Database, curated by the University of Rhode Island, which it said "indicates that the vast majority of right whale sightings in their core calving area occur between November 15 and April 15."[262]

In the final rule restricting fishing gear in the core right whale calving habitat, NMFS once again referenced Garrison's work.[263] NMFS explained its decision to include the waters off South Carolina in what it described at the "core calving area," as follows:

> [NMFS] relied on habitat models that demonstrate a strong relationship between the spatial distribution of calving right whales and specific environmental variables (i.e., water temperature and bathymetry). Environmental conditions strongly correlated with calving right whale distribution are typically found off South Carolina to distances of 35 nm (64.82 km) from shore during winter months. Thus, NMFS is expanding the Southeast U.S. Restricted Area to include waters 35 nm (64.82 km) off the coast of South Carolina to adequately protect right whales from the threat of entanglement in fishing gear during the calving season.[264]

The agency stated in its Record Of Decision that it chose to protect right whales in their core calving habitat off South Carolina "based on a re-examination of aerial survey data and predictive modeling efforts that indicate the most suitable habitat for right whales extends to 27 nm from shore [off the coast of South Carolina]. Because right whales have been detected beyond this distance from shore, we determined a 35 nm boundary would provide a sufficient buffer."[265]

---

[260] 71 Fed. Reg. 66469 (Nov. 15, 2006).
[261] 71 Fed. Reg. 66470 (chart of coordinates).
[262] *Id*. (emphasis added).
[263] 72 Fed. Reg. 34632.
[264] 72 Fed.Reg. at 34673.
[265] May 24, 2007 Record of Decision, Measures to Protect Right Whales in their Southeast U.S. Calving Habitat. *Available at*: http://sero.nmfs.noaa.gov/pr/mm/pdf/SEUS%20gillnet%20final%20rule%20-%20Signed%20DM.pdf..

Since the publication of the 2007 rule restricting risk-prone fishing gear in order to protect right whales, additional aerial survey data have been collected that only confirm the need to protect waters up to the North Carolina/South Carolina border that calving right whales and their newborns regularly use. The right whale sightings data used for Garrison's analysis extended only through 2002, though in his discussion of potential right whale calving habitat further north, the author acknowledges that until recently (i.e. prior to 2007) "there has been very little systematic effort to evaluate calving right whale spatial distribution" outside of the designated critical habitat.[266] Garrison admits, however, that surveys as of 2005 had observed mother and calf pairs off the coast of South Carolina in 2005 calving season "throughout the winter."[267]

Other recent data also provide strong support for designating the waters of South Carolina as part of critical habitat. Starting in 2007, the Wildlife Trust was contracted to provide surveys up to 4 days a week in the waters of South Carolina and northern Georgia during the winter.[268] The Wildlife Trust reports document sightings of 61 individuals in this area during the 2007/2008 calving season, including 18 of the 19 calves documented to have been born in the Southeast.[269] Some of the right whales seen in this expanded survey area had never before been seen in the Southeast, indicating that they may have been using waters to calve that are outside of the currently recognized area. Two of the mother-calf pairs seen were only sighted off South Carolina and Georgia that season, including a newborn calf seen in April.[270]

Published and unpublished data gathered by survey teams during the 2007/2008 and 2008/2009 season further document the presence of right whales well to the north of the larger area (which had a northern border at the South Carolina/Georgia border) proposed by Garrison, but within the enlarged restricted area established by NMFS in 2007.[271] These include an analysis by Taylor et al (2007) of systematic surveys of the mid-Atlantic and southeast Atlantic Bights between 2001 and 2007 that sighted right whales on 57 of 67 survey days between November and April, with peak sightings in March.[272] During this time period, 132 right whales were sighted in an average group size of two. Thirty-seven percent of the sightings were of cow-calf pairs. Several females were re-sighted in this area over a period of several years, at least two of whom had calves not seen in the surveys of the traditionally defined calving area. The authors hypothesized that, rather than continuing to move to the south, some individuals may stop in this area "well north of the traditionally recognized calving ground and federally designated critical

---

[266] Garrison 2007 Calving Habitat, *supra* note 34, at 27.
[267] Garrison 2007 Calving Habitat, *supra* note 34, at 28.
[268] *See* Wildlife Trust Press Release, Dec. 14, 2007, "Wildlife Trust, South Carolina Ports Partner For Endangered Right Whale." *Available at:* http://www.ewire.com/display.cfm/Wire_ID/4403.
[269] *See* Naessig, Patricia and Rachel Sayre, "2007-2008 Wildlife Trust South Carolina and Georgia Right Whale Aerial Surveys Update." *Available at*: http://www.wildlifetrust.org/enter.cgi?p=news/2008/0501_S_whales.shtml.
[270] *Id.*
[271] *See* NMFS Southeast Region's Contract Aerial Survey Reports. *Available at*: http://sero.nmfs.noaa.gov/pr/mm/rightwhales/SoutheastRegionsContractsAerialSurveyReports.htm.
[272] Taylor, C., W. Mclellan, A. Glass, M. Zani and D.A. Pabst. 2007. Right Whale Sightings in the mid-Atlantic and Southeast Atlantic Bight From 2001-2007. Abstract in North Atlantic Right Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford Whaling Museum Nov. 7-8, 2007.

habitat."[273] The use of this area was described as annually "consistent" and most sightings were distributed from the Georgia /South Carolina border north to Long Bay in mid-South Carolina.[274]

Additional survey data from 2007-08 show that right whales use a far broader area of Southeast waters than the area currently as designated critical habitat. When survey effort was extended outside of the more densely surveyed zone within the Mandatory Ship Reporting area in the Southeast, sightings of right whales in 2007 and 2008 extended as far north as the surveys themselves extended (implying that there would have been sightings farther north had the surveys extended further to the north) and sightings continued all the way to the most eastern end of the survey track line (implying that there would have been sightings farther to the east had the surveys continued further to the east).[275]

The current boundaries of critical habitat in the Southeast are clearly inadequate and not representative of the areas that contain the primary constituent elements necessary for right whale recovery and survival. Data analysis by NMFS not only recommends a larger boundary, but NMFS itself has acknowledged the need to extend the area subject to special management requirements significantly further north and east than the current boundaries of critical habitat.

Garrison suggested for protection an area that captures sightings of right whales at the 75th percentile based on the primary constituent elements of bathymetry and water temperature. In designating a large restricted area closed to gillnet fishing, NMFS itself stipulated that that the bathymetry and water temperature that Garrison found to be key to right whale calving occur in the waters off South Carolina out to approximately 35 nm.[276] NMFS did not make such a finding with regard to PCEs in the larger area off the coasts of Florida and Georgia that were included in the restricted area.

Based on this detailed information, we therefore petition NMFS to adopt the larger of the potential critical habitat boundaries suggested by Garrison in his NOAA Technical Memo to capture sightings at the 75th percentile (Garrison at Figure 19) and add the waters from the shore of South Carolina out to 35 nautical miles as described by NMFS in its rule to restrict risk to right whales,[277] as well as waters off the coast of Georgia and Florida from approximately 32.0^{o} N latitude, 80.35^{o} W southward to approximately 28^{o} N latitude, 80.35° W longitude (Figure 2). In addition, the agency should undertake additional modeling and analyses to document these PCEs offshore of the area considered by Garrison, as we believe they may extend further to the east throughout NMFS' Southeast Gillnet Restricted Area.

---

[273] *Id.*

[274] *Id*. *See also* Kahn, C., and C. Taylor. Monitoring North Atlantic Right Whales off the Coasts of South Carolina and Northern Georgia, 2006-2007.

[275] Naessig, P. and C. Taylor, and C. George. Results of 2006-2007 Northern Early Warning System Surveys for Right Whales) In North Atlantic Right Whale Consortium Abstracts of the Annual Meeting. New Bedford, MA. Nov. 2007; Naessig, P., C. Taylor, and C. George. 2008. Results of 2007-2008 Northern Early Warning System Surveys for Right Whales. In North Atlantic Right Whale Consortium Abstracts of the Annual Meeting. New Bedford, MA, Nov. 2008.

[276] 72 Fed. Reg. at 34673.

[277] Guide to The Atlantic Large Whale Take Reduction Plan, at page 51. *Available at*: http://www.nero.noaa.gov/whaletrp/plan/ALWTRPGuide.pdf

3. Mid-Atlantic U.S. Waters

As described above, a large segment of the North Atlantic right whale population migrates seasonally between feeding grounds in the northeastern U.S. and Canada and their calving grounds in the southeastern United States.[278] NMFS itself has recognized the importance of the migratory corridor in providing passage between key habitat areas. In October 2008, NMFS enacted seasonal speed restrictions on large vessels along the U.S. east coast in an attempt to reduce risk of mortality and serious injury to right whales from collisions with vessels.[279] In this rule, NMFS noted that "most right whales that died as a result of ship collision were first reported dead in or near major shipping channels off east coast ports."[280] NMFS also summarized research from 1972 to 2000 indicating that approximately 90% of right whales sighted between the South Carolina/Georgia border and Connecticut stay within 30 nautical miles (55.6 km) of the coastline.[281]

