

**ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION**

Action Agency: National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, through its Sustainable Fisheries Division

Activity: Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the American Lobster Fishery [Consultation No. NER-2014-11076]

Consulting Agency: National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, through its Protected Resources Division

Date Issued: July 31, 2014

Approved by: Harold C. Means

for John K. Bullard
Regional Administrator

TABLE OF CONTENTS

1.0	CONSULTATION HISTORY	4
1.1	Overview of Past Consultations	4
1.2	Cause for Reinitiating	7
2.0	DESCRIPTION OF THE PROPOSED ACTION	7
2.1	Description of the Gear.....	8
2.2	Description of the Current American Lobster Fishery	9
2.2.1	Summary of Lobster Trap Fishery Limiting Access Programs.....	17
2.2.3	American Lobster Fishing Effort.....	20
2.3	Management of American Lobster Exempted Fishing, Scientific Research, and Exempted Educational Activity.....	22
2.4	Summary of the American Lobster Fishery.....	23
2.5	Action Area	23
3.0	STATUS OF THE SPECIES	23
3.1	SPECIES THAT ARE NOT AFFECTED BY THE PROPOSED ACTION	23
3.2	STATUS OF LISTED SPECIES IN THE ACTION AREA THAT MAY BE AFFECTED BY THE PROPOSED ACTION	29
3.2.1	Status of Large Whales	29
3.2.2	Status of Sea Turtles	48
4.0	ENVIRONMENTAL BASELINE	72
4.1	Fishery Operations	73
4.1.1	Federal Fisheries.....	73
4.1.2	Non-federally Regulated Fisheries.....	85
4.1.3	Lobster Fishing in Canadian and State Waters.....	88
4.2	Military Vessel Activity and Operations	88
4.3	Other Activities	90
4.3.1	Hopper Dredging.....	90
4.3.2	Maritime Industry.....	92
4.3.3	Pollution.....	92
4.3.4	Coastal Development.....	92
4.3.5	Catastrophic Events.....	93
4.4	Reducing Threats to ESA-listed Whales and Sea Turtles	93
4.4.1	Education and Outreach Activities.....	93
4.4.2	Sea Turtle Stranding and Salvage Network (STSSN).....	93
4.4.3	Sea Turtle Disentanglement Network (STDN).....	94
4.4.4	Regulatory Measures for Sea Turtles.....	94
4.4.5	Atlantic Large Whale Take Reduction Plan (Plan).....	98
4.4.6	Ship Strike Reduction Program.....	102
4.4.7	Regulatory Measures to Reduce Vessel Strikes to Large Whales.....	102
4.4.8	Marine Mammal Health and Stranding Response Program (MMHSRP).....	105
4.4.9	Harbor Porpoise Take Reduction Plan (HPTRP).....	105
4.4.10	Bottlenose Dolphin Take Reduction Plan (BDTRP).....	106
4.4.11	Atlantic Trawl Gear Take Reduction Strategy (ATGTRS).....	107
5.0	CLIMATE CHANGE	107
5.1	Background Information on Global Climate Change.....	108
5.2	Effects of Climate Change on Individual Species.....	110
5.2.1	Right, Humpback, Fin, and Sei Whales.....	110
5.2.2	Sea Turtles.....	111
6.0	EFFECTS OF THE PROPOSED ACTION ON ESA-LISTED CETACEANS AND SEA TURTLES	115
6.1	Approach to the Assessment	115
6.1.2	Description of ESA-listed Species Interactions in Lobster Trap/pot Gear.....	118

6.1.3	Factors Affecting Cetacean Entanglement in Lobster Gear	130
6.1.4	Factors Affecting Sea Turtle Entanglements in Lobster Gear	131
6.2	Anticipated Effects of the Proposed Action	133
6.2.1	Anticipated Cetacean Interactions in American Lobster Gear	133
6.2.2	Anticipated Sea Turtle Interactions in American Lobster Gear	136
6.3	Summary of Anticipated Interactions of Cetaceans and Sea Turtles	139
7.0	CUMULATIVE EFFECTS	140
8.0	INTEGRATION AND SYNTHESIS OF EFFECTS	143
8.1	North Atlantic Right Whale	144
8.2	Humpback Whale	149
8.3	Fin and Sei Whales	152
8.4	NWA DPS Loggerhead Sea Turtle	152
8.5	Leatherback Sea Turtle	157
9.0	CONCLUSION	160
10.0	INCIDENTAL TAKE STATEMENT	160
11.0	CONSERVATION RECOMMENDATIONS	165
12.0	REINITIATING CONSULTATION	166
	Literature Cited	168

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq.*) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency may affect species listed as threatened or endangered, that agency is required to consult with either NOAA Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (FWS), depending upon the species that may be affected. In instances where NMFS or FWS are themselves proposing an action that may affect listed species, the agency must conduct intra-service consultation. Since the action described in this document is authorized by the NMFS Greater Atlantic Regional Fisheries Office (GARFO), this office has requested formal intra-service section 7 consultation.

NMFS GARFO has reinitiated formal intra-service consultation (Memo to the Record, J. Bullard, June 6, 2014) [Consultation No. NER-2014-11076] on the continued operation of the American lobster fishery, in accordance with section 7(a)(2) of the ESA and 50 CFR 402.16 given new information presented in the marine mammal stock assessment reports (SAR) and the final rule (79 FR 36585, June 27, 2014) issued on June 26, 2014, modifying the Atlantic Large Whale Take Reduction Plan (ALWTRP) with regulations implementing the vertical line strategy. This document represents NMFS' biological opinion (Opinion) on the continued operation of the American lobster fishery and its effects on ESA-listed species under NMFS jurisdiction in accordance with section 7 of the ESA, as amended, based on the information developed by NMFS GARFO and other sources of information, as cited in the Literature Cited section of this document.

1.0 CONSULTATION HISTORY

1.1 Overview of Past Consultations

Formal consultation on the lobster fishery was first initiated in 1988 for the implementation of the Marine Mammal Exemption Program; this consultation concluded that the lobster fishery may adversely affect but was not likely to jeopardize the continued existence of any listed species.

A formal section 7 consultation for the American lobster fishery in federal waters was concluded with the issuance of a Biological Opinion on March 23, 1994, for implementation of Amendment 5 to the American Lobster Fishery Management Plan (FMP). Amendment 5 was developed to prevent over-fishing within the U.S. Exclusive Economic Zone (EEZ) using management principles developed by the Lobster Industry Work Group (LIWG). We concluded that fishing activities under the amendment and its implementing regulations may affect endangered or threatened species but were not likely to jeopardize the continued existence of any listed species under our jurisdiction or result in the destruction or adverse modification of any critical habitat.

In 1996, six right whale deaths were reported from the Southeast right whale calving grounds off Georgia and Florida. This event caused us to reinitiate consultation on the lobster fishery. In an Opinion dated December 13, 1996, we concluded that the lobster trap fishery was likely to

jeopardize the continued existence of Northern right whales¹. A reasonable and prudent alternative (RPA) was provided to avoid the likelihood that operation of the fishery would jeopardize the continued existence of right whales. The primary element of the RPA included the seasonal prohibition of all lobster pot/trap gear in the Great South Channel critical habitat area. An additional provision to the RPA required NMFS to analyze fishing effort and whale distribution in order to avoid clumping fixed gear effort in high-risk/overlap areas and/or sensitive whale areas such as right whale critical habitat. This RPA was supplemented in 1997 by the inclusion of measures developed per the Atlantic Large Whale Take Reduction Plan (ALWTRP). The ALWTRP was designed to reduce the risk of serious injury to or mortality of large whales due to incidental entanglement in U.S. commercial trap/pot and gillnet fishing gear.

In 1997 we conducted a formal consultation on the ALWTRP and issued a biological opinion on July 22, 1997, that concluded the continued operation of the American lobster fishery, including the measures implemented by the ALWTRP, may adversely affect but were not likely to jeopardize the continued existence of any listed species under NMFS jurisdiction. This Opinion replaced the 1996 Opinion. Effective November 15, 1997, NMFS substituted the ALWTRP for the RPA issued with the 1996 biological opinion, thereby removing the likelihood of jeopardy to the right whale from the proposed lobster fishing activities.

In December 1998, NMFS proposed to replace the American Lobster FMP authorized under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) with a new plan to be authorized under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). A new 1998 Opinion concluded that the proposed lobster fishery, as conducted under the ACFCMA, with modifications to reduce impacts of entanglement through the ALWTRP, may affect but was not likely jeopardize ESA-listed species and would also not likely destroy or adversely modify critical habitat that has been designated for the right whale. The Opinion also included an Incidental Take Statement (ITS) for loggerhead and leatherback sea turtles. This ITS exempted the take of up to 10 loggerhead sea turtles and/or 4 leatherback sea turtles annually. Non-discretionary Reasonable and Prudent Measures were also included to minimize the level of incidental take of sea turtles in the lobster fishery. Federal authority for management of American lobster was transferred from the MSFCMA to the ACFCMA, effective January 5, 2000.

Formal consultation was reinitiated in 2000 to consider new information on the status of right whales and changes to the ALWTRP. This consultation was completed with the issuance of a June 14, 2001 Opinion. This Opinion concluded that the continued operation of the American lobster fishery, including measures previously implemented as part of the ALWTRP, was likely to jeopardize the continued existence of right whales. The Opinion also concluded that the operation of the American lobster fishery was likely to adversely affect but not jeopardize the continued existence of other ESA-listed species. An RPA was provided that included a revised

¹ The North Atlantic right whale was originally listed as the “northern right whale” as endangered under the Endangered Species Conservation Act, the precursor the ESA in June 1970. NMFS listed the endangered northern right whale (*Eubalaena spp.*) as two separate endangered species: the North Atlantic right whale (*E. glacialis*) and North Pacific right whale (*E. japonica*) (73 FR 12024; March 6, 2008).

ALWTRP which implemented, in part, the Seasonal Area Management (SAM) and Dynamic Area Management (DAM) programs.

Formal consultation was reinitiated on July 11, 2001 upon review of a proposed action to displace lobster trap gear from Federal Lobster Management Areas (FLMA) 3, 4, and 5 to nearshore lobster management areas where ESA-listed right whales, humpback whales, fin whales, sei whales, leatherback sea turtles, and loggerhead sea turtles could have potentially been adversely affected. The action also implemented a mechanism for conservation equivalency and associated trap limits for federal lobster permit holders fishing in New Hampshire state waters. Consultation concluded with the issuance of an Opinion on October 31, 2002. This Opinion concluded that operation of the federally-regulated portion of the lobster trap fishery, including measures previously implemented as part of the ALWTRP, would likely not jeopardize the continued existence of any listed species under NMFS jurisdiction.

On October 5, 2007, NMFS published a final rule in the *Federal Register* (72 FR 57104; October 5, 2007) that made many changes to the ALWTRP affecting the use of pot/trap gear in the American lobster fishery, amongst others. These changes included elimination of the DAM program as of April 7, 2008, and elimination of the SAM program as of October 6, 2008² in lieu of broad-based gear modifications. The changes to the ALWTRP, therefore, modified the action in a manner that could potentially cause an effect to listed species not considered in the 2002 Opinion for the fishery. NMFS reinitiated formal consultation on the American lobster fishery on July 29, 2003, to consider the effects of the continued operation of the American lobster fishery on ESA-listed cetaceans and sea turtles. Consultation concluded with the issuance of an October 29, 2010 Opinion which concluded that operation of the Federally-regulated portion of the lobster trap fishery would not likely jeopardize the continued existence of any listed species under NMFS jurisdiction.

Formal consultation was reinitiated on February 9, 2012 given two final rules (77 FR 5880-5912; 77FR 5914-5982) issued on February 6, 2012, listing five Distinct Population Segments (DPS) of Atlantic sturgeon as threatened or endangered. Consultation concluded with the issuance of an Opinion on August 3, 2012, which concluded that operation of the Federally-regulated portion of the lobster trap fishery would not likely jeopardize the continued existence of any listed species under NMFS jurisdiction.

Outside of these formal consultations, NMFS PRD routinely reviewed framework adjustments and amendments to the American Lobster FMP. None of these met the triggers for reinitiating formal consultation.

² Effective October 5, 2008, NMFS reinstated the DAM program under the ALWTRP pursuant to a preliminary injunction issued in the case *The Humane Society of the United States, et al. v. Gutierrez, et al.* (Civil Action No. 08-cv-1593 (ESH)). The DAM program was effective through 2400 hrs April 4, 2009, and expired at this time when the broad-based sinking groundline requirement for Atlantic trap/pot fisheries became effective on April 5, 2009.

1.2 Cause for Reinitiating

As provided at 50 CFR 402.16, reinitiation of formal consultation is required where discretionary control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

The 2013 SAR has incorporated new information on serious injury and mortality determinations. NMFS has developed a policy and procedural directives describing national guidance and criteria for distinguishing serious from non-serious injuries of marine mammals (76 FR 42116, July 18, 2011). The directives serve as the basis for analyzing marine mammal injury reports (e.g., observer, disentanglement, and stranding program reports) and incorporating the results into marine mammal stock assessment reports (SAR) and marine mammal conservation management regimes (e.g., MMPA List of Fisheries (LOF), take reduction plans (TRP), ship speed regulations). The directives will ensure the consistent interpretation of what constitutes a serious injury and addresses the issues of accounting for injury cases where the outcome cannot be determined as well as accounting for successful mitigation efforts. The national standard Federal Register notice was published on January 23, 2012 (77 FR 3233).

The 2013 SAR also uses a different method for determining the country of origin of an entanglement. Previously, the location the animal was first sighted was used to categorize the events to “U.S. waters” or “Canadian waters,” then re-assign any events when/if gear analyses provide a confirmed country of origin for the involved gear. The location where an entangled whale is first sighted may be a substantial distance from the original location of entanglement. The 2013 SAR separates entanglements into: either confirmed U.S., or confirmed Canada, or unassigned. This represents a method of determining the country of origin of an entanglement that was not considered in the previous biological opinion on the lobster fishery.

In addition, changes to the ALWTRP have resulted from the recent publication of a final rule (79 FR 36585, June 27, 2014) implementing the vertical line strategy that is intended to reduce the risk of serious injury and mortality to large whales as a result of incidental entanglement in commercial fishing gear. The gear modifications and setting requirements will affect the lobster fishery in a manner that was not considered in the previous biological opinion.

We have reinitiated formal section 7 consultation on the American lobster fishery due to new information becoming available that may reveal effects of the action that may not have been previously considered.

2.0 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the continued operation of the American lobster fishery in federal and state waters managed by NMFS within the constraints of the Atlantic States Marine Fisheries Commission’s Interstate Fishery Management Plan (FMP) for American Lobster, including

measures implemented as part of the ALWTRP as amended most recently (79 FR 36585, June 27, 2014).

Recently, stock assessments and essential fish habitat analyses for the American lobster fishery have been conducted at five-year intervals. Due to frequent changes in the fishery, habitat, and status of the lobster resource, using stock and Essential Fish Habitat (EFH) assessments to inform management decisions beyond five years is not realistic. Due to the availability of staff resources, our time frames for producing new bycatch estimates for loggerheads in trawl, gillnet, and dredge fisheries are also proposed to occur on staggered five-year cycles, with additional periods of time to assess whether there have been significant changes in bycatch rates from one time period to the next. Large whale stock assessment reports also analyze data in five year intervals. Therefore, taking into account the different timelines for all these assessments, we expect that we will have to evaluate whether there is a need to reinstate consultation on the fishery at some point in the next ten years, and that beyond ten years the effects of the fishery in combination with environmental changes on ESA-listed species may be quite different than they are currently.