A focal study of the area found 94.1% of sightings within 30 nm of the mid-Atlantic coast during migrations.[282] Animals preferred water depths of less than 10 fathoms in depth, with most found in depths of 5-10 fathoms.[283] Using visual sightings and telemetry data, this study documented whales offshore of the busy ports entrances to Providence/Buzzards Bay, New York/New Jersey, Delaware Bay, Chesapeake Bay, Morehead City, and Wilmington, North Carolina, among others. The study divided sightings into three sub-areas: north of Cape Hatteras, south of Cape Hatteras, and the coast of Georgia. For the area north of Cape Hatteras, there was a "pulse" of sightings in March and April during the northward migrations with few sightings between May and October. For the area south of Cape Hatteras, a similar pattern was evident.[284] Sightings varied in different port areas. For example, right whales were sighted off Wilmington, NC primarily in February and March. The authors believed these whales were mothers and calves heading northward. Sightings off the Chesapeake Bay were highest in October through December and in February and March. Delaware Bay had little effort directed to sightings and no pattern emerged, as was the case for other more northerly ports.[285] In its rule requiring speed restrictions, the NMFS determined that the majority of animals are passing through the waters of the mid-Atlantic between November 1 and April 30 of each year.[286]

As we note elsewhere in this petition, there is little systematic effort to sight whales in the mid-Atlantic. However, even data gathered by limited survey efforts show that most right whales use a discrete migratory corridor. For example, effort by the Wildlife Trust concentrates on the areas of South Carolina and Georgia[287] but has, with limited effort, sighted right whales

[278] NMFS 2008 Ship Speed EIS, *supra* note 35.
[279] 73 Fed. Reg. 60173 (Oct. 10, 2008).
[280] *Id*. at 60714.
[281] *Id*. at 60178.
[282] Knowlton, A., J. Beaudin Ring, and B. Russell. 2002 Right Whale Sightings and Survey Effort in the Mid-Atlantic Region: Migratory Corridor, Time Frame and Proximity to Port Entrances. *Available at*: http://www.nero.noaa.gov/shipstrike/ssr/midatanticreportrFINAL.pdf
[283] *Id*.
[284] *Id*, at p.19.
[285] *Id.*
[286] 73 Fed Reg. at 60179.
[287] Taylor et al 2007, *supra* note 34.

offshore of Virginia and North Carolina in December through April.[288] The Wildlife Trust concluded that the area from North Carolina northward was likely a migratory corridor, as sighting were largely outside of the prime calving period and were sporadic.[289] The University of North Carolina, Wilmington has been contracted to survey along the coast of North Carolina and has documented sporadic sightings.[290] Passive acoustic monitoring of New York coastal waters was undertaken during the months of February through May of 2008 during what is generally considered the time of northward migration from the calving grounds.[291] Monitoring units detected right whale contact calls south of Long Island during 26 of the 75 recording days. Results from the second phase of the project, intended to monitor during the southward migration, have not yet been reported. The authors stated that "the discovery of right whales only tens of miles from [the busy port of] New York City re-emphasizes the high risks for these animals as they migrate past highly urbanized areas…."[292]

Firestone (2008) used the Right Whale Consortium database through 2005 to model the time it takes for right whales departing their calving grounds to migrate through their mid-Atlantic migratory corridor as they return in the spring to northeastern feeding grounds. The research acknowledged the "small number of observations in the mid-Atlantic during the first half of the year."[293] Given that limitation, the modeling undertaken for this study suggested that there is an approximate departure date from the currently delineated critical habitat off Jacksonville, between early to mid-March with a 30-day departure range.[294] The modeling suggested an average travel time of 21-24 days to the tip of Long Island. The authors state that their model updates earlier modeling by Hiby and Leaper (2005), which used a more limited database.[295] There was no attempt to model the timing of the southern migration, though this clearly is a time of equal risk to migrating right whales. Even less monitoring takes place during the southward migration.

Although sighting effort tends to focus on nearshore waters, right whales do appear to preferentially use shallow, nearshore habitats during their migrations. The reason they might favor shallow water is not entirely certain. For the northerly journey made by mothers and newborn calves, this preference may be due, in part, to the same factors that predispose them to seek shallow, coastal waters for calving. That is, shallow waters are more sheltered in the event of an encounter with a predator and the limited blubber layer of calves makes them more

[288] *Id.*
[289] *Id.*
[290] University of North Carolina, Wilmington. 2008. Sightings Map of 2008 right whale aerial surveys in North Atlantic Right Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford Whaling Museum Nov. 5-6, 2008.
[291] Biedron, I., N. Mihnovets, C. Clark, A. Ward, and J. Michalec. 2008. Determining seasonal distribution of North Atlantic right whales (*Eubalaena glacialis*) in New York coastal waters using passive acoustic monitoring. Abstract in North Atlantic Right Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford Whaling Museum, Nov. 5-6, 2008.
[292] *Id*.
[293] Firestone, J., S. Lyons, C. Wanag, and J. Corbett. 2008. Statistical modeling of North Atlantic right whale migration along the mid-Atlantic region of the eastern seaboard of the United States. Biological Conservation 141 (2008) 221-232.
[294] *Id.*
[295] Firestone, *supra* note 293.

vulnerable to cold, such that warmer waters may be important to them.[296] Shallow waters are generally somewhat warmer than the waters further offshore as right whales move into northerly latitudes.[297]

NMFS has recognized that protecting this migratory corridor is crucial to the survival of the North Atlantic right whale. In its Final Environmental Impact Statement ("FEIS") accompanying the rule to enact slower speeds as a collision risk reduction measure, NMFS considered and rejected an option for a continuous Seasonal Management Area ("SMA") that would include the waters of the mid-Atlantic out to 25 nm from shore along the entire mid-Atlantic coast from Savannah, Georgia to Providence, Rhode Island, including Block Island Sound.[298] The continuous band of protection offered by this proposed SMA would have been in effect from October 1 to April 30. This option was contained in both Alternatives 3 and 5 in the FEIS. While it considered these alternatives to be "environmentally preferable,"[299] NMFS did not choose either of them as a preferred alternative. Instead NMFS chose an option which it felt had a lesser economic impact. NMFS therefore left large areas of the mid-Atlantic in between port entrances unprotected by the risk-reduction measures intended to reduce right whale death. Further, NMFS opted in the final rule to extend risk reduction measures only out to 20 nm from shore. This narrower band encompasses only 87% of the sightings of migrating females and calves rather than the 94% that are out to 30 nm from shore.[300] Thus, seven percent of all sightings were outside of the area subject to seasonal management measures. As a result, NMFS left multiple females vulnerable to death as a result of vessel collisions out of a population for which NMFS itself has found that the life of every female is vital to the recovery of the species.

A recent paper by Schick et al. (2009) analyzed additional sightings and telemetry data on female right whales – including a north-to-south transit by one satellite tracked individual, rather than just the south-to-north transit included in other analyses.[301] The study authors found some females transiting even further offshore than previously thought, with one tracked female going 37 miles offshore. The authors concluded that NMFS should re-visit its 20nm seasonal management zone width, which they believed was inadequately protective of a large number of vulnerable right whales, in favor of a 30 nm wide management area that would include a larger portion of migratory habitat and protect more mothers and calves.

Because of the imperative to preserve the lives of reproductive females, and the well-documented losses of exactly this demographic in the mid-Atlantic, we petition for critical habitat to include all waters along the migratory corridor of the mid-Atlantic from the shore out to 30 nautical miles, between the northern border of South Carolina (approximately 33.85° N latitude and 78.53° W longitude) northward to the southeastern corner of Cape Cod, Massachusetts (approximately 41.55^{o} N latitude, 70.0^{o} W longitude), southeastward to the

[296] Garrison 2007 Whale Calving Habitat, *supra* note 34.
[297] *See* Rutgers University Website, Satellite Imagery, Sea Surface Temperature of Northeast. *Available at*: http://marine.rutgers.edu/mrs/sat_data/?product=sst&region=bigbight&nothumbs=0.
[298] NMFS 2008 Ship Speed EIS, *supra* note 35.
[299] *Id.* at 2-23.
[300] Knowlton et al 2002, *supra* note 282.
[301] Schick et al 2009, *supra* note 121.

southern corner of the current Great South Channel Critical Habitat (41.0° N latitude and 69.1° W longitude) (Figure 3).

B. Petitioners' Recommended Revision Meets the Requirements of the ESA

1. Critical Habitat is Prudent and Determinable

Under the ESA, NMFS can refuse to designate critical habitat only if such designation it "not prudent" or "not determinable."[302] A designation is not prudent when one or both of the following situations exist:

> (i) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of such threat to the species, or
> (ii) Such designation of critical habitat would not be beneficial to the species.[303]

A designation is not determinable when one or both of the following exist:

> (i) Information sufficient to perform required analyses of the impacts of the designation is lacking, or
> (ii) The biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.[304]

NMFS already determined in its 1994 designation that critical habitat for the North Atlantic right whale was both prudent and determinable. The substantial new information presented in this petition, much of it from NMFS's own studies, further supports this conclusion. Because the designation of additional critical habitat for the North Atlantic right whale is both prudent and determinable, NMFS must promptly designate such habitat.

2. The Proposed Critical Habitat Areas Contain Physical and Biological Features Essential to the Conservation of the Species

The ESA mandates that specific areas in which "physical or biological features essential to the conservation of the species" are found qualify as critical habitat.[305] According to NMFS' regulations, in designating critical habitat, NMFS must consider the requirements of the species, including, but not limited to (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing of offspring; and, generally, (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of the species.[306] The proposed critical habitat area described above clearly contains "physical or biological features essential to the conservation" of the North

[302] 50 C.F.R. § 424.12.
[303] 50 C.F.R. § 424.12(a)(1).
[304] 50 C.F.R. § 424.12(a)(2).
[305] 16 U.S.C. §1532(5).
[306] 50 C.F.R. § 424.12(b).

Atlantic right whale and therefore must be designated as critical habitat for the species. These features are known in NMFS regulations as "primary constituent elements" ("PCEs").

For the North Atlantic right whale, PCEs include water of particular depth and temperature, abundant prey resources, oceanographic features that aggregate prey, and waters free of obstruction and disturbance to allow whales to rest, travel, feed, breed, give birth, and raise calves safely. The original 1994 critical habitat designation for northern right whales determined that the areas that had been identified as feeding, nursery, and calving grounds to be essential habitat. These areas generally feature abundant zooplankton or, in the case of nursery areas, relatively shallow, calm water.[307] As detailed above, in 2003, NMFS denied The Ocean Conservancy's petition to revise critical habitat for this species on the grounds that insufficient information was available regarding the physical and biological features essential to the conservation of North Atlantic right whales. The agency also stated that it would continue to assess this information as it emerged.[308] As described above, a plethora of new information regarding essential habitat features has emerged since 2003. Indeed, much of this information comes from NMFS' own studies.

PCEs for the North Atlantic right whale may be considered in geographic terms, or in terms of the essential life functions listed in NMFS' regulations. We will address each of these methods for analyzing PCEs in turn. Notably, under either or these analyses and in all of the proposed critical habitat areas, waters free from obstruction and disturbance are significant primary constituent elements.

The waters of the Gulf of Maine are the primary seasonal feeding and foraging area for North Atlantic right whales. The Gulf of Maine serves as a nursery area to which mothers bring their newborn calves in the spring and summer to nurse and grow to independence. These waters contain key zooplankton resources—the food necessary to meet right whale energetic requirements. Further, recent literature suggests that an area in the Gulf of Maine (Jordan Basin) may serve as a winter breeding area. The area used for foraging and as a recharge area for plankton is larger than first considered when critical habitat was designated.

As NMFS has already recognized, "prey abundance [is] a PCE for right whales in the northeastern U.S. waters."[309] The abundant plankton prey resources of the northeastern U.S. (primarily *Calanus finmarchicus*) are concentrated by physical oceanographic features and associated water depth and bottom mixed layers that aggregate prey in "discrete layers…allowing more efficient foraging by the whales."[310] NMFS determined that the abundance of prey was made possible because "the features characteristic of right whale foraging habitat are a combination of both biological oceanography [i.e., specific areas that concentrate significant numbers of adult copepods] and physical oceanography [i.e., hydrographic processes that concentrate zooplankton densities above some threshold at an acceptable depth that allows efficient foraging]."[311]

[307] 59 Fed. Reg. 28793 (June 3, 1994).
[308] 68 Fed. Reg. 51758, 51763 (Aug. 28, 2003).
[309] Pace and Merrick 2008, *supra*, note 32.
[310] *Id.*
[311] *Id*.

The only known calving ground for North Atlantic right whales is in the southeastern United States. Though the original boundaries captured most of the sightings to that date in the mild, shallow coastal waters, we now know that there is a much broader area that is used for giving birth, extending through the state waters of South Carolina and further offshore than originally thought. These waters shelter the newborn calves as they nurse and prepare for the long journey with their mothers to the northern feeding grounds.

Within these waters, the primary constituent elements have largely been defined by Garrison's analysis of "species-environment" relationships using water temperature and water depth (i.e. water quality/quantity and geologic features as listed in the NMFS regulations) as determinants of calving habitat. Water temperatures between 13 and 15°C) and water depths between 10 and 20 meters define the areas appropriate for calving and are thus primary constituent elements in the Southeast.

The mid-Atlantic also must be protected as critical habitat due to its essential role as a migratory corridor for pregnant females and calves. Protecting only the terminus points of right whale migration leaves their seasonal migratory route unprotected. In fact, up to one quarter of the deaths of right whales (mostly females and calves) have occurred in the migratory corridor. Without a means of safe passage to and from these areas, right whales are at risk and/or restricted in their normal behavior.

Water depth is one of the most important aspects of right whale migratory habitat. Over 94% of right whales migrating between their northern feeding areas and southern calving grounds travel within 30 nm of the coast. Approximately 80% of all observations occurred in waters with depths of 27.4 meters or less and 71% were in waters of 18.3 meters or less.[312] This suggests that the primary constituent element in the migratory corridor is a water depth (i.e., quantity) of 28 meters.

We now address the specific elements identified for consideration in NMFS' regulations:

Space for population growth and normal behavior

Currently designated critical habitat in both the northeastern U.S. and the southeastern U.S. were chosen to help support key life functions. The waters of the Southeast are the only currently recognized area where right whales give birth to their calves. The waters of the northeastern U.S. and Canada contain high concentrations of prey crucial to the survival of both individuals and the population. The waters we propose for inclusion in the Northeast and Southeast critical habitat areas contain similar or identical physical and biological constituent elements vital to the survival of right whales but recognize a more extensive distribution of right whale foraging and nursery use than was known at the time of the original designation of critical habitat.[313] Since the original designation of critical habitat in 1994, expanded survey effort and biological monitoring has revealed that the extent of the primary constituent elements, and concentrations of right whales dependent on them, extends well beyond that recognized in the

[312] Firestone et al 2008, *supra* note 293.
[313] Pace and Merrick 2008, *supra*, note 32.

original designation. In addition, our proposed designation of the species' mid-Atlantic migratory pathway also qualifies as space for population growth and normal behavior. The specific types of behavior that take place in each of these areas, as well as their importance to population growth (as a breeding, nursery, or calving area, or a migratory corridor for mothers and calves to these locations) are detailed in the sections on the critical habitat regions above.

Food and water

In its original designation of critical habitat in the northeastern U.S., NMFS stated that, based on observed distribution patterns compared to oceanographic conditions, scientists speculate that topographic and seasonal oceanographic characteristics of foraging areas are conducive to the dense growth of zooplankton, which then result in higher use areas for right whales.[314] NMFS concluded that "[t]hese high-use areas may comprise the minimal space required for normal foraging behavior that will support the [northern] right whale populations."[315]

As NMFS has documented in its evaluation of ocean habitats important to conservation of right whales in the northeastern U.S., the concentrated sightings of right whales closely follow the availability of *Calanus finmarchicus*, their principal prey. Oceanographic circulation influences the distribution of *Calanus* copepods.[316] Copepods originating from both the Gulf of Ste. Lawrence and the Scotian Shelf enter the Gulf of Maine via slopewaters from the Scotian Shelf. Jordan Basin and Wilkinson Basin serve to concentrate dense concentrations of copepods over the winter. The current circulation patterns of the Gulf of Maine return some of the progeny of copepods produced in the Gulf of Maine back to these deep basins, where they too overwinter and contribute to reproduction in the following spring. Patterns of circulation in Cape Cod Bay may entrain copepods that are produced elsewhere. In the spring, hygrographic processes and mixing fronts combine with circulation patterns in the Gulf of Maine to concentrate copepods north of the 100 meter isobath at the northern end of the Great South Channel. By early summer, there are continuous high-density aggregations of copepods along the northern edge of Georges Bank. In the late fall and winter, dense copepod concentrations are found only in the deep-water basins.[317]

The biological and oceanographic processes resulting in the concentration of copepods in the Northeast are thoroughly described in Appendix 1 of Pace and Merrick (2008).[318] After documenting areas of greatest concentration, and the life cycle of copepods, the authors state that "in addition to the areas where copepods reach sufficient densities to provide forage for right whales, Jordan and Wilkinson Basins, with boundaries approximated by the 200m isopleths, represent habitats important to conserving right whales."[319]

Cover or sheltering

[314] 59 Fed. Reg. at 28794.
[315] *Id*.
[316] Pace and Merrick 2008, *supra*, note 32.
[317] *Id*. at 10.
[318] *Id*.
[319] *Id*. at 12.

As noted in discussion both above and below, the waters of the southeastern U.S. and the mid-Atlantic are shallow, close to shore and with a minimal slope. These waters provide shelter from stormy conditions more prevalent in the Northeast during the winter calving period.[320] Further, the shallow depths and coastline to the west may provide a position of defense for females and calves in the event of aggression by sharks or male right whales.[321]

Sites for breeding, reproduction, or rearing of offspring

The waters of the northeastern United States and Canada function as both a feeding and nursery area for right whale mothers and their calves.[322] As noted above, this extends over a wider area than was originally designated as critical habitat. In addition, the waters around Jordan Basin are also being used as an apparent breeding area for the species. In 2008, NMFS issued a press release stating that on December 3, 2008, 44 right whales were seen near Jordan Basin, with 41 observed on December 14. In its press release, NMFS stated that these sightings led "right whale researchers at NOAA's Northeast Fishery Science Center to believe they have identified a wintering ground and potentially a breeding ground for this critically endangered species."[323]

In the southeastern U.S., calving has been documented to occur in much broader areas than are contained in the current boundaries of critical habitat, which also serve as a crucial neonatal nursery area. In the 2008 final stock assessment for North Atlantic right whales, NMFS states that systematic surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted 8 mothers and newborn calves, "suggesting that calving grounds may extend as far north as Cape Fear." [324] Many of the calves were not sighted further to the south and one of the mothers was new to researchers, having never been seen prior to her sexual maturity and the birth of this calf. In 2007-2008 field reports by aerial survey teams covering northern Georgia and South Carolina, researchers documented 61 different individuals. Two of the mother-calf pairs were only sighted off South Carolina, one of them in April with a calf estimated to be less than a month old.[325] News reports for 2009 quote researchers from South Carolina documenting 95 right whales off South Carolina during the 2008-2009 season, including 14 mother-calf pairs travelling between one and 35 miles offshore.[326]

Newer studies make clear that the North Atlantic right whale's currently designated critical habitat is inadequate to allow for the species' survival and recovery. Additional, suitable – indeed, essential – habitat exists and must be designated. The bathymetry and water temperature requirements for calving in Garrison's NOAA Technical Memo are quite specific and are limited in geographic scope. The necessity of very specific bathymetry and water temperature gradient was referenced in NMFS original designation of critical habitat in 1994.