Given the timeframes related to the data on which management of the fishery are based, we do not believe that it is possible to analyze reliably effects of the action far into the future. We believe that data are such that we can predict out for 10 years with reasonable certainty. Anticipating that the American lobster fishery will operate the same way for more than ten years is not only speculative, but the history and pace of change in the fishery described in sections 1.0 and 2.0 suggests that it is not reasonable to expect the fishery to continue to operate as it is currently beyond ten years from now. Longer-term effects of the fishery on ESA-listed species, whatever they may be, are much more difficult to pinpoint and extrapolate beyond ten years. Since the distribution of effort in the fishery and the status of the resource can change over just a few years, the scope of the action assessed in this Opinion is the next ten years. A summary of the characteristics of the fishery relevant to the analysis of its potential effects on ESA-listed species and critical habitat is presented below.

We have considered whether to employ a longer or shorter timeframe for the proposed action. For the reasons stated above, we are adopting a 10-year timeframe for the proposed action. In addition, we do not have information suggesting that use of a shorter or longer time period would change the agency's conclusions based on the best available scientific and commercial data. As explained below, the best scientific and commercial data currently available indicate that the American lobster fishery is not appreciably reducing the likelihood of the survival and recovery of the listed species at issue. NMFS will reinstate ESA section 7 consultation of the American lobster fishery at the end of the 10-year timeframe for the proposed action, if ESA section 7 consultation has not been reinstated earlier based on new information or based on the reinstatement triggers in Section 12 of this biological opinion.

2.1 Description of the Gear

The American lobster fishery uses, predominantly, trap/pot gear to harvest lobster. A small percentage of the coastwide lobster harvest is landed as bycatch in other fisheries that use otter trawls, gillnets, and dredges. Lobster trap/pot gear consists of the trap, buoy/surface line,

groundline, buoys and/or highflyers. The traps are baited and rest on the bottom until the trap is retrieved. Buoy line(s) connect to the trap and rise vertically to the surface. Lobster traps may be set singly with each trap having its own surface line and buoy, or can be fished in trawls consisting of two or more traps per trawl. Multiple traps are linked together by groundline, with at least one, but most often two surface lines and buoys. The surface lines are typically at an end of a series of traps to mark the location of the gear (Sainsbury 1971). Offshore gear includes additional line at or near the surface that connects a radar reflector highflyer to one of the buoys to aid in relocation and “visibility” of the gear. Excess buoy line is restricted from floating at the surface and all buoys, flotation devices and/or weights must be attached to the buoy with a weak link. All gear is required to be hauled out of the water at least once every 30 days. Fishermen are encouraged, but not required to maintain knot-free buoy lines. Fishermen may only use sinking groundline.

2.2 Description of the Current American Lobster Fishery

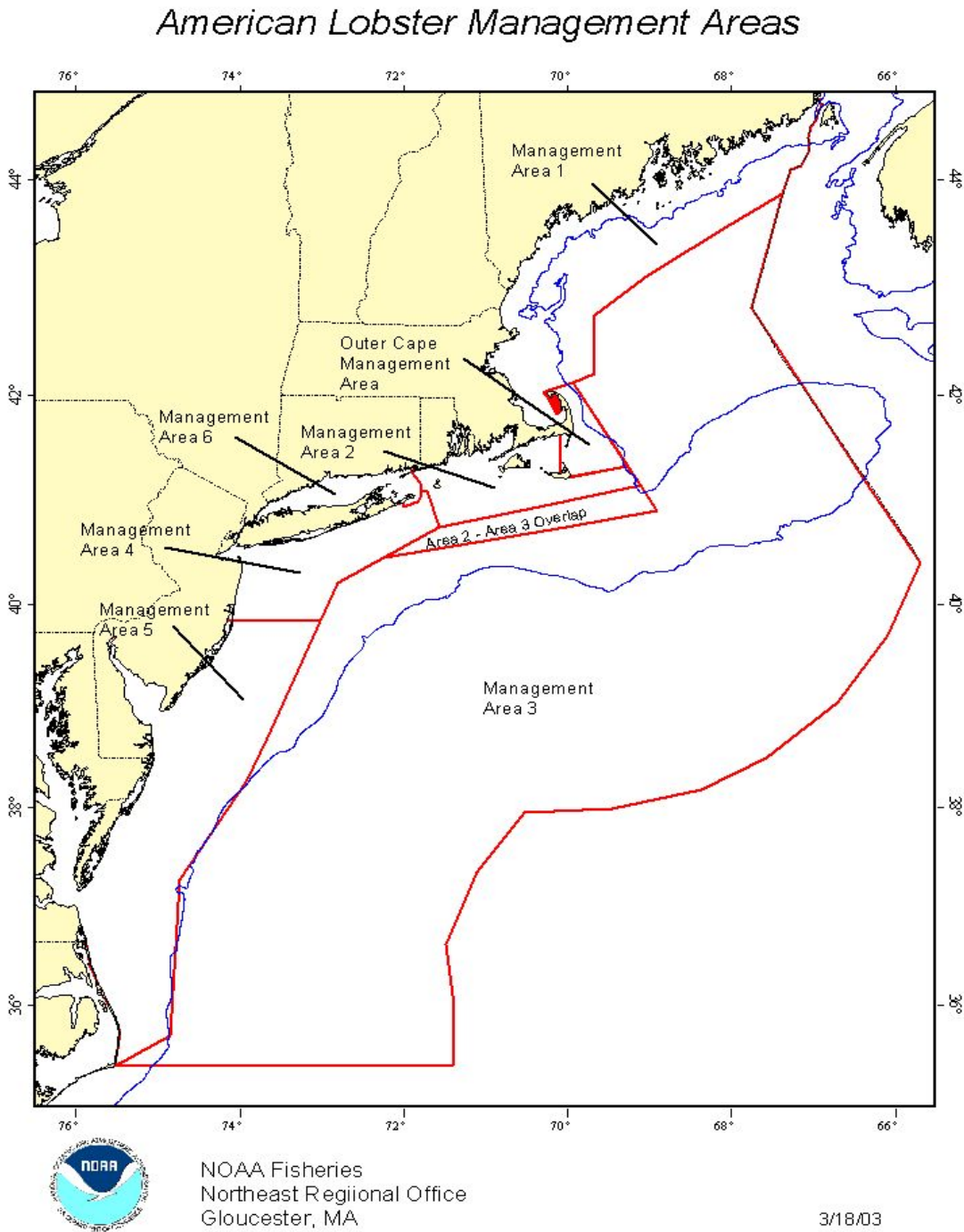
The American lobster (*Homarus americanus*) fishery is cooperatively managed by the states and the Federal government under the framework of the Atlantic States Marine Fisheries Commission (ASMFC). The ASMFC is a deliberative body comprised of representatives from the states and the Federal government charged with developing cooperative fishery management measures for several coastal fish species, including American lobster. Within this framework, the ASMFC has established the Interstate Fishery Management Plan for American Lobster (Lobster Plan) intended to promote the sustainability of the lobster resource and fishery. Under the Lobster Plan, the states and the Federal government are obliged to carry out the management measures adopted into the plan under the authority of the Atlantic Coastal Fisheries Cooperative Management Act, with the states managing the lobster fishery in their respective state waters (0-3 nautical miles from shore) and NMFS managing the lobster fishery in Federal waters (from 3-200 miles from shore). The predominant area of harvest in the United States is the Gulf of Maine, in depths up to 40 meters (ASMFC 1999). Since the 1960s, a secondary offshore fishing area has developed; this area is located from Cape Hatteras, NC to Corsair Canyon (off MA) in depths up to 600 meters. Although lobster traps are set at various depths, it is unlikely that the level of effort is consistent at all depths throughout the range of the fishery, partly because approximately 80% of the American lobster trap fishery occurs in state waters. The landings and revenue figures described in this document refer to state and federal fisheries combined.

Multiple gear types are used in the lobster fishery including trap/pot, otter trawl, gillnet, dredge and hand harvested by SCUBA divers (50 FR 600.725(v)). Between 1981 and 2007, trap/pot gear accounted for an average of 98% of total landings. All other gear types (otter trawl, gillnet, dredge, SCUBA) combined accounted for the remaining 2% and will not be discussed in this Opinion due to their negligible activity in the fishery (ASMFC 2009). The lobster trap/pot fishery is the most active fixed-gear fishery in the Greater Atlantic Region. Lobsters harvested recreationally only represent a small percentage of the total landings. The recreational trap fishery only occurs in state waters; therefore, these components of the fishery are not subject to federal regulations and are outside the scope of this consultation. Commercial lobster fishing in state waters is, however, encompassed within the scope of this consultation.

Federally authorized commercial lobster fishing occurs year-round, although the fishery peaks in summer and early fall months. Landings typically follow a seasonal pattern that is tied into the biological cycle of the American lobster, much of which is temperature-dependent. . January through April typically represent less than 4% of the total annual landings. Landings begin to pick up in May and the majority of lobsters are landed between July and October, typically peaking in August. Compared to the Gulf of Maine, landings tend to increase earlier in the year south of Cape Cod due to warming ocean temperatures.

The Lobster Plan established seven Lobster Conservation Management Areas (LCMAs, Figure 1) as the basis for managing the fishery in consideration of unique regional fishery practices: Area 1 – Inshore Gulf of Maine (GOM); Area 2 – Inshore Southern New England (SNE); Area 3 – Offshore Waters; Area 4 – Inshore Northern Mid-Atlantic; Area 5 – Inshore Southern Mid-Atlantic; Area 6 – New York and Connecticut State Waters (primarily Long Island Sound); and Outer Cape Cod (OCC).

Figure 1. Lobster Conservation Management Areas



Effort in the lobster fishery is controlled by limiting the number of eligible participating vessels (permits) and the number of traps that may be fished per vessel. The fishery is termed a “limited access” fishery meaning that no new entrants are allowed, although permits may be bought, sold and transferred to another vessel. Beginning in 1994, NMFS has generally limited access into the federal lobster fishery to those who documented participation in the fishery prior to 1991. In subsequent years, the ASMFC approved measures to limit access to the lobster trap fishery in all LCMAs to only those who could document fishing history in those areas. Qualified participants are allocated a number of traps within that management area based on their documented past fishing effort in that LCMA. The one exception is Area 1, in the Gulf of Maine, which limits access to the trap fishery based on specific criteria. Qualified Area 1 Federal lobster permit holders may fish up to a common trap limit of 800 traps. In contrast, qualifiers in other lobster management areas are allocated a specific number of traps based on their proven fishing history, not to exceed an area-specific trap cap.

The American lobster fishery is conducted in three stock units – Gulf of Maine (GOM), Georges Bank (GBK), and southern New England (SNE) (Figure 2). While each stock area has an inshore and offshore component to the fishery, GOM and SNE areas are predominantly inshore fisheries and the GBK area is predominantly an offshore fishery. The GOM stock is primarily fished by Maine, Massachusetts, and New Hampshire fishermen. The GBK stock is primarily fished by Massachusetts, New Hampshire and Rhode Island fishermen. The SNE stock is primarily fished by Connecticut, Massachusetts, New York, and Rhode Island fishermen, with smaller contributions from New Jersey, Delaware, and Maryland. American lobster landings by state for 2009 are depicted in Figure 3.

Figure 2. American lobster stock units.

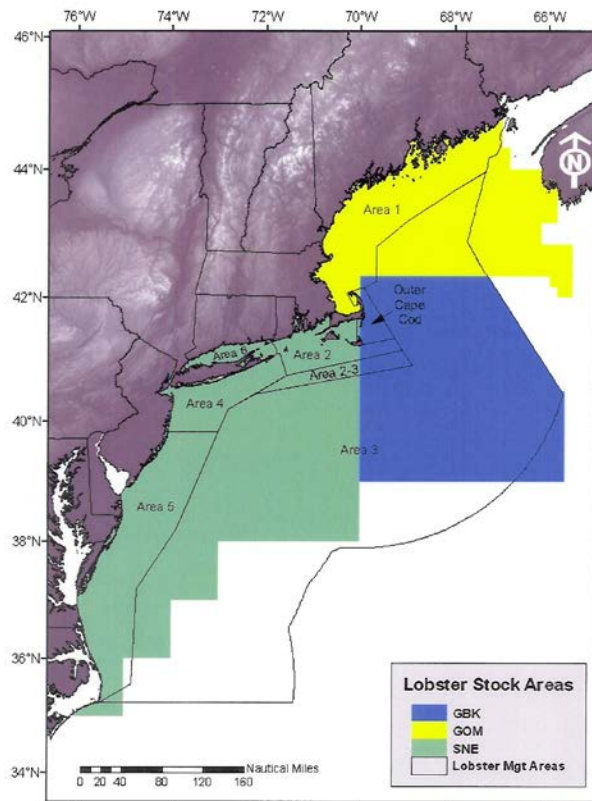
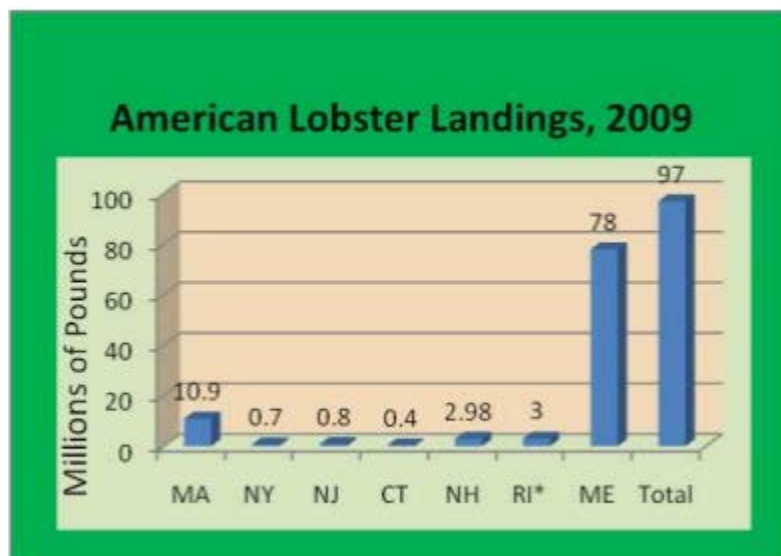


Figure 3. American Lobster Landings by State, 2009



GOM supports the largest fishery, constituting 76% of the U.S. landings between 1981 and 2007, and 87% since 2002. Landings in the GOM were stable between 1981 and 1989, averaging 14,600 metric tons, then increased dramatically from 1990 (19,200 metric tons) to 2006 (37,300 metric tons). Landings averaged 33,000 metric tons from 2000-2007.

GBK constitutes the smallest portion of the U.S. fishery, averaging 5% of the landings from 1981 to 2007. Between 1981-2002, landings from the GBK fishery have remained stable (averaging 1,300 metric tons). Landings nearly doubled between 2003-2007, reaching a high of 2,400 metric tons in 2005; they have remained at similar levels since.

SNE has the second largest fishery, accounting for 19% of the U.S. landings between 1981 and 2007. Landings increased sharply from the early 1980s to the late 1990s, reaching a time series high of 9,935 metric tons in 1997. Landings remained near the time series high until 1999, when the fishery experienced dramatic declines to an average of 2,600 metric tons between 2003 and 2007 likely due to a lobster stock collapse. From 2000 to 2007, landings from the SNE accounted for only 9% of the U.S. landings, reaching a time-series low of 6% in 2004.