[320] Garrison 2007 Calving Habitat, *supra* note 34.
[321] *Id.*
[322] *Id.*
[323] *See* NOAA Press Release Dec. 31, 2008, *supra* note 69.
[324] NMFS 2008 Ship Speed EIS, *supra* note 35.
[325] Naessig and Sayre, *supra* note 269.
[326] *See* Mitchel, Liz , "Teams look for right whale injured by boat off Hilton Head Island," The Island Packet/The Beaufort Gazette, April, 6, 2009. *Available at*: http://www.islandpacket.com/news/local/story/806435.html.

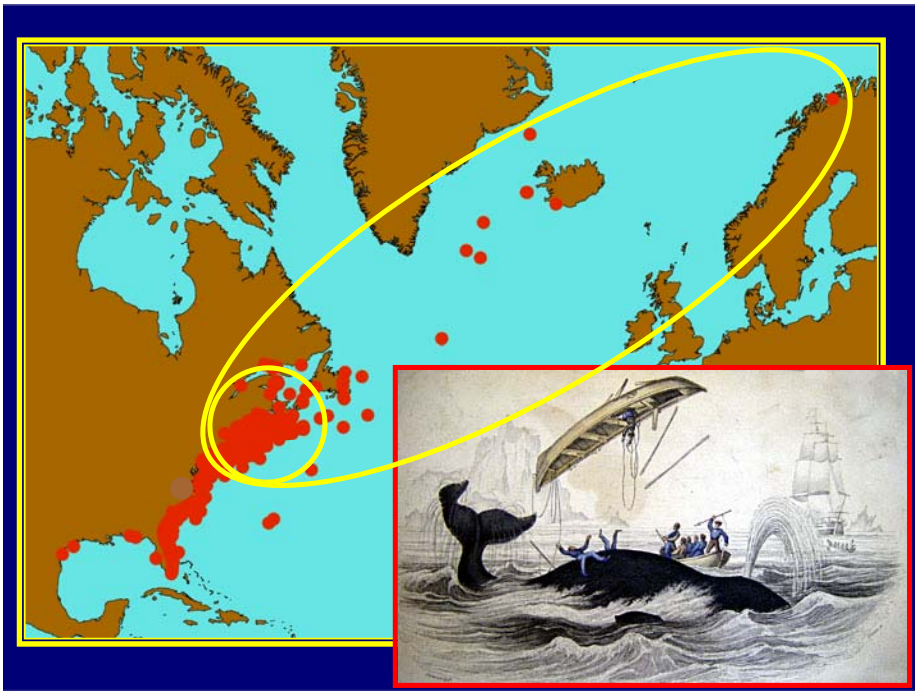
Since that time, additional environmental monitoring and expansion of surveys to sight calving right whales clearly demonstrate the need to include areas with the necessary bathymetry and temperature gradients as a means of protecting calving habitat. It is necessary to protect areas currently in use as well as adjacent areas with the same essential features, thus assuring adequate high-quality habitat into which right whale mothers and their calves can move as the population recovers. As the population recovers, available habitat in the more southern portions of what NMFS described as "core calving areas" will become populated to an extent that requires movement into nearby high quality habitat that appears to have been previously used and also contains the PCEs necessary for successful calving and rearing of vulnerable newborns.

Habitats protected from disturbance or representative of the historic distribution of the North Atlantic right whale

Although not well mapped, the original distribution of North Atlantic right whales encompassed a broad area extending from the southeastern United States northward to Norway (see Figure 7).[327] The dramatic population crash that resulted from overexploitation also resulted in a contracted range.[328] At this point in their history, sightings of right whales to the north and east of Canada are rare. As the population struggles to recover (and as sighting effort increases) we see right whales present in, and dependent on, larger areas of the coastal waters than originally thought (e.g., calving regularly occurring in waters through South Carolina, right whales visually or acoustically detected in New England waters year round, etc.). Kenny et al. (2008) concluded that "substantial growth in the population will require both mitigation of human-caused mortality and re-occupation of habitats where right whales are currently rare or absent."[329] As such, it is vital that a broad range be protected to assure that there is sufficient area for expansion of breeding and feeding into areas that may once have been higher use areas.

[327] Kenny et al. 2008, *supra* note 53.
[328] *Id.*
[329] *Id.*

Fig. 7. Historic distribution of North Atlantic right whale. Taken from Kenny et al. (2008).



3. These Essential Features May Require Special Management Considerations of Protection

The ESA mandates that designated critical habitat for endangered or threatened species must have "physical or biological features which *may require special management considerations or protection.*"[330] The proposed critical habitat areas for the North Atlantic right whale meet this standard.

As detailed above, many of the threats facing right whales are already subject to extensive management, including especially the leading threats of vessel strikes and fishing gear entanglement. In addition, many of the particular areas petitioners request for designation have been subject to special management and protection because of their importance to the essential life functions of the North Atlantic right whale.

The fact that these areas have already received some protections does not lessen their need for critical habitat protection, but rather bolsters the case for designation. As a court held in overturning the U.S. Fish and Wildlife Service's unlawful refusal to designate critical habitat for the Mexican spotted owl – a refusal based upon the agency's conclusion that existing management measures were adequate – the fact that certain management measures were already in place to benefit the owl actually buttressed the argument for designating the contested areas as critical habitat.

[330] 16 U.S.C. § 1532(5) (emphasis added).

> Whether habitat does or does not require special management by Defendant or FWS is not determinative on whether or not that habitat is "critical" to a threatened or endangered species. What is determinative is whether or not the habitat is "essential to the conservation of the species" and special management of that habitat is possibly necessary. 16 U.S.C. § 1532(5)(A)(i). Thus, the fact that a particular habitat does, in fact, require special management is demonstrative evidence that the habitat is "critical." Defendant, on the other hand, takes the position that if a habitat is actually under "adequate" management, then that habitat is per se not "critical." This makes no sense. A habitat would not be subject to special management and protection if it were not essential to the conservation of the species. The fact that a habitat is already under some sort of management for its conservation is absolute proof that such habitat is "critical."[331]

Efforts to address the threat of fishing gear entanglement have been in place since 1996, shortly after the original right whale critical habitat was designated, and originally focused largely on those areas designated as critical habitat. As noted above, the original fisheries targeted by the Atlantic Large Whale Take Reduction Plan were the South Atlantic shark gillnet fishery, the Gulf of Maine and Mid-Atlantic lobster trap/pot fishery, the Mid-Atlantic gillnet fishery, and the Gulf of Maine sink gillnet fishery. But because deaths and injuries from entanglement continued even after regulation of these fisheries, regulations have gradually expanded to protect right whales in additional times and places they are vulnerable. Perhaps the best example of expanding management to protect the essential habitats for the species, even when not formally designated as critical habitat, is the emergency rule for the Southeast Gillnet Restricted Area in 2006, which recognized coastal waters extending as far north as the southern border of North Carolina as a "core calving area" for the species.[332] In addition, it bears noting that NMFS recently moved to universal requirements for sinking groundline in times and areas right whales are expected to be present in greatest numbers. These regulations now encompass virtually the entire Gulf of Maine.[333]

Efforts to address the threat of ship strikes, the leading cause of death to North Atlantic right whales, have also expanded in recent years, reflecting the increased knowledge of right whale habitat use in the Northeast, Southeast, and mid-Atlantic. Even the first efforts to address this threat – the 2001 establishment of a Mandatory Ship Reporting Systems in the Northeast and the Southeast – included an area larger than the current critical habitat boundaries in the Southeast. In that region, ships within approximately 25 nautical miles of the Georgia and Florida coasts from shore eastward to longitude 80.51'.60W and with southern and northern boundaries of 30.00'.00N and 31.27'.00N respectively, are required to report on their course, speed, position, route and the destination upon entering the area and can be advised of right whale sightings made from aerial surveys.[334]

---

[331] *Center for Biological Diversity v. Norton*, 240 F. Supp. 2d 1090, 1099 (D. Ariz. 2003) (emphasis added).
[332] See discussion at Section IV.A.2 (citing 71 Fed. Reg. 66469 (Nov. 15, 2006)).
[333] 72 Fed. Reg. 57103 (Oct. 5, 2007). See also discussion at Section III.B.
[334] 66 Fed. Reg. 58066 (Nov. 10, 2001).

As with entanglements, however, further regulations were needed. To reduce threats from collisions with ships, the NMFS established zones mandating slowed vessel speeds.[335] These areas in which risk reduction measures are mandated for all vessels over 65 feet in length include the mid-Atlantic migratory corridor, as well as a substantially larger areas in the Southeast calving grounds and Northeast than are currently designated as critical habitat.[336]

In explaining the rationale for this recent rulemaking, NMFS amply documented why broad protections for the species and its habitats were necessary, including especially protections for right whale mothers and calves as they transit between the calving and feeding areas. NMFS found that "the right whale population is sufficiently fragile for the early death of a single mature female to make recovery of the species unattainable."[337] NMFS also noted that in the 16 months between January 2004 and May 2005, there were eight confirmed right whale deaths and six of them were adult females, three of whom were carrying near-term fetuses. NMFS stated that "since, on average, a female right whale will produce 5.25 calves over her lifetime, the death of four females represents a lost reproductive potential of as many as 21 animals."[338] In further discussing the deaths, NMFS stated that "given the small population size, the death of any right whale is serious and during the four-year period from 2001-2004, five females and calves died from ship strikes in the MAUS [mid-Atlantic]. Two right whale calves were found dead in the region in 2001, one had propeller wounds, indicating that the death was caused by a ship strike." The FEIS also documented the deaths of the two pregnant females in 2004, one off Virginia and the other off North Carolina, as well as a young non-pregnant female off Ocean City Maryland in 2002. Indeed, over one quarter (26%) of all ship strike mortalities of right whales between 1970 and 2002 occurred in the mid-Atlantic.[339]

Given the precarious status of the species and the critical roles that the Northeast feeding and nursery grounds, the Southeast calving grounds, and the mid-Atlantic migratory corridor play in the essential life functions of the North Atlantic right whale, it is clear that the areas Petitioners have requested for designation of critical habitat contain "physical or biological features which may require special management considerations or protection."[340] In addition, it is clear that current management still is not sufficient for the conservation of the species and that designation of critical habitat will provide additional important benefits to the species that will help ensure its survival and recovery in the face of well known and emerging threats. (See discussion at Section III.)