Lobster landings ranged from a low of 71.2 million pounds in 2001 to a time series high of 149.5 million pounds in 2012 (Table 1). Despite landings that exceed those in 2001 by 50 percent, 2012 revenues only exceeded those in 2001 by 15 percent, because the 2012 price per pound had dropped by more than \$2 over the time period (Table 1). In contrast, landings in 2007 and 2008 were nearly identical but the landed value of lobster fell by \$60 million as the price per pound fell from \$4.42 in 2007 to \$3.73 per pound in 2008. The price of lobster has continued to decline since 2007, reaching a low of \$2.87 per pound in 2012. Despite annual price declines, lobster revenues have improved since 2008 due to an increase in landings from 79.3 million pounds in 2008 to 149.5 million pounds in 2012.

Table 1: Landings and Inflation Adjusted Value and Price per Pound – 1998 - 2012^a

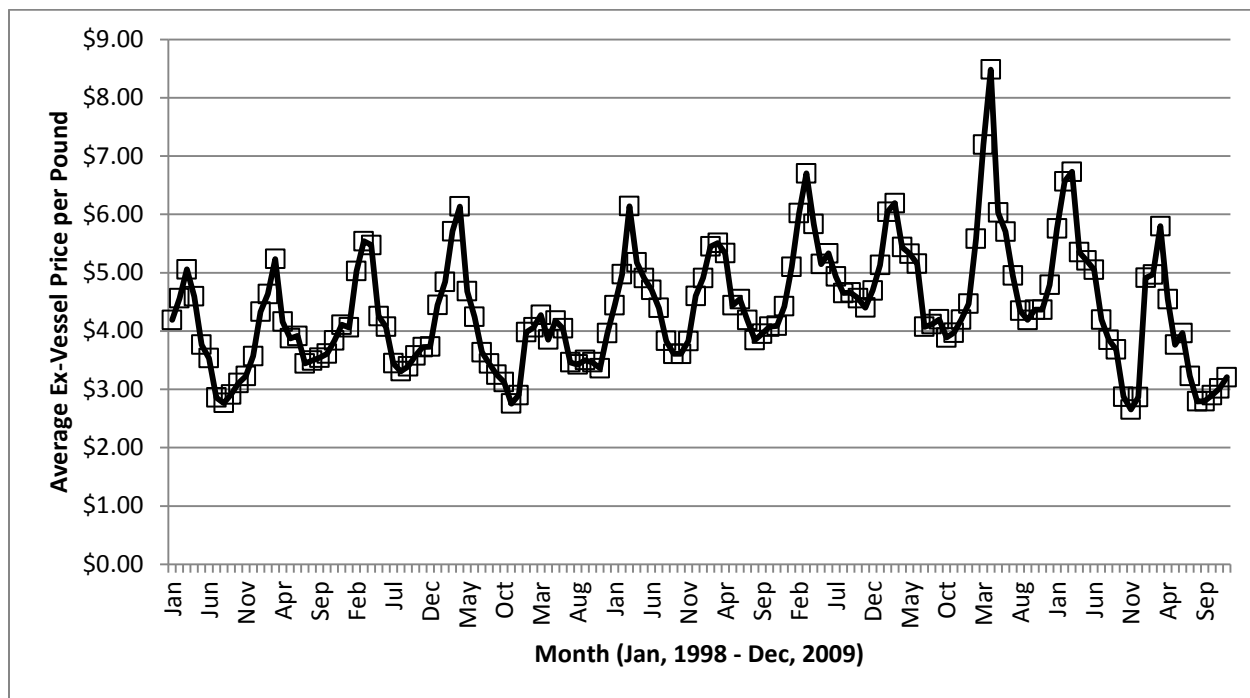
Year	Value (millions)	Landings (millions)	Price per Pound
1998	\$248.4	79.5	\$3.12
1999	\$337.3	88.6	\$3.81
2000	\$316.9	86.6	\$3.66
2001	\$365.8	71.2	\$5.14
2002	\$316.3	85.1	\$3.72
2003	\$287.8	73.4	\$3.92
2004	\$366.3	89.3	\$4.10
2005	\$354.3	87.3	\$4.06
2006	\$369.3	91.7	\$4.03
2007	\$355.9	80.6	\$4.42
2008	\$295.5	79.3	\$3.73
2009	\$310.2	100.5	\$3.09
2010	\$403.9	117.5	\$3.44
2011	\$422.9	126.3	\$3.45
2012	\$429.2	149.5	\$2.87
^a Base year = 2012			

Lobster prices typically follow a seasonal pattern corresponding with peaks and valleys in landings. Prices tend to be highest during late winter and early spring months when available supplies are low, and lower during the summer and fall when supplies are high (Figure 4). The fall months correspond with a period of high landings and reduced demand for live lobster. In the past a substantial portion of the excess supply of lobster harvested during the fall was sold to Canadian processors or pound operators. This available market tends to keep ex-vessel prices higher than they would be if this market were not available, which turned out to be the case in October, 2008.

The reasons for the decline in ex-vessel prices are partially rooted in the collapse of Icelandic banks in 2008, which are an important source of financing for Canadian lobster processors – a sector which routinely purchases and processes about half of the Maine lobster harvest each year and ships it worldwide to restaurants, cruise lines and supermarkets (CNN, 2009). Without financing from the Icelandic banks, Canadian processors lacked the capital to purchase Maine

lobster, cutting the largest market for Maine lobstermen and processors. Domestic markets were also diminished as poor economic conditions in the U.S. limited the purchasing power of U.S. consumers on expensive seafood choices such as lobster, despite record low retail prices. Lobster fishermen were further affected by high costs of bait and fuel, which added to the expense of lobster fishing and decreased profits because revenues were reduced by low wholesale prices (CNN, 2009). Prices remained below \$3.00 per pound in both November and December, 2008 and fell again to the sub-\$3.00 per pound range during much of the late summer and early fall months of 2009. This trend has continued in recent years causing variability in ex-vessel lobster prices.

Figure 4: Monthly Average Price per Pound for American Lobster (1998-2009 YTD)



American Lobster Stock Status

The most recent peer-reviewed stock assessment conducted in 2009 concluded that the GOM stock is in favorable condition based on the recommended reference points. The stock is above the reference abundance threshold and slightly below the effective exploitation threshold.

Therefore the GOM lobster stock is not depleted and overfishing is not occurring.

The GBK stock is in a favorable condition based on the recommended reference points. The stock is above the reference abundance threshold and below the effective exploitation threshold.

Therefore the GBK lobster stock is not depleted and overfishing is not occurring.

The SNE stock is in poor condition based on the recommended reference points. The stock is below the reference abundance threshold and below the effective exploitation threshold. Model runs that incorporated increasing trends (50 percent-100 percent) in natural mortality (M) also predicted reference abundance below the median. *Therefore, the SNE lobster stock is depleted*

but overfishing is not occurring. The ASMFC is working on a new peer-reviewed stock assessment scheduled for completion in the spring of 2015.

Recruitment Failure in the Southern New England Lobster Stock

Given the results of the 2009 stock assessment showing a continued decline in the condition of the SNE lobster stock, the ASMFC's Lobster Technical Committee (TC) continued to monitor the situation. At the ASMFC's May 2010 Lobster Management Board meeting the TC presented a report on the status of the Southern New England (SNE) lobster stock. That report (ASMFC, 2010) indicated that the SNE stock is critically depleted and well below the minimum threshold abundance. The report was based on the TC review of new data from trawl surveys, sea sampling, ventless trap surveys, and young of the year (YOY) indices, which became available after the 2009 stock assessment and concluded that the stock's reproductive capability and abundance continued in a persistent downward trend, with abundance nearing the lowest levels since the early 1980's. In the report to the Commission's Lobster Board (Board) the TC declared that the SNE stock is experiencing recruitment failure due to a combination of environmental factors and continued fishing mortality, which are keeping the stock from rebuilding.

Ultimately, the Board moved to address the stock recruitment failure by adopting two addenda to the Lobster Plan that would apply to lobster management areas within the SNE stock area. First, in 2011, the Board approved Addendum XVII. This addendum is intended to reduce fishing exploitation by 10 percent through changes to the minimum and maximum carapace sizes, closed seasons, and v-notching.

When the Board voted on Addendum XVII in November 2011, its approval was contingent upon the development of a new addendum, Addendum XVIII that would serve as the second of a two-phase initiative to address the poor stock conditions in SNE. Addendum XVIII was developed with the intent to scale the SNE fishery to the diminished size of the SNE stock and includes a series of multi-year trap reductions for Areas 2 and 3.

2.2.1 Summary of Lobster Trap Fishery Limiting Access Programs

During the past few decades, lobster management has included several actions to control fishing effort and restrict the movement of federal permits across management areas. In 1994, when the Federal waters component of the lobster fishery was managed under the authority of the Magnuson-Stevens act via the New England Fishery Management Council, NMFS limited access to the federal lobster fishery to those who could document participation in the fishery prior to 1991 (59 FR 31943 – June 1994). In August 1999, the Commission passed Addendum I, which limited access to the lobster trap fishery in LCMA's 3, 4, and 5 to those who could document fishing history in those areas.

Since then, the ASMFC has adopted multiple addenda to the Lobster Plan to cap and control trap fishing effort by limiting access to other LCMA's (see Table 2). NMFS responded by implementing a limited entry program in the Area 1 lobster trap fishery in 2012, and, more recently, set forth regulations in 2013 to limit access to the Area 2 and Outer Cape Cod lobster trap fisheries, and to allow qualified Federal lobster permit holders with allocations in Area 2,

the Outer Cape Area, and Offshore Area 3 to sell part of their trap allocations to other Federal lobster permit holders. This trap transferability component, called an individual transferable trap (ITT) program, would allow permit holders to buy and sell portions of their trap allocations, which will provide a means for lobstermen to adjust their businesses. As part of the program, with each transfer, the number of traps allowed in the water would be reduced by 10 percent, depending on the number of traps sold (a conservation “tax”).

The qualification and allocation process for Area 2 and Outer Cape Area limited access is currently underway as NMFS is reviewing the applications during 2014. A Final Environmental Impact Statement published by NMFS for the action estimates that approximately 192 Federal lobster permit will qualify for Area 2 and about 24 will qualify for the Outer Cape Area, with total trap allocations reaching about 121,000 traps for Area 2 and about 10,000 traps for the Outer Cape Area. NMFS expects to allow trap transfers to begin sometime in 2014 or 2015.

The ASMFC, concerned that federal lobster permits that don't qualify for the trap fishery in certain management areas may migrate into Area 1, adopted Addendum XV to Amendment 3 of the Lobster Plan in 2009 and recommended that NMFS implement a limited entry program for the Area 1 lobster trap fishery to cap effort at current levels. NMFS published a final rule on June 1, 2012 (77 FR 32420), cap the number of Federal Area 1 lobster trap permits at 2008 levels. The new rules address the concerns of the Gulf of Maine lobster industry, scientists, and the ASMFC's lobster management board that unchecked fishing effort in Area 1 could have long-term negative impacts on the Gulf of Maine lobster stock and fishery. Beginning May 1, 2013, only those Federal lobster permits that meet the eligibility criteria set forth in the final rule will be authorized to fish with lobster traps in the federal waters of Area 1. Upon completion of the qualification process, NMFS qualified approximately 1,700 Federal lobster permits for Area 1 access.

Table 2. Limited Entry Actions in the American Lobster Fishery

Area of Limited Entry	Commission Action	Corresponding Federal Action
EEZ	March 1994 – Amendment 5 ³	June 1994 (59 FR 31943)
Area 6 (Long Island Sound – state waters of CT/New York (NY))	1995 – by State Action	None
Area 3 (Offshore EEZ)	August 1999 – Addendum I	March 2003 (68 FR 14902)
Area 4 (Northern Nearshore Mid-Atlantic)	August 1999 – Addendum I	March 2003 (68 FR 14902)
Area 5 (Southern Nearshore Mid-Atlantic)	August 1999 – Addendum I	March 2003 (68 FR 14902)
Outer Cape Cod Area	February 2002 – Addendum III	Under analysis
Area 2	December 2003 – Addendum IV ⁴	Under analysis
Area 1	November 2009 – Addendum XV	June 2012 (77 FR 32420)

As noted above, NMFS has carried out an area-specific eligibility process in the federal lobster fishery for Areas 3, 4 and 5 with the publication of a final rule (68 FR 14902) on March 27, 2003. Area 3 is the largest lobster management area and is located exclusively in federal waters. It begins on the eastern boundary of the nearshore lobster management areas, extending from the GOM to Cape Hatteras, NC and out to the Hague Line (EEZ 200-mile limit). Area 3 overlaps all three lobster stock areas. Area 4 is the northern nearshore Mid-Atlantic lobster management area, extending from east of Montauk, New York, southwesterly to mid-coast New Jersey and eastward to approximately 50 miles from shore. Area 5 is the southern nearshore Mid-Atlantic lobster management area, extending from mid-coast New Jersey to Cape Hatteras, NC and eastward approximately 60 miles from shore.

The 2003 rule was implemented to support measures recommended by the fishing industry and adopted by the Commission in the Addendum I to Amendment 3 of the FMP. The intent of the action was to cap and control fishing effort in these three management areas as part of an overall program to end overfishing and rebuild lobster stocks. The final rule included criteria, consistent with those established by the Commission in the FMP, to determine Federal permit holder eligibility in each specific management area. The criteria, which varied by area, included a minimum landings requirement (Area 3) and proof of participation of the historical number of traps fished, as well as proof that the vessel fished at least 200 traps in the area over a two consecutive month period. Ultimately, vessels were assigned individual trap allocations for each qualified area. The Area 4 and 5 programs established a trap limit of 1,440 lobster traps per

³ New England Fishery Management Council document. This action occurred prior to the 1999 transfer of Federal lobster management to the Commission under the Atlantic Coastal Act.

⁴ Addendum IV was rescinded and replaced by Addendum VI in February 2005.

vessel. In Area 3, qualified vessels were capped at 2,656 traps, with subsequent annual trap reductions bringing the maximum Area 3 trap limit to no more than 2,267 traps in 2006. In a 2007 final rule (72 FR 56935), additional annual trap reductions of 2.5% per vessel were imposed in Area 3. At the end of the reduction schedule, the trap limit for each vessel in Area 3 was reduced to no more than 1,945 traps as of July 1, 2010. Initial qualification for each area reduced the number of vessels eligible to fish to the following numbers of permits as shown in Table 3.

Table 3. Number of Qualified and Active Permits in LCMAs 3, 4 and 5

Limited Access Management Area	Total Permits Qualified 2006	Active Permits 2009 ⁵	Total Eligible Permits 2009 ⁶
Area 3	139	101	137
Area 4	81	68	80
Area 5	42	40	41

2.2.3 American Lobster Fishing Effort

Fishing effort is difficult to define in the American lobster fishery as there is no linear relationship between the number of traps fished and fishing effort. The lack of systematic record keeping of commercial lobster fishing has historically made it a challenge for NMFS to develop comprehensive analysis of American lobster fishery data. One cannot, for example, assume that an individual fisher who purchases 800 trap tags actually fishes traps for all of those trap tags, and there is no official record keeping of what is actually fished. The analysis in this Opinion uses best available data, largely from federal and state sources, to measure inputs, such as the number of federal lobster permit holders by area, associated trap tag allocations and purchases, and outputs, such as landings data. Where data gaps remain, other best-available sources have been used and are appropriately described and cited within this Opinion.

The total number of fishing permits in the U.S. lobster fishery (state and federal) varies around a time series mean of 11,900 from 1981 to 2000. The total number of permits began to steadily decline in 2001 and reached a low of 10,763 in 2007 (ASMFC 2009), and has continued to decline as permits are consolidated through permit transfers or vacated (not renewed and relinquished by the permit holder). As of 2012, there were approximately 2,800 federal lobster permits, but not all are active on an annual basis (Table 4).

⁵ The 2009 values reflect the number of permit holders who selected Area 3, 4 or 5 during the 2009 Federal fishing year and represent a lower value than the current number of Federal permits eligible for these areas.