[335] *See* 73 Fed. Reg. 60173 (Oct.10, 2008) and discussion at Section III.A.
[336] *Id.*
[337] NMFS 2008 Ship Speed EIS, *supra* note 35.
[338] *Id*.
[339] *Id*.
[340] 16 U.S.C. § 1532(5)

C. Proposed Regulatory Text

50 CFR part 226 is amended as follows:

PART 226--DESIGNATED CRITICAL HABITAT

1. The authority citation for part 226 continues to read as follows:

Authority: 16 U.S.C. § 1533.

2. Section 226.203 is amended to read as follows:

§ 226.203. Critical habitat for the North Atlantic Right Whale (*Eubalaena glacialis*)

(a) *Northeastern United States.* The area bounded to the south by waters off the Northeast United States to include the Gulf of Maine and its associated Bays (e.g., Cape Cod and Massachusetts Bays) and the area northward of lines drawn diagonally from the southern corner of the current Great South Channel Critical Habitat (41.0° N latitude, 69.1° W longitude), northeastward to the Exclusive Economic Zone/Hague Line (42.2° N latitude, 67.2° W longitude) thence northerly along the Hague Line to the U.S.-Canadian border, to include State and Federal waters adjacent to the states of Maine, New Hampshire, and Massachusetts, and northwestward to the southern corner of Cape Cod, Massachusetts (approximately 41.55° N latitude, 70.0° W longitude) (Figure 1).

(b) *Southeastern United States.* The area bounded to the east by the shoreline South Carolina out to 35 nautical miles, and the waters off the coast of Georgia and Florida from approximately 32.0^{o} N latitude, 80.35^{o} W southward to approximately 28^{o} N latitude, 80.35° W longitude (Figure 2).

(c) *Mid-Atlantic migratory corridor:* The coastal waters from the shore out to 30 nautical miles, between the northern border of South Carolina (approximately 33.85° N latitude and 78.53° W longitude) northward to the southeastern corner of Cape Cod, Massachusetts (approximately 41.55^{o} N latitude, 70.0^{o} W longitude), southeastward to the southern corner of the current Great South Channel Critical Habitat (41.0° N latitude and 69.1° W longitude) (Figure 3).

(d) *Primary Constituent Elements.* Within these areas, the primary constituent elements are those habitat components that are essential for the primary biological needs of feeding, breeding, calving, raising calves, overwintering, resting, and migrating between habitat areas. The primary constituent elements for the Northeastern United States are ocean waters with dense aggregations of copepods (*Calanus sp.*) and associated oceanographic features that accumulate such fauna, such as deepwater basins, and which are free from physical barriers that impede safe passage through or rest in the area and free from significant noise disturbance. The primary constituent elements for the Southeastern United States are ocean waters 10-20 meters in depth and 13-15°C in temperature, including associated zooplankton in the water, which are free from physical barriers that impede safe passage through or rest in the area and free from significant

noise disturbance. The primary constituent elements for the mid-Atlantic migratory corridor are ocean waters less than approximately 10 fathoms in depth which are free from physical barriers that impede safe passage through or rest in the area and free from significant noise disturbance.

Figure 1. Proposed Critical Habitat for the Gulf of Maine-Northeast Region

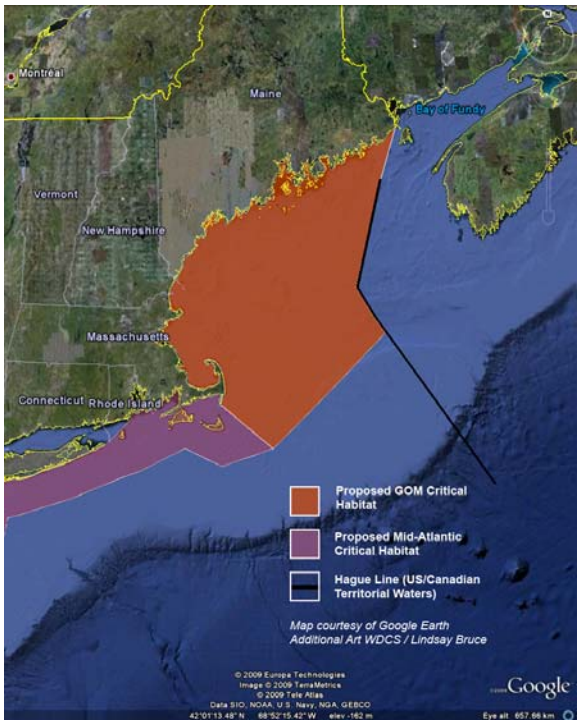


Figure 2. Proposed Critical Habitat for the Southeast Region

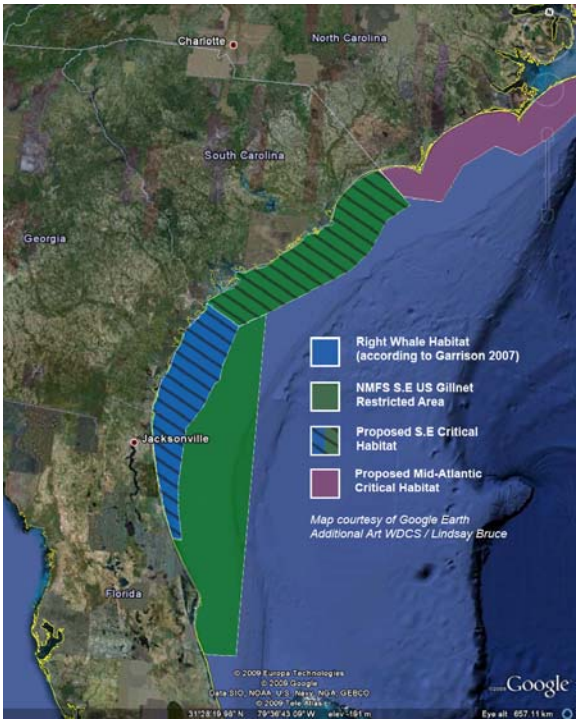
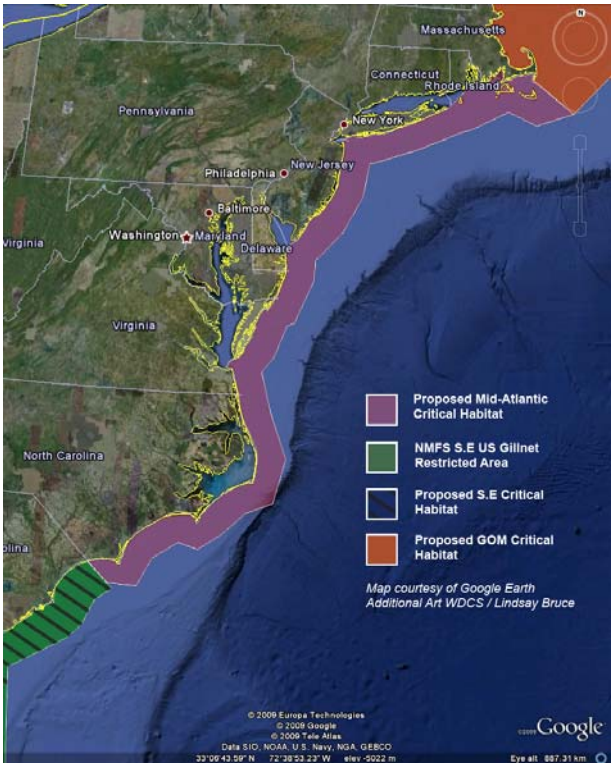


Figure 3. Proposed Critical Habitat for the Mid-Atlantic Region



CONCLUSION

We request that the critical habitat designation for the North Atlantic right whale be revised to include additional waters in both the Northeastern and Southeastern United States as well as waters of the mid-Atlantic that serve as a migratory corridor for the species. Petitioners' proposed critical habitat area meets the ESA criteria for designation as critical habitat because it contains physical and biological features that are essential to the conservation of the species and which may require special management considerations or protection.[341] Scientific data assembled since the original designation of critical habitat in 1994 shows clearly that a revision of the designation is necessary to provide for the survival and recovery of the species.

[341] *See* 16 U.S.C. §1532(5)

RESOURCES CITED

Albritton, D.L. et al., *In: Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change,* Cambridge University Press, Cambridge, United Kingdom and New York 2001. *Available at:* http://www.picc.ch/.

Angell, C. 2005. Blubber thickness in Atlantic E. glacialis and E. australis. PhD. Thesis. Boston University. Page 304 In: S. D. Kraus and R. M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA

ASOC 2003. Marine Acoustic Technology and the Antarctic Environment. Information Paper by the Antarctic and Southern Ocean Coalition XXVI ATCM Information Paper. Madrid Spain 9/20/03. IP-073-ASOC. *Available at*: http://www.asoc.org/Portals/0/IP-73acoustics.pdf

Ball, Ken, "Atlantic Canada Changing New England's Energy Outlook," Pollution Equipment News. *Available at*: http://www.rimbach.com/scripts/Article/PEN/Number.idc?Number=33

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

Baumgartner, M.F., T.V.N. Cole, R.G. Campbell, G.J. Teegarden, and E.G. Durbin. 2003. Associations between North Atlantic right whales and their prey, *Calanus finmarchicus*, over diel and tidal time scales. Marine Ecology Progress Series. 264:155-166.

Beaugrand, G., P. Reid, F. Idanex, J.A. Lindley, and M. Edwards. 2002. Reorganization of North Atlantic Marine Copepod Biodiversity and Climate. Science. 31 May 2002. 296 (5573. pp. 1692-1694). *Abstract available at*: http://www.sciencemag.org/cgi/content/abstract/296/5573/1692

Behrenfeld, M. J., R.T. O'Malley, D.A. Siegel, C.R. McClain, J.L. Sarmiento, G.C. Feldman, A.J. Milligan, P.G. Falkowski, R.M. Letelier, and E.S. Boss. 2006. Climate-driven trends in contemporary ocean productivity. Nature 444:752-755.

Belson, Ken, "New Jersey Grants Right to Build a Wind Farm About 20 Miles Offshore," New York Times, Oct. 3, 2008. *Available at*: http://www.nytimes.com/2008/10/04/nyregion/04wind.html

Best, P., J. Bannister, R. Brownell, and G. Donovan, (eds.). 2001. Right Whales: Worldwide Status. Journal of Cetacean Research and Management (Special Issue) 2: 309.

Biedron, I., N. Mihnovets, C. Clark, A. Ward, and J. Michalec. 2008. Determining seasonal distribution of North Atlantic right whales (*Eubalaena glacialis*) in New York coastal waters using passive acoustic monitoring. Abstract in North Atlantic Right Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford Whaling Museum, Nov. 5-6, 2008.

Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley, and A. Unnikrishnan. 2007. 2007: Observations: Oceanic Climate Change and Sea Level. in S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller (eds.). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Brown, M.W., S. Brault, P.K. Hamilton, R.D. Kenney, A.R. Knowlton, K.Marx, C.A. Mayo, C.K. Slay, and S.D. Kraus. 2001. Sighting heterogeneity of right whales in the western North Atlantic: 1980-1992. J. Cetacean Res. Manage. (special issue) 2:245-50.

Caldeira, K. and M.E.Wickett. 2003. Ocean model predictions of chemistry changes from carbon dioxide emissions to the atmosphere and ocean. Journal of Geophysical Research. 110: 1-12.

Cao, L. and K. Caldeira. 2008. Atmospheric CO2 stabilization and ocean acidification. pp. 1-18.

Cape Cod Today. "Congress to Ban Georges Bank oil and gas exploration while Canada moves toward lifting moratorium on drilling for Oil," Blog entry for Feb. 4, 2009. *Available at*: http://www.capecodtoday.com/blogs/index.php/2009/02/04/georges-bank-preservation-act?blog=53

Cape Wind website on Project Construction. *Available at*: http://www.capewind.org/article20.htm

Checkley, D.M., Jr., A.G. Dickson, M. Takahashi, J.A. Radich, N. Eisenkolb, and R. Asch. 2009. Elevated CO2 Enhances Otolith Growth in Young Fish. Science 324:1683, 26 June 2009.

Cohen, Nancy, "Whale Detection Buoys Will Help LNG Ships Avoid Right Whales," WNPR Connecticut Public Radio. *Available at*: http://www.cpbn.org/whale-detection-buoys-will-help-lng-ships-avoid-right-whales

Clapham, P. (ed.). 2002. Report of the working group on survival estimation for North Atlantic right whales. NOAA/NEFSC. Woods Hole, MA.

Danish Institute for Fisheries Research. 2000. Effects of marine windfarms on the distribution of fish, shellfish and marine mammals in the Horns Rev area. Report to ELSAMPORJECKT A/S. 42pp.

Denman, K.L. et al. 2007. Couplings Between Changes in the Climate System and Biogeochemistry, in: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA, 2007.

Engle, M., M. Marcondes, C. Martins, F. Luna, R. Lima, and A. Campos. 2004. Are seismic surveys responsible for cetacean strandings? An unusual mortality of adult humpback whales in Abrolos Bank, Northeastern coast of Brazil. Report to the International Whaling Commission Scientific Committee Meeting. 2004. SC/56/E28. *Available at*: http://www.marineconnection.org/docs/humpback_stranding.pdf.

Fabry, V., B.A. Seibel, R.A. Feely, and J.C. Orr. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. ICES Journal of Marine Science. 65: 414-32.

Feely, R.A., C.L. Sabine, K. Lee, W. Berelson, J. Kleypas, V. Fabry, and F.J. Millero. 2004. Impact of Anthropogenic CO_2 on the $CaCO_3$ System in the Oceans. Science. 16 July 2004. pp. 362-66.

Firestone, J., S. Lyons, C. Wanag, and J. Corbett. 2008. Statistical modeling of North Atlantic right whale migration along the mid-Atlantic region of the eastern seaboard of the United States. Biological Conservation 141 (2008) 221-232.

Garrison, L. 2007. The Big Picture: Modeling Right Whales in Space and Time. In: Kraus, S.D. and R.M. Rolland (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

Garrison, L.P. 2007. Defining the North Atlantic Right Whale Calving Habitat in the Southeastern United States: An Application of a Habitat Model. NOAA Technical Memorandum NOAA NMFS-SEFSC-553: 66 p.

Geraci, G., D. Anderson, R. Timeri, D. St. Aubin, G. Early, J. Prescott, and C. Mayo. 1989. Humpback Whales (*Megaptera noavaeangliae*) Fatally Poisoned by Dinoglagellate Toxin. Canadian Journal of Fisheries and Aquatic Science. 46: 1895-1898. *Available at*: http://www.whoi.edu/cms/files/Geraci_etal_1989_Humpbacks-PSP_30824.pdf.

Gill, J., K. Norris, and W. Sutherland. 2001. Why behavioural responses may not reflect the population consequences of human disturbance. Biological Conservation. 97: 265-268. *Abstract available at*: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V5X-41MJ18J-G&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=989433686&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=10cfdf69041c8650e628c927f3431cd9

George, J., J. Bada, J. Zeh, L. Scott, and S. Brown. 1999. Age and Growth Estimates of Bowhead Whales (*Balaena mysticetus*) Via Aspartic Acid Racemization. Canadian Journal of Zoology *77*: 571-580.

Green, C., A. Pershing, R. Kenny, and J. Jossi. 2003. Impact of Climate Variability on the Recovery of Endangered North Atlantic Right Whales. Oceanography. *Available at*: http://www.geo.cornell.edu/pershing/papers/docs/Ocean03.pdf

Greene, C. and A. Pershing. 2005. Climate and the Conservation Biology of North Atlantic Right Whale: Being a Right Whale at the Wrong Time?" 2004 Frontiers in Ecology and the Environment. *Available at*: http://www.geo.cornell.edu/pershing/papers/docs/FEE04.pdf.

Hamilton, P. and M.K. Marx. 1995. Weaning in North Atlantic Right Whales, 11(3) Marine Mammal Science.

Hansen, J. et al. 2005. Earth's Energy Imbalance: Confirmation and Implications. *Science* 308: 1431-1435.

Hester, K.C., E.T. Peltzer, W.J. Kirkwood, and P.G. Brewer. 2008. Unanticipated consequences of ocean acidification: A noisier ocean at lower pH. Geophysical Research Letters. 35: 1-5.

Hornblower Marine Services High Speed Vessels. *Available at*: http://www.hornblowermarine.com/highspeed.html

IWC. 2004. International Whaling Commission Scientific Committee. Annex K of the 2004 Scientific Committee Report: Report of the Standing Working Group on Environmental Concerns. Annual IWC meeting. Sorrento, Italy. 29 June-10 July 2005. 56 pp. *Available at* http://www.iwcoffice.org/_documents/sci_com/SCRepFiles2009/Annex%20K%20-%20Final-sq.pdf

Jensen, A. and G. Silber. 2004. Large Whale Ship Strike Database. NOAA Tech. Memo NMFS-OPR-25. 37pp. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/lwssdata.pdf

Johnson, A., G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry and P. Clapham. 2005. Fishing gear involved in entanglements of right and humpback whales. Marine Mammal Science 21 (4): 635-645.

Jones, M., S. Swartz, and M. Dalheim. 1994. Census of Gray Whale Abundance in San Ignacio Lagoon: A Follow-up Study in Response to Low Whale Counts Recorded During Acoustic Playback Study of Noise Effects on Gray Whales. Report to the U.S. Marine Mammal Commission. Washington, DC, NTIS PB94195062. 32 pp.

Kahn, C. and C. Taylor. Monitoring North Atlantic Right Whales off the Coasts of South Carolina and Northern Georgia, 2006-2007.

Keller, C., L. Ward-Geiger, W. Brooks, C. Slay, C. Taylor and B. Zoodsma. 2006. North Atlantic Right Whale Distribution in Relation to Sea-Surface Temperature in the Southeastern United States Calving Ground. Marine Mammal Science, 22(2) 426-445, at Fig.1.

Kenny, R., M. Hyman, R. Owen, G. Scott, and H. Winn. 1986. Estimation of Prey Densities Required by Western North Atlantic Right Whales. Marine Mammal Science. V. 2 (1) p. 1-13.