⁶ Indicates the number of existing permit “histories” that qualify for each area. They have decreased slightly for each area since 2006 due to the voluntary relinquishment of the lobster permit due to permit consolidation.

Table 4: Characterization of the 2012 Trap Fishery Permits by State

State	Total 2012 Total Permits	2012 Total Area Trap holders	2012 Active Permits	Area 1 Active Permits	Area 2 Active Permits	Area 3 Active Permits	Area 4 Active Permits	Area 5 Active Permits	Area 6 Active Permits	Area OCC Active Permits
ME	1,332	1,283	1,220	1,218	0	4	0	0	0	0
NH	92	72	49	38	0	11	0	0	0	0
MA	730	469	358	269	46	23	0	0	0	21
RI	201	166	115	3	91	25	0	0	0	1
CT	27	23	6	0	2	0	1	0	5	0
NY	87	48	18	1	8	4	13	0	7	1
NJ	184	86	36	2	1	4	25	10	0	0
DE	8	7	4	0	0	0	0	4	0	0
MD	10	7	6	1	0	1	0	5	0	0
VA	46	7	1	0	0	1	0	0	0	0
NC	31	5	0	0	0	0	0	0	0	0
SC	0	0	0	0	0	0	0	0	0	0
FL	2	2	0	0	0	0	0	0	0	0
Totals	2,750	2,175	1,813	1,532	148	73	39	19	12	23

Federal permit data can be used to estimate the total amount of effort potentially fishing in an LCMA in any given year. Approximately 2,175 federal lobster permits were issued to vessels using trap/pot gear in 2012, each of which must be renewed annually or relinquished (Table 4). However, many individuals designate LCMA's on their permits despite having little intention of actually fishing there. Just over 1,700 American lobster federal permit holders actually purchased trap tags in each fishing year. Trap tags are required to be present on all lobster trap/pot gear being fished in the EEZ. Assuming vessel owners that purchase trap tags actually participate in the lobster trap fishery, approximately 70% of all permitted trap vessels are active in federal waters. Trap tag data represents how many trap tags each permit holder ordered each year and for which LCMA. Trap tag data is limited in its ability to provide a more precise estimate of fishing effort in LCMA, but may be the best estimate of the upper boundary of fishing effort in LCMA.

Table 5. Federal Lobster Trap Permits by Management Area⁷

Lobster Management Area	Number of Federal Lobster Permits
A1 - Gulf of Maine	1,960
A2 - Southern New England	427
A3 - Offshore	110
A4 - Northern Mid-Atlantic	70
A5 – Southern Mid-Atlantic	30
A6 – Long Island Sound	64
OC - Outer Cape Cod	160
TOTAL Federal Trap Permits	2,821

2.3 Management of American Lobster Exempted Fishing, Scientific Research, and Exempted Educational Activity

Regulations at 50 CFR 600.745 allow the Northeast Regional Administrator to authorize the targeting or incidental harvest of species managed under an FMP or fishing activities that would otherwise be prohibited for scientific research, limited testing, public display, data collection, exploratory, health and safety, environmental cleanup, hazardous waste removal purposes, or educational activity. Every year, the GARFO may issue a small number of exempted fishing permits (EFPs) and/or exempted educational activity authorizations (EEAA) exempting the collection of a limited number of American lobster from Northeast federal waters from American Lobster FMP regulations. For example, between 2009 and 2013, GARFO issued five EFPs relative to the American lobster fishery. EFPs and EEAs typically involve fishing by commercial or research vessels, similar or identical to the fishing methods of the lobster fishery, which is the primary subject of this Opinion. For the five EFPs examined between 2009 and 2013, we were able to conclude that in all cases, the types and rates of interactions with listed species from the EFP activities would be expected to be similar to those analyzed in this Opinion. Given our past experience, we would expect that future EFPs and/or EEAs would propose fishing types and associated fishing effort similar to that analyzed in this Opinion and therefore not introducing significant increase over effort levels for the overall fishery considered in this Opinion. Therefore, the issuance of some EFPs and EEAs would be expected to fall within the level of effort and impacts considered in this opinion. For example, issuance of an EFP to an active commercial vessel likely does not add additional effects than would not otherwise accrue from the vessel’s normal commercial activities. Similarly, issuance of an EFP or EEAA to a vessel to conduct a minimal number of lobster trips with trap/pot gear likely would not add sufficient fishing effort to produce a detectable change in the overall amount of fishing effort in a given year. Therefore, we consider the issuance of EFPs and EEAs by the GARFO to be within the scope of this Opinion. If an EFP or EEAA is proposed which modifies this

⁷ These numbers were not screened for specific permit histories and they are overestimated in the case of Area 1 and underestimated for Areas 3, 4, and 5. This data was obtained from a simple query of the NMFS vessel permit database to provide the reader with a rough estimate of the number of permits by areas.

agency action in a manner that causes an effect to listed species or critical habitat not considered in this Opinion then consultation will be reinitiated.

2.4 Summary of the American Lobster Fishery

The U.S. American lobster resource occurs in continental shelf waters from Maine to North Carolina. The American lobster fishery is conducted in each of three stock units –GOM, GBK, and SNE. Between 1981 and 2007 the GOM, SNE and GBK landed 76%, 19%, and 5% of U.S. landings respectively.

The fishery is the most active fixed-gear fishery in the Northeast Region. Between 1981 and 2007, trap/pot gear accounted for an average of 98% of total landings. Lobster trap/pot gear consists of the trap, buoy/surface line, groundline, buoys and/or highflyers. The traps are baited and rest on the bottom until the trap is retrieved. Buoy line(s) connect to the trap and rise vertically to the surface. Federally authorized commercial lobster fishing occurs year-round, although the fishery peaks in summer and early fall months.

While the total number of active federal permits declined from 2001 through 2007, the recorded landings increased through the 1990s and continued to increase through 2006. In general, the 2009 Stock Assessment Report concluded that “(t)he American lobster fishery resource presents a mixed picture, with stable abundance for much of the GOM stock, increasing abundance for the GBK stock, and decreased abundance and recruitment yet continued high fishing mortality for the SNE stock.”

2.5 Action Area

Current federal lobster regulations manage the lobster fishery in the EEZ from Maine through North Carolina, and affect federal lobster permit holders regardless of whether they fish in federal or state waters. For the purposes of this Opinion, the area to be directly and indirectly affected by the American lobster fishery (the action area) is the area in which the American lobster fishery operates, broadly defined as all EEZ waters from Maine through Cape Hatteras, NC, and the adjoining state waters that are affected through the regulation of activities of federal American lobster permit holders fishing in those waters.

3.0 STATUS OF THE SPECIES

3.1 SPECIES THAT ARE NOT AFFECTED BY THE PROPOSED ACTION

NMFS has determined that the action being considered in this Opinion will not effect any DPS of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), the Gulf of Maine DPS of Atlantic salmon (*Salmo salar*), Kemp’s ridley sea turtles (*Lepidochelys kempii*), green sea turtles (*Chelonia mydas*), hawksbill sea turtles (*Eretmochelys imbricata*) blue whales (*Balaenoptera musculus*), and sperm whales (*Physeter*

macrocephalus), all of which are listed as threatened or endangered species under the ESA⁸. Additionally, the operation of the American lobster fishery is not likely to adversely affect the designated critical habitat for the GOM DPS of Atlantic salmon, critical habitat for North Atlantic right whales, or critical habitat for Northwest Atlantic (NWA) DPS of loggerhead sea turtles. Thus, these species or critical habitat will not be considered in this Opinion. The following is NMFS' rationale for these determinations.

Atlantic sturgeon are distributed along the eastern coast of North America from Labrador, Canada to Cape Canaveral, Florida. Based on the joint NMFS and U.S. Fish and Wildlife Service policy for identifying DPSs (61 FR 4722; February 7, 1996), NMFS has concluded that the Atlantic sturgeon that originate from U.S. rivers are discrete from Atlantic sturgeon that originate from Canadian rivers, and comprise five DPSs, as follows: (1) Gulf of Maine (GOM) DPS; (2) New York Bight (NYB) DPS; (3) Chesapeake Bay (CB) DPS; (4) Carolina DPS; and, (5) South Atlantic DPS. NMFS has listed the GOM DPS as threatened and has listed the other DPSs as endangered [77 FR 5880-5912; 77 FR 5914-5982]. Atlantic sturgeon are a long lived (approximately 60 years; Mangin, 1964; Stevenson and Secor, 1999), late maturing, estuarine dependent, anadromous species (ASSRT, 2007). Atlantic sturgeon can reach lengths of up to 14 feet (4.26 meters) and weigh more than 800 pounds (~364 kilograms). Atlantic sturgeon are anadromous; adults spawn in freshwater in the spring and early summer and migrate into estuarine and marine waters where they spend most of their lives. Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (10-50 meter depth) nearshore areas dominated by gravel and sand substrates. Long distance migrations away from spawning rivers are common. As stated in ASMFC (2007) and Stein *et al.* (2004), the American lobster fishery is not likely to adversely affect Atlantic sturgeon since trap/pot gear does not have any documented record of interactions with Atlantic sturgeon; therefore it is unlikely that this operation would affect this species. We have reviewed all available records and there have been no observed captures of Atlantic sturgeon in trap/pot gear or any other gear when the primary trip or haul target was lobster. Because there are no proposed changes to the lobster fishery that would increase the likelihood of interactions between Atlantic sturgeon and lobster trap/pot gear, we do not anticipate any future interactions. Because of this, we determined there will be no effect to any DPS of Atlantic sturgeon from this fishery.

Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers. They can be found in rivers along the western Atlantic coast from St. Johns River, Florida (possibly extirpated from this system) to the Saint John River in New Brunswick, Canada. Shortnose sturgeon have been described as anadromous but for some shortnose sturgeon populations that rarely leave their natal river, freshwater amphidromous may be a better description (Kieffer and Kynard, 1993). A freshwater amphidromous species is defined as a species that spawns and remains in freshwater for most of its life cycle but spends some time in saline water. Most researchers previously believed that coastal movements were rare (Dadswell, 1984; NMFS 1998) and that shortnose sturgeon seldom ventured beyond their natal rivers. However, there is conclusive evidence that shortnose sturgeon make coastal movements to

⁸ Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters.

adjacent rivers from both tagging data and genetic analysis. Telemetry data and genetic analyses have demonstrated that inter-riverine movements of shortnose sturgeon may be relatively common in some areas (*e.g.* Maine Rivers based on Fernandes 2008; Southeast Rivers based on J. Fleming, GADNR, pers. comm. 2008; and T. King, USGS, pers. comm. 2009). Since the American lobster fishery does not operate in or near the rivers where concentrations of shortnose sturgeon are most likely found, it is highly unlikely that the American lobster fishery will affect shortnose sturgeon. We have reviewed all available records, and there have been no observed captures of shortnose sturgeon in trap/pot gear or any other gear when the primary trip or haul target was lobster. Because there are no proposed changes to the lobster fishery that would increase the likelihood of interactions between shortnose sturgeon and lobster trap/pot gear, we do not anticipate any future interactions. Because of this, we determined there will be no effect to shortnose sturgeon from this fishery.

The wild populations of Atlantic salmon, whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, are listed as endangered under the ESA. Juvenile salmon in New England rivers typically migrate to sea in May after a two-to-three year period of development in freshwater streams, and remain at sea for two winters before returning to their U.S. natal rivers to spawn (Reddin 2006). The preferred habitat of post-smolt salmon in the open ocean is principally the upper 10 meters of the water column (ICES SGBYSAL, 2005), although there is evidence of forays into deeper water for shorter periods; in contrast adult Atlantic salmon demonstrate a wider depth profile (ICES SGBYSAL, 2005). Results from a 2001-2003 post-smolt trawl survey in the nearshore waters of the Gulf of Maine indicate that Atlantic salmon post-smolts are prevalent in the upper water column throughout this area in mid to late May (Lacroix and Knox 2005). Therefore, fishing at the bottom, as practiced in the American lobster fishery, reduces the potential for catching Atlantic salmon as either post-smolts or adults. It is highly unlikely that the action being considered in this Opinion will affect the Gulf of Maine DPS of Atlantic salmon given that operation of the American lobster fishery does not occur in or near the rivers where concentrations of Atlantic salmon are likely to be found and pot/trap gear operates in the ocean at the bottom rather than near the surface. We have reviewed all available records, and there have been no observed captures of Atlantic salmon in trap/pot gear or any other gear when the primary trip or haul target was lobster. Because there are no proposed changes to the lobster fishery that would increase the likelihood of interactions between Atlantic salmon and lobster trap/pot gear, we do not anticipate any future interactions. Because of this, we determined there will be no effect to Atlantic salmon from this fishery.

The hawksbill sea turtle is uncommon in the waters of the continental United States. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America. Hawksbills feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. The Culebra Archipelago of Puerto Rico contains especially important foraging habitat for hawksbills. Nesting areas in the western North Atlantic include Puerto Rico and the Virgin Islands. There are accounts of hawksbills in South Florida and individuals have been sighted along the East Coast as far north as Massachusetts, although sightings north of Florida are rare. Hawksbills occasionally have been found stranded as far north as Cape Cod, Massachusetts, but many of these strandings were observed after hurricanes or offshore storms. Since operation of the American lobster fishery does not occur in waters that are typically used by hawksbill sea

turtles, it is highly unlikely that the American lobster fishery will affect this turtle species. Because of this, we determined there will be no effect to hawksbill sea turtles from this fishery.

The Kemp's ridley sea turtle is one of the least abundant of the world's sea turtle species. Kemp's ridley typically occur only in the Gulf of Mexico and the northwestern Atlantic Ocean (USFWS and NMFS 1992). Foraging areas documented along the U.S. Atlantic coast include Charleston Harbor, Pamlico Sound (Epperly *et al.* 1995c), Chesapeake Bay (Musick and Limpus 1997), Delaware Bay, and Long Island Sound (Morreale and Standora 1993). Adult Kemp's ridleys are found in the coastal regions of the Gulf of Mexico and southeastern U.S., but are typically rare in the northeastern U.S. waters of the Atlantic (TEWG 2000). Gear interactions of Kemp's ridley turtles have been recorded by sea sampling coverage in the Northeast otter trawl fishery, pelagic longline fishery, and Southeast shrimp and summer flounder bottom trawl fisheries. There are no documented interactions of Kemp's ridley sea turtles with gear from the lobster trap/pot fishery; because there are no proposed changes to the lobster fishery that would increase the likelihood of interactions between Kemp's ridleys and lobster trap/pot gear, we do not anticipate any future interactions. Because of this, we determined there will be no effect to Kemp's ridleys from this fishery.

In the western Atlantic, green sea turtles range from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean (Wynne and Schwartz 1999). Green sea turtles occur seasonally in Mid-Atlantic and Northeast waters such as Chesapeake Bay and Long Island Sound (Musick and Limpus 1997, Morreale and Standora 1998, Morreale *et al.* 2005), which serve as foraging and developmental habitats. As with the other sea turtle species, incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Gear interactions of green sea turtles have been recorded by sea sampling coverage in the pelagic driftnet, pelagic longline, Southeast shrimp trawl, and summer flounder bottom trawl fisheries. There are no documented interactions of green sea turtles with gear from the lobster trap/pot fishery; because there are no proposed changes to the lobster fishery that would increase the likelihood of interactions between greens and lobster trap/pot gear, we do not anticipate any future interactions. Because of this, we determined there will be no effect to green sea turtles from this fishery.

Blue whales do not regularly occur in waters of the U.S. Exclusive Economic Zone (EEZ) (Waring *et al.* 2010). In the North Atlantic, blue whales are most frequently sighted in the St. Lawrence from April to January (Sears 2002). No blue whales were observed during the Cetacean and Turtle Assessment Program (CeTAP) surveys of the Mid- and North Atlantic areas of the outer continental shelf (CeTAP 1982). Calving for the species occurs in low latitude waters outside of the area where the American lobster fishery operates. Blue whales feed on euphausiids (krill) (Sears 2002), which are too small to be captured in American lobster fishing gear. Given that the species is unlikely to occur in areas where the American lobster fishery operates, and given that the operation of the American lobster fishery will not affect the availability of blue whale prey or areas where calving and nursing of young occurs, NMFS has determined that the continued operation of the American lobster fishery will have no effect on blue whales.

Sperm whales do regularly occur in waters of the U.S. EEZ in the Atlantic Ocean. However, sperm whales are generally found on the continental shelf edge, over the continental slope, and into mid-ocean regions (Waring *et al.* 2007). In contrast, the American lobster fishery operates in continental shelf waters. The average depth of sperm whale sightings observed during the CeTAP surveys was 1,792 meters (CeTAP 1982). Female sperm whales and young males almost always inhabit waters deeper than 1,000 meters and at latitudes less than 40° N (Whitehead 2002). Sperm whales feed on larger organisms that inhabit the deeper ocean regions (Whitehead 2002). Calving for the species occurs in low latitude waters outside of the area where the American lobster fishery operates. Given that sperm whales are unlikely to occur in areas (based on water depth) where the American lobster fishery operates, and given that the operation of the American lobster fishery will not affect the availability of sperm whale prey or areas where calving and nursing of young occurs, NMFS has determined that the continued operation of the American lobster fishery will have no effect on sperm whales.

On June 3, 1994, NMFS designated critical habitat in the Atlantic for the northern right whale (59 FR 28793). This designation includes areas in Cape Cod Bay and Great South Channel which are located within the action area. NMFS has been, and continues to be, in rulemaking to designate critical habitat for the North Atlantic right whale following the 2008 change in the way the three species of right whales were listed under the ESA (73 FR 12024, March 6, 2008). On October 1, 2009, NMFS received a petition to revise the 1994 critical habitat designation. In an October 2010 Federal Register notice (75 FR 61690), we announced that we intend to revise existing critical habitat by continuing our ongoing rulemaking process to designate critical habitat for North Atlantic right whales with the expectation that a proposed critical habitat rule for the North Atlantic right whale will be published in 2011. To date, we have not yet published a proposed rule so the 1994 critical habitat designation for northern right whales is the only critical habitat for right whales in the Atlantic.

NMFS has determined that the action being considered in the Opinion will have no effect on right whale critical habitat. This determination is based on the action's effects on the conservation value of the habitat that has been designated. Specifically, we considered whether the action was likely to affect the physical or biological features that afford the designated area value for the conservation of right whales. Critical habitat for right whales has been designated in the Atlantic Ocean in Cape Cod Bay, Great South Channel, and in nearshore waters off Georgia and Florida (50 CFR 226.13). The features important for right whales are the factors that result in high densities of certain species of copepods. The lobster fishery will not affect the availability of copepods for foraging right whales because copepods are very small organisms that are not expected to be captured or injured in lobster fishing gear. Additionally, the action will not affect the oceanographic features that act to aggregate copepods. Since the action being considered in this Opinion is not likely to affect the availability of copepods or the factors that serve to aggregate copepods, and these were the biological feature that characterized feeding habitat, this action will have no effect on designated critical habitat for right whales and, therefore, right whale critical habitat will not be considered further in this Opinion.

Coincident with the June 19, 2009, endangered listing, NMFS designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300; June 19, 2009). Designation of critical habitat is focused on the known primary constituent elements (PCEs) within the occupied areas of a listed

species that are deemed essential to the conservation of the species. Within the GOM DPS, the PCEs for Atlantic salmon are 1) sites for spawning and rearing and 2) sites for migration (excluding marine migration; although successful marine migration is essential to Atlantic salmon, NMFS was not able to identify the essential features of marine migration and feeding habitat or their specific locations at the time critical habitat was designated). While there is potential for lobster fishing activity to occur within the GOM DPS of Atlantic salmon critical habitat, the placement of lobster traps and trawls is expected to allow adequate passage for migrating salmon. Likewise, the associated fishing activities (*i.e.*, hauling gear and vessel movements) are not expected to alter water chemistry or physical attributes to levels that would affect migration patterns of smolts or adult salmon. Because of this, we determined there will be no effect to designated critical habitat for the GOM DPS of Atlantic salmon from this fishery.

On July 10, 2014, NMFS published a final rule (79 FR 39856) designating critical habitat for the NWA DPS of loggerhead sea turtles. Specific areas designated include 38 occupied marine areas within the range of the NWA DPS. These areas contain one or a combination of: nearshore reproductive habitat, winter area, breeding areas, migratory corridors, and *Sargassum* habitat. The USFWS designated ~685 miles of nesting beaches in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi as critical habitat in a separate rulemaking (79 FR 39756, July 10, 2014). Maps of loggerhead sea turtle critical habitat in the Northwest Atlantic Ocean are available at: http://www.nmfs.noaa.gov/pr/species/turtles/criticalhabitat_loggerhead.htm. The effective date of both rules is August 11, 2014.

The action area for the lobster fishery overlaps with two of the five types of marine areas identified as critical habitat for the NWA DPS of loggerhead sea turtles: (1) *Sargassum* habitat in offshore waters associated with the Gulf Stream current off Maryland, Virginia, and North Carolina, and (2) constricted migratory habitat in continental shelf waters off North Carolina. As indicated in the final rule for marine areas, commercial fishing activities may affect both *Sargassum* and migratory habitat. In particular, fisheries using fixed gear (*e.g.*, pots) that are arranged closely together over a wide geographic area could adversely affect habitat conditions needed for efficient migratory passage of loggerheads. While there is the potential for lobster fishing activity to occur within the critical habitat for NWA DPS loggerheads, fishing effort data for lobster harvests utilizing trap/pot gear in the Mid-Atlantic indicate that effort in this area is minimal to non-existent compared to areas further north. As a result, the occasional placement of lobster traps and trawls in waters off North Carolina is not expected to impede the passage of migrating turtles through the area. Likewise, associated fishing activities (*i.e.*, hauling gear and vessel movements) are not expected to alter water chemistry parameters or physical attributes of the areas to levels that would affect migration patterns of individual turtles or the health of prey species found in either type of habitat. Based on this information, we determined there will be no effect to designated critical habitat for NWA DPS loggerheads from this fishery.

3.2 STATUS OF LISTED SPECIES IN THE ACTION AREA THAT MAY BE AFFECTED BY THE PROPOSED ACTION

NMFS has determined that the action being considered in this Opinion may affect the following ESA-listed species in a manner that will likely result in adverse effects:

North Atlantic right whale	<i>(Eubalaena glacialis)</i>	Endangered
Humpback whale	<i>(Megaptera novaeangliae)</i>	Endangered
Fin whale	<i>(Balaenoptera physalus)</i>	Endangered
Sei whale	<i>(Balaenoptera borealis)</i>	Endangered
Loggerhead sea turtle - NWA DPS ⁹	<i>(Caretta caretta)</i>	Threatened
Leatherback sea turtle	<i>(Dermochelys coriacea)</i>	Endangered

3.2.1 Status of Large Whales

All of the cetacean species considered in this Opinion were once the subject of commercial whaling, which likely caused their initial decline. Commercial whaling for right whales along the U.S. Atlantic coast peaked in the 18th century, but right whales continued to be taken opportunistically along the coast and in other areas of the North Atlantic into the early 20th century (Kenney 2002). Worldwide, humpback whales were often the first species to be targeted and frequently hunted to commercial extinction (Clapham *et al.* 1999), meaning that their numbers had been reduced so low by commercial exploitation that it was no longer profitable to target the species. Wide-scale exploitation of the more offshore fin whale occurred later with the introduction of steam-powered vessels and harpoon gun technology (Perry *et al.* 1999). Fin whales were given total protection in the North Atlantic in 1987, with the exception of an aboriginal subsistence whaling hunt for Greenland (Gambell 1993, Caulfield 1993). Sei whales became the target of modern commercial whalers in the late 19th and early 20th centuries after populations of other whales, including right, humpback, fin, and blue, had already been depleted. The species continued to be exploited in Iceland until 1986, even though measures to stop whaling of sei whales had been enacted in the 1970s (Perry *et al.* 1999). However, Iceland has increased its whaling activities in recent years and reported a catch of 136 whales in the 1988/89 and 1989/90 seasons (Perry *et al.* 1999), seven in 2006/07, and 273 in 2009/2010. In 2011 and 2012, Iceland temporarily suspended commercial whaling for fin whales due to decreased demand from Japan, but resumed in 2013 with 134 fin whales reported. Today, the greatest known threats to these cetaceans are ship strikes and gear interactions, although the number of each species affected by these activities does vary.

Information on the range-wide status of each species as it is listed under the ESA is included here to provide the reader with information on the status of each species. Additional background information on the range-wide status of these species can be found in a number of published documents, including recovery plans (NMFS 1991a, b; 2005a), the Marine Mammal Stock Assessment Reports (SAR) (*e.g.*, Waring *et al.* 2014), status reviews (*e.g.*, Conant *et al.* 2009), and other publications (*e.g.* Clapham *et al.* 1999; Perry *et al.* 1999; Best *et al.* 2001).

⁸ NWA DPS = Northwest Atlantic DPS, the only loggerhead DPS expected to occur in the action area

3.2.1.1 North Atlantic Right Whales

Historically, right whales have occurred in all the world's oceans from temperate to subarctic latitudes (Perry *et al.* 1999). In both southern and northern hemispheres, they are observed at low latitudes and in nearshore waters where calving takes place in the winter months, and in higher latitude foraging grounds in the summer (Clapham *et al.* 1999; Perry *et al.* 1999).

The North Atlantic right whale (*Eubalaena glacialis*) has been listed as endangered under the ESA since 1973. Originally called the "northern right whale," it was listed as endangered under the Endangered Species Conservation Act, the precursor to the ESA in June 1970. The species is also designated as depleted under the Marine Mammal Protection Act (MMPA).

In December 2006, NMFS completed a comprehensive review of the status of right whales in the North Atlantic and North Pacific Oceans. Based on the findings from the status review, NMFS concluded that right whales in the Northern Hemisphere exist as two species: North Atlantic right whale (*Eubalaena glacialis*) and North Pacific right whale (*Eubalaena japonica*). NMFS determined that each of the species is in danger of extinction throughout its range. In 2008, based on the status review, NMFS listed the endangered northern right whale (*Eubalaena spp.*) as two separate endangered species: the North Atlantic right whale (*E. glacialis*) and North Pacific right whale (*E. japonica*) (73 FR 12024; March 6, 2008).

The International Whaling Commission (IWC) recognizes two right whale populations in the North Atlantic: a western and eastern population (IWC 1986). It is thought that the eastern population migrated along the coast from northern Europe to northwest Africa. The current distribution and migration patterns of the eastern North Atlantic right whale population, if extant, are unknown. Sighting surveys from the eastern Atlantic Ocean suggest that right whales present in this region are rare (Best *et al.*, 2001) and it is unclear whether a viable population in the eastern North Atlantic still exists (Brown 1986, NMFS 1991a). Photo-identification work has shown that some of the whales observed in the eastern Atlantic were previously identified as western Atlantic right whales (Kenney 2002). This Opinion will focus on the western North Atlantic right whale (*Eubalaena glacialis*), which occurs in the action area.

Habitat and Distribution

Western North Atlantic right whales generally occur from the southeast U.S. to Canada (*e.g.*, Bay of Fundy and Scotian Shelf) (Kenney 2002; Waring *et al.* 2014). Like other right whale species, they follow an annual pattern of migration between low latitude winter calving grounds and high latitude summer foraging grounds (Perry *et al.* 1999; Kenney 2002).

The distribution of right whales seems linked to the distribution of their principal zooplankton prey, calanoid copepods (Winn *et al.* 1986; NMFS 2005a; Baumgartner and Mate 2005; Waring *et al.* 2012). Right whales are most abundant in Cape Cod Bay between February and April (Hamilton and Mayo 1990; Schevill *et al.* 1986; Watkins and Schevill 1982) and in the Great South Channel in May and June (Kenney *et al.* 1986; Payne *et al.* 1990; Kenney *et al.* 1995; Kenney 2001) where they have been observed feeding predominantly on copepods of the genera *Calanus* and *Pseudocalanus* (Baumgartner and Mate 2005; Waring *et al.* 2011). Right whales also frequent Stellwagen Bank and Jeffreys Ledge, as well as Canadian waters including the Bay

of Fundy and Browns and Baccaro banks in the summer through fall (Mitchell *et al.* 1986; Winn *et al.* 1986; Stone *et al.* 1990). The consistency with which right whales occur in such locations is relatively high, but these studies also note high interannual variability in right whale use of some habitats. Calving is known to occur in the winter months in coastal waters off of Georgia and Florida (Kraus *et al.* 1988). Calves have also been sighted off the coast of North Carolina during winter months, suggesting the calving grounds may extend as far north as Cape Fear, NC. In the North Atlantic, it appears that not all reproductively active females return to the calving grounds each year (Kraus *et al.* 1986; Payne 1986). Patrician *et al.* (2009) analyzed photographs of a right whale calf sighted in the Great South Channel in June 2007 and determined the calf appeared too young to have been born in the known southern calving area. Although it is possible the female traveled south to New Jersey or Delaware to give birth, evidence suggests that calving in waters off the northeastern U.S. is possible.

The location of some portion of the population during the winter months remains unknown (NMFS 2005a). However, recent aerial surveys conducted under the North Atlantic Right Whale Sighting Survey (NARWSS) program have indicated that some individuals may reside in the northern Gulf of Maine during the winter. In 2008, 2009, 2010, and 2011, right whales were sighted on Jeffreys and Cashes Ledges, Stellwagen Bank, and Jordan Basin during December to February (Khan *et al.* 2009, 2010, 2011, 2012). Results from winter surveys and passive acoustic studies suggest that animals may be dispersed in several areas including Cape Cod Bay (Brown *et al.* 2002) and offshore waters of the southeastern U.S. (Waring *et al.* 2012). On multiple days in December 2008, congregations of more than 40 individual right whales were observed in the Jordan Basin area of the Gulf of Maine, leading researchers to believe this may be a wintering ground (NOAA 2008). Telemetry data have shown lengthy and somewhat distant excursions into deep water off the continental shelf (Mate *et al.* 1997) as well as extensive movements over the continental shelf during the summer foraging period (Mate *et al.* 1992; Mate *et al.* 1997; Bowman 2003; Baumgartner and Mate 2005). Knowlton *et al.* (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland; in addition, resightings of photographically identified individuals have been made off Iceland, arctic Norway, and in the old Cape Farewell whaling ground east of Greenland. The Norwegian sighting (September 1999) is one of only two sightings in the 20th century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. Similarly, records from the Gulf of Mexico (Moore and Clark 1963; Schmidly *et al.* 1972) represent either geographic anomalies or a more extensive historic range beyond the sole known calving and wintering ground in the southeastern United States. The frequency with which right whales occur in offshore waters in the southeastern United States remains unclear (Waring *et al.* 2012).