Kenny, R., P. Hamilton, T. Frasier, and R. Pace. 2008. Trends in minimum number alive: Are Gulf of Maine right whales approaching carrying capacity? Abstract in North Atlantic Right

Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford, MA. Nov. 2008.

Kenny, R.D. 2007. Right Whales and Climate Change. In: Kraus, S.D. and R.M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

Kleypas, J.A., R.A. Feely, V.J. Fabry, C. Langdon, C.L. Sabine, and L.L. Robbins. 2006. Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers; A Guide to Future Research. Report of Workshop Sponsored by NSF, NOAA, and USGS.

Knowlton, A., J. Beaudin Ring, and B. Russell. 2002. Right Whale Sightings and Survey Effort in the Mid-Atlantic Region: Migratory Corridor, Time Frame and Proximity to Port Entrances. *Available at*: http://www.nero.noaa.gov/shipstrike/ssr/midatanticreportrFINAL.pdf

Knowlton, A. and M. Brown. 2007. Running the Gauntlet: Right Whales and Vessels Strikes. In: Kraus, S.D. and R.M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

Knowlton, A.R., S.D. Kraus, and R.D. Kenney 1994. Reproduction in North Atlantic right whales (*Eubalaena glacialis*). Can. J. Zool. 72: 1297-1305.

Knowlton, A.R., M.K. Marx, H.M. Pettis, P.K. Hamilton, and S.D. Kraus. 2008. Scarification analysis of North Atlantic right whales (*Eubalaena glacialis*): monitoring rates of entanglement interaction. Report to NMFS. *Available from*: New England Aquarium, Central Wharf, Boston, MA 02110.

Kraus, S.D. 1990. Rates and potential causes of mortality in North Atlantic right whales (*Eubalaena glacialis*). Mar. Mammal Sci. 6(4):278-91.

Kraus, S.D., P.K. Hamilton, R.D. Kenney, A. Knowlton, and C.K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. J. Cetacean Res. Manage. (Special Issue) 2:231-236.

Kraus, S., M. Brown, H. Caswell, C. Clark, M. Fujiwara, P. Hamilton, R. Kenney, A. Knowlton, S. Landry, C. Mayo, W. McLellan, M. Moore, D. Nowacek, D. Pabst, A. Read, and R. Rolland. 2005. North Atlantic right whales in Crisis. Science. 309 (5734) p. 561-562.

Kraus, S.D., R.M. Pace, and T.R. Frasier. 2007. High investment, low return: the strange case of reproduction in *Eubalaena glacialis*. Pages 172-199. In: S.D. Kraus and R.M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

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

Levitus, S., J.I. Antonov, T.P. Boyer, and C. Stephens. 2000. Warming of the world ocean. Science 287:2225-2229.

Levitus, S., J. Antonov, and T. Boyer. 2005. Warming of the world ocean, 1955-2003. Geophysical Research Letters 32.

Marine Resources Council. 2006. Right Whale Volunteer News, Summer 2006. *Available at*: http://www.mrcirl.org/whale/whalenews0806/Summer2006lowres.pdf.

Maritime Administration webpage on Deepwater Port Licensing Program, Approved Applications and Operational Facilities. *Available at*: http://www.marad.dot.gov/ports_landing_page/deepwater_port_licensing/dwp_current_ports/dwp_current_ports.htm

Mayo, C.S., E.G. Lyman, and A. DeLorenzo. 2000. Monitoring the Habitat of the North Atlantic Right Whale in Cape Cod Bay in 2000 and Comparison of Seasonal Caloric Availability in Cape Cod Bay with North Atlantic Right Whale Calving Rates: 1984 – 2000. Final report submitted to the Division of Marine Fisheries, Commonwealth of Massachusetts, Boston, MA. October 2000. Contract No. SCFWE3000-8365027 and to the Massachusetts Environmental Trust.

Mayo, C.S., M. Page, D. Osterberg, and A. Pershing. 2008. On the path to starvation: the effects of anthropogenic noise on right whale foraging success. North Atlantic Right Whale Consortium. Abstracts of the Annual Meeting. New Bedford, MA, Nov. 2008.

McCauley, R., J. Fewtrell, A. Duncan, C. Jenner, M-N. Jenner, J. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K. McCabe. 2000. Marine seismic surveys—A study of environmental implications. APPEA J. 40: 692-708. *Available at*: http://cwr.org.au/publications/appea2000.pdf.

Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S.,D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Miller, P., N. Biasson, A. Samuels, and P. Tyack. 2000. Whale songs lengthen in response to sonar. Nature 405. 903. *Abstract available at*: http://www.nature.com/nature/journal/v405/n6789/full/405903a0.html.

Moore, M., A. Bogomolni, R. Bowman, P. Hamilton, C. Harry, A. Knowlton, S. Landry, D. Rotstein, and K. Touhey. 2006. Fatally entangled right whales can die extremely slowly. Oceans '06 MTS/IEEE-Boston, MA, September 18-21, 2006 - ISBN: 1-4244-0115-1.:3 pp.

Moore, J.C. and E. Clark. 1963. Discovery of Right Whales in the Gulf of Mexico. Science, New Series. Vol. 141, Issue 3577 (July 19, 1963), 269.

Moore, M.J., A.R. Knowlton, S.D. Kraus, W.A. McLellan, and R.K. Bonde. 2004. Morphometry, gross morphology and available histopathology in North Atlantic right whale

(*Eubalena glacialis*) mortalities (1970-2002). Journal of Cetacean Research and Management 6:199-214.

Moore, M.J., W.A. Mclellan, P.Y. Daoust, R.K. Bonde, A.R. Knowlton. 2007. Right Whale Mortality: A Message from the Dead to the Living. In: Kraus, S.D. and R.M. Rolland (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

Mitchel, Liz, "Teams look for right whale injured by boat off Hilton Head Island," The Island Packet/The Beaufort Gazette, April, 6, 2009. *Available at*: http://www.islandpacket.com/news/local/story/806435.html.

Naessig, Patricia and Rachel Sayre, "2007-2008 Wildlife Trust South Carolina and Georgia Right Whale Aerial Surveys Update." *Available at*: http://www.wildlifetrust.org/enter.cgi?p=news/2008/0501_S_whales.shtml

Naessig, P., C. Taylor, and C. George. Results of 2006-2007 Northern Early Warning System Surveys for Right Whales) In North Atlantic Right Whale Consortium Abstracts of the Annual Meeting. New Bedford, MA. Nov. 2007

Naessig, P., C. Taylor, and C. George. 2008. Results of 2007-2008 Northern Early Warning System Surveys for Right Whales. In North Atlantic Right Whale Consortium Abstracts of the Annual Meeting. New Bedford, MA, Nov. 2008

National Academies Press. 2003. Ocean Noise and Marine Mammals. *Available at* http://www.nap.edu/openbook.php?record_id=10564&page=1.

NAS. 2003. In Summary: Ocean Noise and Marine Mammals. *Available at*: http://books.nap.edu/html/ocean_noise/reportbrief.pdf

NEAq Right Whale Aerial Survey Blog, Jan. 8, 2009. *Available at*: http://www.neaq.org/education_and_activities/blogs_webcams_videos_and_more/blogs/right_whale_aerial_survey/2009/01/exciting-right-whale-sighting-in-azores.php

Nieukirk, S., K. Stafford, D. Mellinger, R. Dziak, and C. Fox. 2004. Low Frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. J. Acoustic Society of America. 115 (4) 1832-1843.
Available at http://www.awionline.org/ht/a/GetDocumentAction/i/10170

NMFS 2005, Recovery Plan for the North Atlantic Right Whale (May 26, 2005). *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/recovery/whale_right_northatlantic.pdf

NMFS 2008. Final Environmental Impact Statement (FEIS) to Implement the Vessel Operational Measures to Reduce Ship Strikes to the North Atlantic Right Whale. August 2008. *Available at*: http://www.nmfs.noaa.gov/pr/shipstrike/eis.htm

NMFS 2008. Final Rule to Implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic Right Whales. 73 Fed. Reg. 60173 (Oct. 10, 2008). *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr73-60173.pdf

NMFS 2009. North Atlantic right whale stock assessment. Draft 2009 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2009_draft_all.pdf.

NMFS Protected Resources Website on North Atlantic Right Whales. *Available at*: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/rightwhale_northatlantic.htm

NMFS Protected Resources Website on Recommended Shipping Routes to Reduce Ship Strikes to North Atlantic Right Whales. *Available at*: http://www.nmfs.noaa.gov/pr/shipstrike/routes.htm

NMFS Southeast Region's Contract Aerial Survey Reports. *Available at*: http://sero.nmfs.noaa.gov/pr/mm/rightwhales/SoutheastRegionsContractsAerialSurveyReports.htm

NOAA 2004. Final Report of the NOAA International Symposium: Shipping Noise and Marine Mammals: A Forum for Science, Management and Technology. May 2004, Arlington, VA. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/acoustics/shipping_noise.pdf

NOAA and NMFS 2007-2008 Right Whale Sighting Advisory System Website, *available at*: http://whale.wheelock.edu/whalenet-stuff/reportsRW_NE

NOAA Press Release, Dec. 31, 2008. "High Numbers of Right Whales Seen in Gulf of Maine: NOAA Researchers Identify Wintering Ground and Potential Breeding Ground." *Available at*: http://www.nmfs.noaa.gov/mediacenter/docs/right_whale_newwinteringgrounds_12_08.pdf

NOAA Press Release, Jan. 2, 2009. "High Number of Right Whales Seen In Gulf of Maine: NOAA Researchers identify wintering ground and potential breeding ground." *Available at*: http://www.eurekalert.org/pub_releases/2009-01/nnmf-hno010209.php.

NOAA Press Release, May 20, 2009. "NOAA Expedition Hears Endangered North Atlantic Right Whales off Greenland." *Available at*: http://www.noaanews.noaa.gov/stories2009/20090520_rightwhales.html

Noer, H., T.J. Christensen, I. Clausager, and I.K. Petersen. 2000. Effects on birds of an offshore wind park at Horns Rev: Environmental impact assessment. NERI Report 2000. 112pp.

North Atlantic Right Whale Consortium, unpublished. Whale Facts: Identification. *Available at* http://www.rightwhaleweb.org/index.php?mc=2&p=12 .

Nowacek, D.P., M.P. Johnson, and P.L. Tyack. 2004. Right whales ignore ships but respond to alarm stimuli. Proceedings of the Royal Society B: Biological Sciences, 271, 227-231.

NRC 2003. Summary: Ocean Noise and Marine Mammals. Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals, National Research Council. 204 pgs.

Olafsson, J., S. Olafsdottir, A. BenoitpCattin, M. Danielson, T.S. Arnarson, and T. Takahashi. 2009. Rate of Iceland Sea acidification from time series measurements. Biogeosciences Discussions. 6. 5252-5270. *Available at*: http://www.biogeosciences-discuss.net/6/5251/2009/bgd-6-5251-2009-print.pdf

Orr, J. et al. 2005. Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature. 29 September 2005. 437: 681-86.

Pace, R.M., III, and R. Merrick. 2008. Northwest Atlantic Ocean Habitats Important to the Conservation of North Atlantic Right Whales (*Eubalaena glacialis*). NEFSC Ref. Doc. 08-07. *Available at*: http://www.nefsc.noaa.gov/publications/crd/crd0807/index.html.

Parks, S.E. 2003. Acoustic communication in the North Atlantic right whale (Eubalaena glacialis). Ph.D. Thesis. MIT-WHOI Joint Program in Oceanography. Woods Hole, MA. *Abstract available at*: https://darchive.mblwhoilibrary.org/handle/1912/2453.

Parks, S.E. and C.W. Clark. 2007. Social Sounds and the Potential Impacts of Noise. In: Kraus S.D. and R.M. Rolland (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA

Payne, P.M., D. Wiley. S. Young, S. Pittman, P. Clapham, and J. Jossi 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relations to changes in selected prey. Fisheries Bulletin. 88(4) 687-696.

Pettis, Heather. 2009. North Atlantic Right Whale Consortium Annual Report Card (01 Nov. 2007 – 30 April 2009). International Whaling Commission Scientific Committee Meeting, 2009 SC/61/BRG11. *Available at*: http://www.iwcoffice.org/_documents/sci_com/SC61docs/SC-61-BRG11.pdf.

Pineda, J. 2009. Plankton distribution in internal waves and bores. Benthic Ecology and Nearshore Oceanography Lab's webpage at the Woods Hole Oceanographic Institution. *Available at*: http://science.whoi.edu/labs/pinedalab/Subpages/PLanktonDistributionInISW.html.

Philpot, Liz, and Mary Hallisey Hunt, "Southern Winds" Offshore Project Summary for the Georgia Winds Working Group. Dec. 3, 2007. *Available at*: http://www.gawwg.org/images/Talking_points_December_2007_compressed_rev.pdf

Reeves, R., J. Breiwick, and E. Mitchell. 1992 Pre-exploitation abundance of right whales off the eastern United States. P. 5-7 in J. Hain (ed.). The right whale in the western North Atlantic: A science and management workshop. 14-15 April 1992. Silver Spring, MD. NEFSC Ref. Document 92-05. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2008whnr-w.pdf.

Reeves, R., E. Josephson, and T. Smith. 2004. Putative historical occurrence of North Atlantic right whales in mid-latitude offshore waters: Maury's smear is likely apocryphal. Marine Ecology Progress Series. 282. -. 295-305. *Available at*: http://archive.wcs.org/media/file/m282p295.pdf.

Reeves, R.A., J. Read, L. Lowry, S.K. Katona, and D.J. Boness. 2007. Report of the North Atlantic right whale program review-prepared for the Marine Mammal Commission. 13–17 March 2006, Woods Hole, MA. 69pp.

Reeves R., R. Rolland, and P. Clapham (eds.). 2001. Causes of Reproductive Failure in North Atlantic Right Whales: New Avenues of Research. Report of a Workshop Held 26-28 April 2000. NEFSC Ref. Doc. 01-16. 46 p. *Available at*: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0116/0116.htm.

Richardson, W., G. Miller, and C. Greene. 1999. Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea. J. Acoustic Society of America. 106: 2281 *Abstract avaiable at*: http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=JASMAN0001060000040 02281000003&idtype=cvips&gifs=yes.

Right Whale News, Feb. 2005. Vol. 12 Num.1. *Available at*: http://graysreef.noaa.gov/rtwh/rwfeb05.pdf

Right Whale News, May 2005. Vol. 12, Num. 2.

Right Whale News, May 2009. Vol. 17 Num. 2. *Available at*: http://www.rightwhaleweb.org/pdf/rwhale_news_may09.pdf

Robbins, J. and Mattila, D. 2000. Gulf of Maine humpback whale entanglement scar monitoring results 1997-1999. NOAA Contract No. 40ENNF900253. 24 p.

Rolland, R.M., K.E. Hunt, G.J. Doucette, L.G. Rickard, and S.K. Wasser. 2007. The inner whale: hormones, biotoxins and parasites. In: Kraus S.D. and R.M. Rolland, (eds.). The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge, MA.

Royal Society. 2005. Ocean acidification due to increasing atmospheric carbon dioxide. Policy document 12/05.

Rutgers University Website, Satellite Imagery, Sea Surface Temperature of Northeast. *Available at*: http://marine.rutgers.edu/mrs/sat_data/?product=sst&region=bigbight&nothumbs=0.

Schick, R.S., P.N. Halpin, A.J. Read, C.K. Slay, S.D. Kraus, B.R. Mate, M.F. Baumgartner, J.J. Roberts, B.D. Best, C.P. Good, S.R. Loarie, and J.S. Clark. 2009. Striking the right balance in right whale conservation. Can. J. Fish. Aquat. Sci. 66(9): 1399–1403. *Abstract Available at*: http://rparticle.web-

p.cisti.nrc.ca/rparticle/AbstractTemplateServlet?journal=cjfas&volume=66&year=2009&issue=9&msno=f09-115&calyLang=eng

Shackell, N., K. Frank, and D. Brickman. 2005. Range Contraction May Not Always Predict Core Areas: An Example from Marine Fish. Ecological Applications. 15(4) 1440-1449. *Available at*: http://oceanography.dal.ca/publications/files/shackell_Frank_Brick_ecap05.pdf

Shukman, D. 2006. Sharp rise in CO2 levels recorded. BBC News, March 14, 2006. *Available at* http://news.bbc.co.uk/1/hi/sci/tech/4803460.stm.

Smith, J., K. Koyama, and J. Kenney. 2006. Atlantic Large Whale Entanglement and Ship Strike Report 2004 and 2005. NOAA/NMFS Gloucester, MA.

Solomon, S., D. Qin, M. Manning, R. B. Alley, T. Bentsen, N. L. Bindoff, Z. Chen, A. Chidthaisong, J. M. Gregory, G. C. Hegerl, M. Heimann, B. Hewitson, B. J. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, R. Somerville, T. F. Stocker, P. Whetton, R. A. Wood, and D. Wratt. 2007. 2007: Technical Summary. In S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, editors. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA.

Stellwagen Bank National Marine Sanctuary Webpage on Physical Oceanography. *Available at*: http://stellwagen.noaa.gov/about/sitereport/oceanog.html

Stevick, P.T. 1999. Age-length relationships in humpback whales: A comparison of strandings in the western North Atlantic with commercial catches. Marine Mammal Science 15:725-737.

Taylor, C., W. Mclellan, A. Glass, M. Zani, and D.A. Pabst. 2007. Right Whale Sightings in the mid-Atlantic and Southeast Atlantic Bight From 2001-2007. Abstract in North Atlantic Right Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford Whaling Museum Nov. 7-8, 2007.

Time Magazine, Nov. 26, 1979. "Environment: Georges Bank: Fish or Fuel." *Available at*: http://www.time.com/time/magazine/article/0,9171,946407,00.html.

Trenberth, K.E. et al., 2007. Observations: Surface and Atmospheric Climate Change. in Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA, 2007.

University of North Carolina, Wilmington. 2008. Sightings Map of 2008 right whale aerial surveys in North Atlantic Right Whale Consortium Annual Meeting Abstracts and Sighting Summaries. New Bedford Whaling Museum, Nov. 5-6, 2008.

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

Waring, G.T., E. Josephson, C.P. Fairfield, and K. Maze-Foley (eds.). 2009. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2008. NOAA Technical Memorandum NMFS-NE-210, 429 p.

Ward-Geiger, L., G. Silber, R. Baumstark, and T. Pulfer. 2005. Characterization of Ship Traffic in Right Whale Critical Habitat. Coastal Management. 33:263-278. *Available at*: http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/critical_habitat_traffic.pdf.

Wildlife Trust Press Release, Dec. 14, 2007, "Wildlife Trust, South Carolina Ports Partner For Endangered Right Whale." *Available at:* http://www.ewire.com/display.cfm/Wire_ID/4403

WBGU. 2006. The future of oceans – warming up, rising high, turning sour. German Advisory Council on Global Climate Change, Special Report, March 2006, *Available at* www.wbgu.de.