Abundance Estimates and Trends

An estimate of the pre-exploitation population size for the North Atlantic right whale is not available. As is the case with most wild animals, an exact count of North Atlantic right whales cannot be obtained. However, abundance can be reasonably estimated as a result of the extensive study of western North Atlantic right whale population. IWC participants from a 1999 workshop agreed to a minimum direct-count estimate of 263 right whales alive in 1996 and noted that the true population was unlikely to be much greater than this estimate (Best *et al.* 2001). Based on a

census of individual whales using photo-identification techniques and an assumption of mortality for those whales not seen in seven years, a total of 299 right whales was estimated in 1998 (Kraus *et al.* 2001), and a review of the photo-ID recapture database on October 29, 2012 indicated that 455 individually recognized whales were known to be alive during 2010 (Waring *et al.* 2014). This number represents a minimum population size. The minimum number alive population index for the years 1990-2010 suggests a positive and slowly accelerating trend in population size. These data reveal a significant increase in the number of catalogued whales with a geometric mean growth rate for the period of 2.8% (Waring *et al.* 2014).

A total of 338 right whale calves were born from 1993 to 2011 (Waring *et al.* 2014). The mean calf production for this 19-year period is estimated to be 17.8/year (Waring *et al.* 2014). Calving numbers have been variable, with large differences among years, including a second largest calving season in 2000/2001 with 31 right whale births (Waring *et al.* 2014). The three calving years (97/98; 98/99; 99/00) prior to this record year provided low recruitment levels with only 11 calves born. The 2000-2011 calving seasons were remarkably better with 31, 21, 19, 17, 28, 19, 23, 23, 39, 19, and 22 births, respectively (Waring *et al.* 2014). However, the western North Atlantic stock has also continued to experience losses of calves, juveniles, and adults.

As is the case with other mammalian species, there is an interest in monitoring the number of females in this western North Atlantic right whale population since their numbers will affect the population trend (whether declining, increasing or stable). Kraus *et al.* (2007) reported that, as of 2005, 92 reproductively-active females had been identified, and Schick *et al.* (2009) estimated 97 breeding females. From 1983 to 2005, the number of new mothers recruited to the population (with an estimated age of 10 for the age of first calving), varied from 0-11 each year with no significant increase or decline over the period (Kraus *et al.* 2007). By 2005, 16 right whales had produced at least six calves each, and four cows had at least seven calves. Two of these cows were at an age that indicated a reproductive life span of at least 31 years (Kraus *et al.* 2007). As described above, the 2000/2001-2006/2007 calving seasons had relatively high calf production and have included several first time mothers (*e.g.*, eight new mothers in 2000/2001). However, over the same time period, there have been continued losses to the western North Atlantic right whale population, including the death of mature females, as a result of anthropogenic mortality (like that described in Henry *et al.* 2011, below). Of the 12 serious injuries and mortalities in 2005-2009, at least six were adult females, three of which were carrying near-term fetuses and four of which were just starting to bear calves (Waring *et al.* 2011). Since the average lifetime calf production is 5.25 calves (Fujiwara and Caswell 2001), the deaths of these six females represent a loss of reproductive potential of as many as 32 animals. However, it is important to note that not all right whale mothers are equal with regards to calf production. Right whale #1158 had only one recorded calf over a 25-year period (Kraus *et al.* 2007). In contrast, one of the largest right whales on record, “Stumpy,” as a prolific breeder, successfully rearing calves in 1980, 1987, 1990, 1993, and 1996 (Moore *et al.* 2007). Stumpy was killed in February 2004 of an apparent ship strike (NMFS 2006a). At the time of her death, she was estimated to be 30 years of age and carrying her sixth calf; the near-term fetus also died (NMFS 2006a).

Abundance estimates are an important part of assessing the status of the species. However, for section 7 purposes, the population trend (*i.e.*, whether increasing or declining) provides better information for assessing the effects of a proposed action on the species. As described in

previous Opinions, data collected in the 1990s suggested that right whales were experiencing a slow but steady recovery (Knowlton *et al.* 1994). However, Caswell *et al.* (1999) used photo-identification data and modeling to estimate survival and concluded that right whale survival decreased from 1980 to 1994. Modified versions of the Caswell *et al.* (1999) model as well as several other models were reviewed at the 1999 IWC workshop (Best *et al.* 2001). Despite differences in approach, all of the models indicated a decline in right whale survival in the 1990s with female survival particularly affected (Best *et al.* 2001). In 2002, NMFS NEFSC hosted a workshop to review right whale population models to examine: (1) potential bias in the models, and (2) changes in the subpopulation trend based on new information collected in the late 1990s (Clapham *et al.* 2002). Three different models were used to explore right whale survivability and to address potential sources of bias. Although biases were identified that could negatively affect the results, all three modeling techniques resulted in the same conclusion: survival had continued to decline according to these three models and seemed to be affecting females disproportionately (Clapham *et al.* 2002). Increased mortalities in 2004 and 2005 were cause for serious concern (Kraus *et al.* 2005). Calculations indicate that this increased mortality rate would reduce population growth by approximately 10% per year (Kraus *et al.* 2005), in conflict with the 2.8% positive trend from 1990-2010 noted above by Waring *et al.* (2014). Despite the preceding, examination of the minimum number alive population index calculated from the individual sightings database for the years 1990-2010 suggest a positive and slowly accelerating trend in population size (Waring *et al.* 2014). These data reveal a significant increase in the number of catalogued right whales alive during this period (Waring *et al.* 2014). As described above, the mean growth rate estimated in the latest stock assessment report was 2.8% (Waring *et al.* 2014).

Reproduction

Healthy reproduction is critical for the recovery of the North Atlantic right whale (Kraus *et al.* 2007). Researchers have suggested that the population has been affected by a decreased reproductive rate (Best *et al.* 2001; Kraus *et al.* 2001). Kraus *et al.* (2007) reviewed reproductive parameters for the period 1983-2005, and estimated calving intervals to have changed from 3.5 years in 1990 to more than five years between 1998-2003, and then decreased to just over three years in 2004 and 2005.

Factors that have been suggested as affecting the right whale reproductive rate include reduced genetic diversity (and/or inbreeding), contaminants, biotoxins, disease, and nutritional stress. Although it is believed that a combination of these factors is likely affecting right whales (Kraus *et al.* 2007), there is currently no evidence to support this. The dramatic reduction in the North Atlantic right whale population due to commercial whaling may have resulted in a loss of genetic diversity that could affect the ability of the current population to successfully reproduce (*i.e.*, decreased conceptions, increased abortions, and increased neonate mortality). One hypothesis is that the low level of genetic variability in this species produces a high rate of mate incompatibility and unsuccessful pregnancies (Frasier *et al.* 2007). Analyses are currently underway to assess this relationship further and to examine the influence of genetic characteristics on the potential for species recovery (Frasier *et al.* 2007). Studies by Schaeff *et al.* (1997) and Malik *et al.* (2000) indicate that western North Atlantic right whales are less genetically diverse than southern right whales. Similarly, while contaminant studies have confirmed that right whales are exposed to and accumulate contaminants, researchers could not conclude that these contaminant loads were negatively affecting right whale reproductive success

since PCB and DDT concentrations were lower than those found in other affected marine mammals (Weisbrod *et al.* 2000). Another suite of contaminants (i.e. antifouling agents and flame retardants) that disrupt reproductive patterns and have been found in other marine animals, raises new concerns (Kraus *et al.* 2007). Recent data also support a hypothesis that chromium, an industrial pollutant, may be a concern for the health of the North Atlantic right whales and that inhalation may be an important exposure route (Wise *et al.* 2008).

A number of diseases could be also affecting reproduction, although tools for assessing disease factors in free-swimming large whales currently do not exist (Kraus *et al.* 2007). Once developed, such methods may allow for the evaluation of diseases on right whales. Impacts of biotoxins on marine mammals are also poorly understood, yet there is some data showing that marine algal toxins may play significant roles in mass mortalities of large whales (Rolland *et al.* 2007). Although there are no published data concerning the effects of biotoxins on right whales, researchers conclude that right whales are being exposed to measurable quantities of paralytic shellfish poisoning (PSP) toxins and domoic acid via trophic transfer from their prey upon which they feed (Durbin *et al.* 2002, Rolland *et al.* 2007).

Data on food-limitation are difficult to evaluate (Kraus *et al.* 2007). North Atlantic right whales seem to have thinner blubber than right whales from the South Atlantic (Kenney 2002; Miller *et al.* (2011). Miller *et al.* (2011) suggests that lipids in the blubber are used as energetic support for reproduction in female right whales. In the same study, blubber thickness was also compared among years of differing prey abundances. During a year of low prey abundance, right whales had significantly thinner blubber than during years of greater prey abundance. The results suggest that blubber thickness is indicative of right whale energy balance and that the marked fluctuations in the North Atlantic right whale reproduction have a nutritional component (Miller *et al.* (2011)).

Modeling work by Caswell *et al.* (1999) and Fujiwara and Caswell (2001) suggests that the North Atlantic Oscillation (NAO), a naturally occurring climatic event, affects the survival of mothers and the reproductive rate of mature females, and Clapham *et al.* (2002) also suggests it affects calf survival. Greene *et al.* (2003) described the potential oceanographic processes linking climate variability to reproduction of North Atlantic right whales. Climate-driven changes in ocean circulation have had a significant impact on the plankton ecology of the Gulf of Maine, including effects on *Calanus finmarchicus*, a primary prey resource for right whales. Researchers found that during the 1980s, when the NAO index was predominately positive, *C. finmarchicus* abundance was also high; when a record drop occurred in the NAO index in 1996, *C. finmarchicus* abundance levels also decreased significantly. Right whale calving rates since the early 1980s seem to follow a similar pattern, where stable calving rates were noted from 1982-1992, but then two major, multi-year declines occurred from 1993 to 2001, consistent with the drops in copepod abundance. It has been hypothesized that right whale calving rates are a function of both food availability and the number of females available to reproduce (Greene *et al.* 2003; Greene and Pershing 2004). Such findings suggest that future climate change may emerge as a significant factor influencing the recovery of right whales. Some believe the effects of increased climate variability on right whale calving rates should be incorporated into future modeling studies so that it may be possible to determine how sensitive right whale population numbers are to variable climate forcing (Greene and Pershing 2004).

Anthropogenic Mortality

The potential biological removal (PBR)¹⁰ for the Western Atlantic stock of North Atlantic right whale is 0.9 (Waring *et al.* 2014). Right whale recovery is negatively affected by anthropogenic mortality. From 2007 to 2011, right whales had the highest proportion relative to their population of reported entanglement and ship strike events of any species (Waring *et al.* 2014). Given the small population size and low annual reproductive rate of right whales, human sources of mortality may have a greater effect on population growth rate than for other large whale species (Waring *et al.* 2014). For the period 2007-2011, the annual human-caused mortality and serious injury rate for the North Atlantic right whale averaged 4.75 per year (Waring *et al.* 2014). This is derived from two components: 1) incidental fishery entanglement records at 3.25 per year and 2) ship strike records at 0.8 per year. These numbers represent the minimum values for serious injury and mortality for this period. Given the range and distribution of right whales in the North Atlantic, and the fact that positively buoyant species like right whales may become negatively buoyant if injury prohibits effective feeding for prolonged periods, it is highly unlikely that all carcasses will be observed (Moore *et al.* 2004; Glass *et al.* 2009). Moreover, carcasses floating at sea often cannot be examined sufficiently and may generate false negatives if they are not towed to shore for further necropsy (Glass *et al.* 2009). Decomposed and/or unexamined animals represent lost data, some of which may relate to human impacts (Waring *et al.* 2012).

Considerable effort has been made to examine right whale carcasses for the cause of death (Moore *et al.* 2004). Examination is not always possible or conclusive because carcasses may be discovered floating at sea and cannot be retrieved, or may be in such an advanced stage of decomposition that a complete examination is not possible. Wave action and post-mortem predation by sharks can also damage carcasses, and preclude a thorough examination of all body parts. It should be noted that mortality and serious injury event judgments are based upon the best available data and later information may result in revisions (Henry *et al.* 2012). Of the 6 total confirmed right whale mortalities (2007-2011) described in Waring *et al.* (2014), four were confirmed to be entanglement mortalities and two were confirmed to be ship strike mortalities. Serious injury involving right whales was documented for ten entanglement events and two ship strike events. In three of the entanglement cases, the fate of the animals were unknown.

Although disentanglement is often unsuccessful or not possible for many cases, there are several documented cases of entanglements for which the intervention of disentanglement teams averted a likely serious injury (Waring *et al.* 2014). Even when entanglement or vessel collision does not cause direct mortality, it may weaken or compromise an individual so that subsequent injury or death is more likely (Waring *et al.* 2014). Some right whales that have been entangled were later involved in ship strikes (Hamilton *et al.* 1998) suggesting that the animal may have become debilitated by the entanglement to such an extent that it was less able to avoid a ship. Similarly, skeletal fractures and/or broken jaws sustained during a vessel collision may heal, but then compromise a whale's ability to efficiently filter feed (Moore *et al.* 2007). A necropsy of right whale #2143 ("Lucky") found dead in January 2005 suggested the animal (and her near-term

¹⁰ Potential biological removal is the product of minimum population size, one-half the maximum net productivity rate and a "recovery" factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population.

fetus) died after healed propeller wounds from a ship strike re-opened and became infected as a result of pregnancy (Moore *et al.* 2007, Glass *et al.* 2008). Sometimes, even with a successful disentanglement, an animal may die of injuries sustained by fishing gear (e.g. RW #3107) (Waring *et al.* 2014).

Whales often free themselves of gear following an entanglement event, and as such, scarification analysis of living animals may provide better indications of fisheries interactions rather than entanglement records (Waring *et al.* 2014). A review of scars on identified individual right whales over a period of 30 years (1980–2009) documented 1,032 definite, unique entanglements events on the 626 individual whales identified (Knowlton *et al.* 2012). Most individual whales (83%) were entangled at least once, and almost half of them (306 of 626) were definitely entangled more than once. About a quarter of the individuals identified in each year (26%) were entangled in that year. Juveniles and calves were entangled at higher rates than were adults. Based on photographs of catalogued animals from 1935 through 1995, Hamilton *et al.* (1998) estimated that 6.4% of the North Atlantic right whale population exhibits signs of injury from vessel strikes.

Right whales are expected to be affected by climate change; however, no significant climate change-related impacts to right whales have been observed to date. The impact of climate change on cetaceans is likely to be related to changes in sea temperatures, potential freshening of sea water due to melting ice and increased rainfall, sea level rise, the loss of polar habitats, and the potential decline of forage.

The North Atlantic right whale currently has a range of sub-polar to sub-tropical waters. An increase in water temperature would likely result in a northward shift of range, with both the northern and southern limits moving poleward. The northern limit, which may be determined by feeding habitat and the distribution of preferred prey, may shift to a greater extent than the southern limit, which requires ideal temperature and water depth for calving. This may result in an unfavorable effect on the North Atlantic right whale due to an increase in the length of migrations (MacLeod 2009) or a favorable effect by allowing them to expand their range.

The indirect effects to right whales that may be associated with sea level rise are the construction of sea-wall defenses and protective measures for coastal habitats, which may impact coastal marine species and may interfere with migration (Learmonth *et al.* 2006). The effect of sea level rise to cetaceans is likely negligible.

The direct effects of increased CO₂ concentrations, and associated decrease in pH (ocean acidification), on marine mammals are unknown (Learmonth *et al.* 2006). Marine plankton is a vital food source for many marine species. Studies have demonstrated adverse impacts from ocean acidification on the ability of free-swimming zooplankton to maintain protective shells as well as a reduction in the survival of larval marine species. A decline in marine plankton could have serious consequences for the marine food web.

Summary of Right Whale Status

In March 2008, NMFS listed the North Atlantic right whale as a separate, endangered species (*Eubalaena glacialis*) under the ESA. This decision was based on an analysis of the best

scientific and commercial data available, taking into consideration current population trends and abundance, demographic risk factors affecting the continued survival of the species, and ongoing conservation efforts. NMFS determined that the North Atlantic right whale is in danger of extinction throughout its range because of: (1) overuse for commercial, recreational, scientific, or educational purposes; (2) the inadequacy of existing regulatory mechanisms; and (3) other natural and manmade factors affecting its continued existence.

Previous models estimated that the right whale population in the Atlantic numbered 300 (+/- 10%) (Best *et al.* 2001). However, an October 2012 review of the photo-ID recapture database indicated that 455 individually recognized right whales were known to be alive in 2010 (Waring *et al.* 2014). The 2000/2001-2010/2011 calving seasons had relatively high calf production (31, 21, 19, 17, 28, 19, 23, 23, 39, 19, and 22 calves, respectively) and included additional first time mothers (*e.g.*, eight new mothers in 2000/2001) (Waring *et al.* 2009, 2014).

Over the five-year period 2007-2011, the annual human-caused mortality and serious injury rate for the North Atlantic right whale averaged 4.75 per year (Waring *et al.* 2014). This represents an absolute minimum number of the right whale serious injury and mortalities for this period. Given the range and distribution of right whales in the North Atlantic, it is highly unlikely that all carcasses will be observed. Scarification analysis indicates that some whales do survive encounters with ships and fishing gear. However, the long-term consequences of these interactions are unknown. Right whales are adversely affected by human causes of mortality. This mortality appears to have a greater impact on the population growth rate of right whales, compared to other baleen whales in the western North Atlantic, given the small population size and low annual reproductive rate of right whales (Waring *et al.* 2014).

A variety of modeling exercises and analyses indicate that survival probability declined in the 1990s (Best *et al.* 2001), and mortalities in 2004-2005, including a number of adult females, also suggested an increase in the annual mortality rate (Kraus *et al.* 2005). Nonetheless, a census of the minimum number alive population index calculated from the individual sightings database as of October 29, 2012 for the years 1990-2010 suggest a positive trend in numbers of right whales (Waring *et al.* 2014). In addition, calving intervals appear to have declined to three years in recent years (Kraus *et al.* 2007), and calf production has been relatively high over the past several seasons.

3.2.1.2 Humpback Whales

Humpback whales inhabit all major ocean basins from the equator to subpolar latitudes. With the exception of the northern Indian Ocean population, they generally follow a predictable migratory pattern in both southern and northern hemispheres, feeding during the summer in the higher near-polar latitudes and migrating to lower latitudes in the winter where calving and breeding takes place (Perry *et al.* 1999). Humpbacks are listed as endangered under the ESA at the species level and are considered depleted under the MMPA. Therefore, information is presented below regarding the status of humpback whales throughout their range.

North Pacific, Northern Indian Ocean, and Southern Hemisphere

Humpback whales in the North Pacific feed in coastal waters from California to Russia and in the Bering Sea. They migrate south to wintering destinations off Mexico, Central America, Hawaii, southern Japan, and the Philippines (Carretta *et al.* 2011). Although the IWC only considered one stock (Donovan 1991) there is evidence to indicate multiple populations migrating between their summer/fall feeding areas to winter/spring calving and mating areas within the North Pacific Basin (Angliss and Outlaw 2007, Carretta *et al.* 2011).

NMFS recognizes three management units within the U.S. EEZ in the Pacific for the purposes of managing this species under the MMPA. These are: the California-Oregon-Washington stock (feeding areas off the U.S. west coast), the central North Pacific stock (feeding areas from Southeast Alaska to the Alaska Peninsula) and the western North Pacific stock (feeding areas from the Aleutian Islands, the Bering Sea, and Russia) (Carretta *et al.* 2011). Because fidelity appears to be greater in feeding areas than in breeding areas, the stock structure of humpback whales is defined based on feeding areas (Carretta *et al.* 2011). Recent research efforts via the Structure of Populations, Levels of Abundance, and Status of Humpback Whales (SPLASH) Project estimate the abundance of humpback whales to be just under 20,000 whales for the entire North Pacific, a number that doubles previous population predictions (Calambokidis *et al.* 2008). There are indications that the California-Oregon-Washington stock was growing in the 1980s and early 1990s, with a best estimate of 8% growth per year (Carretta *et al.* 2011). The best available estimate for the California-Oregon-Washington stock is 2,043 whales (Carretta *et al.* 2011). The central North Pacific stock is estimated at 4,005 (Allen and Angliss 2011), and various studies report that it appears to have increased in abundance at rates between 6.6%-10% per year (Allen and Angliss 2011). Although there is no reliable population trend data for the western North Pacific stock, as surveys of the known feeding areas are incomplete and many feeding areas remain unknown, minimum population size is currently estimated at 732 whales (Allen and Angliss 2011).

The Northern Indian Ocean population of humpback whales consists of a resident stock in the Arabian Sea, which apparently does not migrate (Minton *et al.* 2008). The lack of photographic matches with other areas suggests this is an isolated subpopulation. The Arabian Sea subpopulation of humpback whales is geographically, demographically, and genetically isolated, residing year-round in sub-tropical waters of the Arabian Sea (Minton *et al.* 2008). Although potentially an underestimate due to small sample sizes and insufficient spatial and temporal coverage of the population's suspected range, based on photo-identification, the abundance estimate off the coast of Oman is 82 animals [60-111 95% confidence interval (CI)](Minton *et al.* 2008).

The Southern Hemisphere population of humpback whales is known to feed mainly in the Antarctic, although some have been observed feeding in the Benguela Current ecosystem on the migration route west of South Africa (Reilly *et al.* 2008). The IWC Scientific Committee recognizes seven major breeding stocks, some of which are tentatively further subdivided into substocks. The seven major breeding stocks, with their respective breeding ground estimates in parenthesis, include Southwest Atlantic (6,251), Southeast Atlantic (1,594), Southwestern Indian Ocean (5,965), Southeastern Indian Ocean (10,032), Southwest Pacific (7,472), Central South Pacific (not available), and Southeast Pacific (2,917) (Reilly *et al.* 2008). The total abundance estimate of 36,600 humpback whales for the Southern Hemisphere is negatively biased due to no

available abundance estimate for the Central South Pacific subpopulation and only a partial estimate for the Southeast Atlantic subpopulation. Additionally, these abundance estimates have been obtained on each subpopulation's wintering grounds, and the possibility exists that the entire population does not migrate to the wintering grounds (Reilly *et al.* 2008).

Like other whales, Southern Hemisphere humpback whales were heavily exploited for commercial whaling. Although they were given protection by the IWC in 1963, Soviet-era whaling data made available in the 1990s revealed that 48,477 Southern Hemisphere humpback whales were taken from 1947 to 1980, contrary to the original reports to the IWC which accounted for the take of only 2,710 humpbacks (Zemsky *et al.* 1995; IWC 1995; Perry *et al.* 1999).

Gulf of Maine (North Atlantic)

Humpback whales from most Atlantic feeding areas calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod bays. Previously, the North Atlantic humpback whale population was treated as a single stock for management purposes, however due to the strong fidelity to the region displayed by many whales, the Gulf of Maine stock was reclassified as a separate feeding stock (Waring *et al.* 2012). The Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and northern Norway are the other regions that represent relatively discrete subpopulations. Sightings are most frequent from mid-March through November between 41°N and 43°N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982) and peak in May and August. Small numbers of individuals may be present in this area, including the waters of Stellwagen Bank, year-round. They feed on small schooling fishes, particularly sand lance and Atlantic herring, targeting fish schools and filtering large amounts of water for their associated prey. Humpback whales may also feed on euphausiids (krill) as well as on capelin (Waring *et al.* 2010; Stevick *et al.* 2006).

In winter, whales from waters off New England, Canada, Greenland, Iceland, and Norway migrate to mate and calve primarily in the West Indies, where spatial and genetic mixing among these groups occurs (Waring *et al.* 2014). Various papers (Clapham and Mayo 1990; Clapham 1992; Barlow and Clapham 1997; Clapham *et al.* 1999) summarize information gathered from a catalogue of photographs of 643 individuals from the western North Atlantic population of humpback whales. These photographs identified reproductively mature western North Atlantic humpbacks wintering in tropical breeding grounds in the Antilles, primarily on Silver and Navidad banks north of the Dominican Republic. The primary winter range also includes the Virgin Islands and Puerto Rico (NMFS 1991a). Acoustic recordings made on Stellwagen Bank National Marine Sanctuary in 2006 and 2008 detected humpback song in almost all months, including throughout the winter (Vu *et al.* 2012). This confirms the presence of male humpback whales in the area (a mid-latitude feeding ground) through the winter in these years. In addition, photographic records from Newfoundland have shown a number of adult humpbacks remain there year-round, particularly on the island's north coast. In collaboration with colleagues in the French islands of St. Pierre and Miquelon, a new photographic catalogue and concurrent matching effort is being undertaken for this region (J. Lawson, DFO, pers. comm.).

Humpback whales use the Mid-Atlantic as a migratory pathway to and from the calving/mating grounds, but it may also be an important winter feeding area for juveniles. Since 1989, observations of juvenile humpbacks in the Mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle *et al.* 1993). Biologists theorize that non-reproductive animals may be establishing a winter feeding range in the Mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Swingle *et al.* (1993) identified a shift in distribution of juvenile humpback whales in the nearshore waters of Virginia, primarily in winter months. Identified whales using the Mid-Atlantic area were found to be residents of the Gulf of Maine and Atlantic Canada (Gulf of St. Lawrence and Newfoundland) feeding groups, suggesting a mixing of different feeding populations in the Mid-Atlantic region. Strandings of humpback whales have increased between New Jersey and Florida since 1985, consistent with the increase in Mid-Atlantic whale sightings. Strandings between 1985 and 1992 were most frequent September through April in North Carolina and Virginia waters, and were composed primarily of juvenile humpback whales of no more than 11 meters in length (Wiley *et al.* 1995).

Abundance Estimates and Trends

Photographic mark-recapture analyses from the Years of the North Atlantic Humpback (YONAH) project gave an ocean-basin-wide estimate of 11,570 animals during 1992/1993 and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 whales (95% CI. = 8,000-13,600) (Stevick *et al.* 2003; Waring *et al.* 2014). For management purposes under the MMPA, the estimate of 11,570 individuals is regarded as the best available estimate for the North Atlantic population (Waring *et al.* 2014). The minimum population estimate for the Gulf of Maine stock is 823 whales, derived from a 2008 mark-recapture based count (Waring *et al.* 2014).

Population modeling, using data obtained from photographic mark-recapture studies, estimates the growth rate of the Gulf of Maine stock to be 6.5% for the period 1979-1991 (Barlow and Clapham 1997). More recent analysis for the period 1992-2000 estimated lower population growth rates ranging from 0% to 4.0%, depending on calf survival rate (Clapham *et al.* 2003 in Waring *et al.* 2014). However, it is unclear whether the apparent decline in growth rate is a bias result due to a shift in distribution documented for the period 1992-1995, or whether the population growth rates truly declined due to high mortality of young-of-the-year whales in U.S. Mid-Atlantic waters (Waring *et al.* 2014). Regardless, calf survival appears to have increased since 1996, presumably accompanied by an increase in population growth (Waring *et al.* 2012). Stevick *et al.* (2003) calculated an average population growth rate of 3.1% in the North Atlantic population overall for the period 1979-1993.

Anthropogenic Injury and Mortality

The PBR for the Gulf of Maine stock of humpback whale is 2.7. As with other large whales, the major known sources of anthropogenic mortality and injury of humpback whales occur from fishing gear entanglements and ship strikes. For the period 2007-2011, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged 11.2 animals per year (Waring *et al.* 2014). This value includes incidental fishery interaction records, 9.2; and records of vessel collisions, 2.0 (Waring *et al.* 2014). Between 2007 and 2011, humpback whale entanglements accounted for 8 mortalities and 36.5 serious injuries (Waring *et al.* 2014). In 2007-2011 there are 10 reports of serious injuries and mortalities as a

result of shipstrike. It was assumed that all of these events involved members of the Gulf of Maine stock of humpback whales unless a whale was confirmed to be from another stock. In reports prior to 2007, only events involving whales confirmed to be members of the Gulf of Maine stock were included. There were also many carcasses that washed ashore or were spotted floating at sea for which the cause of death could not be determined. Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or no necropsy performed) represent 'lost data,' some of which may relate to human impacts (Henry *et al.* 2012; Waring *et al.* 2012).

Based on photographs taken from 2000-2002 of the caudal peduncle and fluke of humpback whales, Robbins and Mattila (2004) estimated that at least half (48-57%) of the sample (187 individuals) was coded as having a high likelihood of prior entanglement. Evidence suggests that entanglements have occurred at a minimum rate of 8-10% per year. Scars acquired by Gulf of Maine humpback whales between 2000 and 2002 suggest a minimum of 49 interactions with gear. Based on composite scar patterns, male humpback whales appear to be more vulnerable to entanglement than females. Males may be subject to other sources of injury that could affect scar pattern interpretation. Of the images obtained from a humpback whale breeding ground, 24% showed raw injuries, presumably a result from agonistic interactions. However, current evidence suggests that breeding ground interactions alone cannot explain the higher frequency of healed scar patterns among Gulf of Maine male humpback whales (Robbins and Matilla 2004).

Humpback whales, like other baleen whales, may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources resulting from a variety of activities including fisheries operations, vessel traffic, and coastal development. Currently, there is no evidence that these types of activities are affecting humpback whales. However, Geraci *et al.* (1989) provide strong evidence that a mass mortality of humpback whales in 1987-1988 resulted from the consumption of mackerel whose livers contained high levels of saxitoxin, a naturally occurring red tide toxin, the origin of which remains unknown. The occurrence of a red tide event may be related to an increase in freshwater runoff from coastal development, leading some observers to suggest that such events may become more common among marine mammals as coastal development continues (Clapham *et al.* 1999). There were three additional known cases of a mass mortality involving large whale species along the East Coast between 1998 and 2008. In the 2006 mass mortality event, 21 dead humpback whales were found between July 10 and December 31, 2006, triggering NMFS to declare an unusual mortality event (UME) for humpback whales in the Northeast United States. The UME was officially closed on December 31, 2007 after a review of 2007 humpback whale strandings and mortality showed that the elevated numbers were no longer being observed. The cause of the 2006 UME is listed as “undetermined,” and the investigation has been closed, though could be re-opened if new information becomes available.

Changes in humpback whale distribution in the Gulf of Maine have been found to be associated with changes in herring, mackerel, and sand lance abundance associated with local fishing pressures (Stevick *et al.* 2006; Waring *et al.* 2014). Shifts in relative finfish species abundance correspond to changes in observed humpback whale movements (Stevick *et al.* 2006). However, whether humpback whales were adversely affected by these trophic changes is unknown.

Humpback whales are expected to be affected by climate change; however, no significant climate change-related impacts to humpback whales have been observed to date. The impact of climate change on cetaceans is likely to be related to changes in sea temperatures, potential freshening of sea water due to melting ice and increased rainfall, sea level rise, the loss of polar habitats, and the potential decline of forage.

Of the main factors affecting distribution of cetaceans, water temperature appears to be the main influence on geographic ranges of cetacean species (MacLeod 2009). Humpback whales are distributed in all water temperature zones, therefore, it is unlikely that their range will be directly affected by an increase in water temperature.

The indirect effects to humpback whales that may be associated with sea level rise are the construction of sea-wall defenses and protective measures for coastal habitats, which may impact coastal marine species and may interfere with migration (Learmonth *et al.* 2006). Cetaceans are unlikely to be directly affected by sea level rise, although important coastal bays for humpback breeding could be affected (IWC 1997).

The direct effects of increased CO₂ concentrations, and associated decrease in pH (ocean acidification), on marine mammals are unknown (Learmonth *et al.* 2006). Marine plankton is a vital food source for many marine species. Studies have demonstrated adverse impacts from ocean acidification on the ability of free-swimming zooplankton to maintain protective shells as well as a reduction in the survival of larval marine species.

Summary of Humpback Whale Status

The best available population estimate for humpback whales in the North Atlantic Ocean is 11,570 animals, and the best recent estimate for the Gulf of Maine stock is 823 whales (Waring *et al.* 2014). Anthropogenic mortality associated with fishing gear entanglements and ship strikes remains significant. In the winter, mating and calving occurs in areas located outside of the U.S. where the species is afforded less protection. Despite all of these factors, current data suggest that the Gulf of Maine humpback stock is steadily increasing in size (Waring *et al.* 2014). This is consistent with an estimated average trend of 3.1% in the North Atlantic population overall for the period 1979-1993 (Stevick *et al.* 2003). With respect to the species overall, there are also indications of increasing abundance for the California-Oregon-Washington, central North Pacific, and Southern Hemisphere stocks: Southwest Atlantic, Southeast Atlantic, Southwest Indian Ocean, Southeast Indian Ocean, and Southwest Pacific. Trend data is lacking for the western North Pacific stock, the central South Pacific and Southeast Pacific subpopulations of the southern hemisphere humpback whales, and the northern Indian Ocean humpbacks.

3.2.1.3 Fin Whales

The fin whale (*Balaenoptera physalus*) is listed as endangered under the ESA and also is designated as depleted under the MMPA. Fin whales inhabit a wide range of latitudes between 20-75°N and 20-75°S (Perry *et al.* 1999). The fin whale is ubiquitous in the North Atlantic and occurs from the Gulf of Mexico and Mediterranean Sea northward to the edges of the Arctic ice pack (NMFS 1998b). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on

acoustic recordings from hydrophone arrays, Clark (1995) reported a general southward flow pattern of fin whales in the fall from the Labrador/Newfoundland region, past Bermuda, and into the West Indies. The overall distribution may be based on prey availability, as this species preys opportunistically on both invertebrates and fish (Watkins *et al.* 1984). Fin whales feed by gulping prey concentrations and filtering the water for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments.

Pacific Ocean

Within U.S. waters of the Pacific, fin whales are found seasonally off the coast of North America and Hawaii and in the Bering Sea during the summer (Allen and Angliss 2010). Although stock structure in the Pacific is not fully understood, NMFS recognizes three fin whale stocks in U.S. Pacific waters for the purposes of managing this species under the MMPA. These are: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii (Carretta *et al.* 2011). Reliable estimates of current abundance for the entire Northeast Pacific fin whale stock are not available (Allen and Angliss 2010). A provisional population estimate of 5,700 was calculated for the Alaska stock west of the Kenai Peninsula by adding estimates from multiple surveys (Allen and Angliss 2010). This can be considered a minimum estimate for the entire stock because the surveys covered only a portion of its range (Allen and Angliss 2010). An annual population increase of 4.8% between 1987-2003 was estimated for fin whales in coastal waters south of the Alaska Peninsula (Allen and Angliss 2010). This is the first estimate of population trend for North Pacific fin whales; however, it must be interpreted cautiously due to the uncertainty in the initial population estimate and the population structure (Allen and Angliss 2010). The best available estimate for the California/Washington/Oregon stock is 3,044, which is likely an underestimate (Carretta *et al.* 2011). The best available estimate for the Hawaii stock is 174, based on a 2002 line-transect survey (Carretta *et al.* 2011).

Stock structure for fin whales in the Southern Hemisphere is unknown. Prior to commercial exploitation, the abundance of Southern Hemisphere fin whales was estimated at 400,000 (IWC 1979, Perry *et al.* 1999). There are no current estimates of abundance for Southern Hemisphere fin whales. Since these fin whales do not occur in U.S. waters, there is no recovery plan or stock assessment report for the Southern Hemisphere fin whales.

North Atlantic

NMFS has designated one population of fin whales in U.S. waters of the North Atlantic (Waring *et al.* 2012). This species is commonly found from Cape Hatteras northward. Researchers have suggested the existence of fin whale subpopulations in the North Atlantic based on local depletions resulting from commercial overharvesting (Mizroch and York 1984) or genetics data (Bérubé *et al.* 1998). Photo-identification studies in western North Atlantic feeding areas, particularly in Massachusetts Bay, have shown a high rate of annual return by fin whales, both within years and among years (Seipt *et al.* 1990) suggesting some level of site fidelity. The Scientific Committee of the International Whaling Commission (IWC) has proposed stock boundaries for North Atlantic fin whales. Fin whales off the eastern United States, Nova Scotia, and southeastern coast of Newfoundland are believed to constitute a single stock of fin whales under the present IWC scheme (Donovan 1991). However, it is uncertain whether the proposed boundaries define biologically isolated units (Waring *et al.* 2014).

During the 1978-1982 aerial surveys, fin whales accounted for 24% of all cetaceans and 46% of all large cetaceans sighted over the continental shelf between Cape Hatteras and Nova Scotia (Waring *et al.* 2014). Underwater listening systems have also demonstrated that the fin whale is the most acoustically common whale species heard in the North Atlantic (Clark 1995). The single most important area for this species appeared to be from the Great South Channel, along the 50 meter isobath past Cape Cod, over Stellwagen Bank, and past Cape Ann to Jeffreys Ledge (Hain *et al.* 1992).

Like right and humpback whales, fin whales are believed to use North Atlantic waters primarily for feeding, and more southern waters for calving. However, evidence regarding where the majority of fin whales winter, calve, and mate is still scarce. Clark (1995) reported a general pattern of fin whale movements in the fall from the Labrador/Newfoundland region, south past Bermuda and into the West Indies, but neonate strandings along the U.S. Mid-Atlantic coast from October through January suggest the possibility of an offshore calving area (Hain *et al.* 1992).

Fin whales achieve sexual maturity at 6-10 years of age in males and 7-12 years in females (Jefferson *et al.* 2008), although physical maturity may not be reached until 20-30 years (Aguilar and Lockyer 1987). Conception is believed to occur in tropical and subtropical areas during the winter with birth of a single calf after an 11-12 month gestation (Jefferson *et al.* 2008). The calf is weaned 6-11 months after birth (Perry *et al.* 1999). The mean calving interval is 2.7 years (Agler *et al.* 1993).

The predominant prey of fin whales varies greatly in different geographical areas depending on what is locally available (IWC 1992). In the western North Atlantic, fin whales feed on a variety of small schooling fish (*i.e.*, herring, capelin, sand lance).

Population Trends and Status

Various estimates have been provided to describe the current status of fin whales in western North Atlantic waters. One method used the catch history and trends in Catch Per Unit Effort (CPUE) to obtain an estimate of 3,590 to 6,300 fin whales for the entire western North Atlantic (Perry *et al.* 1999). Hain *et al.* (1992) estimated that about 5,000 fin whales inhabit the Northeastern U.S. continental shelf waters. The 2013 Stock Assessment Report (SAR) gives a best estimate of abundance for fin whales in the western North Atlantic of 3,522 (CV = 0.27). However, this estimate must be considered extremely conservative in view of the incomplete coverage of the known habitat of the stock and the uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas (Waring *et al.* 2014). The minimum population estimate for the western North Atlantic fin whale is 2,817 (Waring *et al.* 2014). However, there are insufficient data at this time to determine population trends for the fin whale (Waring *et al.* 201). The PBR for the western North Atlantic fin whale is 5.6.

Other estimates of the abundance of fin whales in the North Atlantic are presented in Pike *et al.* (2008) and Hammond *et al.* (2011). Pike *et al.* (2008) estimates the abundance of fin whales to be 27,493 (CV 0.2) in waters around Iceland and the Denmark Strait. Hammond *et al.* (2008) estimates the abundance of 19,354 (CV 0.24) fin whales in the eastern North Atlantic.

Anthropogenic Injury and Mortality

The major known sources of anthropogenic mortality and injury of fin whales include entanglement in commercial fishing gear and ship strikes. The minimum annual rate of confirmed human-caused serious injury and mortality to North Atlantic fin whales in U.S. and Canadian waters from 2007 to 2011 was 3.7 (Waring *et al.* 2014). This value includes incidental fishery interaction records, 2.3; and records of vessel collisions, 1.4. Fin whales are believed to be the cetacean most commonly struck by large vessels (Laist *et al.* 2001). In addition, hunting of fin whales continued well into the 20th century. Fin whales were given total protection in the North Atlantic in 1987 with the exception of an aboriginal subsistence whaling hunt for Greenland (Gambell 1993; Caulfield 1993). However, Iceland has increased its whaling activities in recent years and reported a catch of 136 whales in the 1988/89 and 1989/90 seasons (Perry *et al.* 1999), seven in 2006/07, and 273 in 2009/2010. Fin whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources resulting from a variety of activities.

Fin whales are expected to be affected by climate change; however, no significant climate change-related impacts to fin whales have been observed to date. The impact of climate change on cetaceans is likely to be related to changes in sea temperatures, potential freshening of sea water due to melting ice and increased rainfall, sea level rise, the loss of polar habitats, and the potential decline of forage.

Of the factors affecting geographic distribution of cetaceans, water temperature appears to be the main influence, with other factors primarily influencing how individuals are distributed within their ranges (MacLeod 2009). Cetacean species most likely to be affected by increases in water temperature are those with ranges restricted to non-tropical waters and with a preference for shelf waters. Fin whales are distributed in all water temperature zones, therefore, it is unlikely that their range will be directly affected by an increase in water temperature.

The indirect effects to fin whales that may be associated with sea level rise are the construction of sea-wall defenses and protective measures for coastal habitats, which may impact coastal marine species and may interfere with migration (Learmonth *et al.* 2006). The effect of sea level rise to fin whales is likely negligible.

The direct effects of increased CO₂ concentrations, and associated decrease in pH (ocean acidification), on marine mammals are unknown (Learmonth *et al.* 2006). Marine plankton is a vital food source for many marine species. Studies have demonstrated adverse impacts from ocean acidification on the ability of free-swimming zooplankton to maintain protective shells as well as a reduction in the survival of larval marine species. A decline in marine plankton could have serious consequences for the marine food web.

Summary of Fin Whale Status

Information on the abundance and population structure of fin whales worldwide is limited. NMFS recognizes three fin whale stocks in the Pacific for the purposes of managing this species under the MMPA. Reliable estimates of current abundance for the entire Northeast Pacific fin whale stock are not available (Angliss *et al.* 2001). Stock structure for fin whales in the Southern Hemisphere is unknown and there are no current estimates of abundance for Southern

Hemisphere fin whales. As noted above, the best population estimate for the western North Atlantic fin whale is 3,522 and the minimum population estimate is 2,817. The 2013 SAR indicates that there are insufficient data at this time to determine population trends for the fin whale. Fishing gear appears to pose less of a threat to fin whales in the North Atlantic Ocean than to North Atlantic right or humpback whales. However, commercial whaling for fin whales in the North Atlantic has resumed and fin whales continue to be struck by large vessels. Based on the information currently available, for the purposes of this Opinion, NMFS considers the population trend for fin whales to be undetermined.

3.2.1.4 Sei Whales

The sei whale (*Balaenoptera borealis*) is listed as endangered under the ESA and is designated as depleted under the MMPA. Sei whales are a widespread species in the world's temperate, subpolar, subtropical, and tropical marine waters. Sei whales reach sexual maturity at 5-15 years of age. The calving interval is believed to be two to three years (Perry *et al.* 1999).

North Pacific and Southern Hemisphere

The IWC only considers one stock of sei whales in the North Pacific (Donovan 1991), but for NMFS management purpose under the MMPA, sei whales within the Pacific U.S. EEZ are divided into three discrete non-contiguous areas: 1) waters around Hawaii, 2) California, Oregon, and Washington waters, and 3) Alaskan waters (Carretta *et al.* 2011). There are no abundance estimates for sei whales in the entire eastern North Pacific. The best estimate of abundance for California, Oregon, and Washington waters out to 300 nautical miles is 126 (CV=0.53) sei whales (Barlow and Forney 2007; Forney 2007; Carretta *et al.* 2011). No fishery related serious injuries or mortalities have been documented from 2004 through 2008 in the eastern North Pacific stock of sei whales (Carretta *et al.* 2011). During 2002-2008 there was one reported ship strike mortality in Washington in 2003 (NMFS Northwest Regional Office, unpublished data). The Hawaiian stock includes animals found both within the Hawaiian Islands EEZ and in adjacent international waters; however, because data on abundance, distribution, and human-caused impacts are largely lacking for international waters, the status of this stock is evaluated based on data from U.S. EEZ waters of the Hawaiian Islands (Carretta *et al.* 2011). The best estimate of abundance for the Hawaiian stock of sei whales is 77 (CV=1.06). Between 2004 and 2008, no human-caused serious injury or mortality was documented in the Hawaiian stock of sei whales (Carretta *et al.* 2011).

The stock structure of sei whales in the Southern Hemisphere is unknown. Like other whale species, sei whales in the Southern Hemisphere were heavily impacted by commercial whaling, particularly in the mid-20th century as humpback, fin, and blue whales became scarce. Sei whales were protected by the IWC in 1977 after their numbers had substantially decreased and they also became more difficult to find (Perry *et al.* 1999). Since Southern Hemisphere sei whales do not occur in U.S. waters, there is no stock assessment report for Southern Hemisphere sei whales.

North Atlantic

NMFS considers sei whales in the North Atlantic as one stock, known as the Nova Scotia stock (formerly known as the Western North Atlantic stock). Sei whales occur in deep water

throughout their range, typically over the continental slope or in basins situated between banks (NMFS 1998b). In the Northwest Atlantic, it is speculated that the whales migrate from south of Cape Cod along the eastern Canadian coast in June and July, and return on a southward migration again in September and October (Waring *et al.* 2014). Olsen *et al.* (2009) tracked a tagged sei whale that moved from the Azores to off eastern Canada; however, such a migration remains unverified. Within the U.S. Atlantic EEZ, the sei whale is most common on Georges Bank and into the Gulf of Maine/Bay of Fundy region during spring and summer, primarily in deeper waters. Recent springtime research in the Southwestern Gulf of Maine, suggests sei whales are reasonably common in this area in most years (Baumgartner *et al.* 2011). Although sei whales may prey upon small schooling fish and squid, available information suggests that calanoid copepods and euphausiids are the primary prey of this species (Flinn *et al.* 2002). Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy. However, there is no evidence to demonstrate interspecific competition between these species for food resources.

There is limited information on the stock identity of sei whales in the North Atlantic (Waring *et al.* 2012). For purposes of the Marine Mammal Stock Assessment Reports, and based on a proposed IWC stock definition, NMFS recognizes the sei whales occurring from the U.S. East Coast to Cape Breton, Nova Scotia, and east to 42°W as the “Nova Scotia stock” of sei whales (Waring *et al.* 2012).

Abundance Estimates and Trends

The 2011 abundance estimate of 357 sei whales (CV=0.52) is considered the best available for the Nova Scotia stock of sei whales according to the 2013 SAR (Waring *et al.* 2014). This estimate is considered extremely conservative because all of the known range of this stock was not surveyed, and because of uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas. Hammond *et al.* (2011) estimates the abundance of sei whales in European Atlantic waters to be 619 (CV of 0.34) for identified sightings identified to species. The minimum population estimate for this sei whale stock is 236 (Waring *et al.* 2014). Current and maximum net productivity rates are unknown for this stock. There are insufficient data to determine trends of the sei whale population (Waring *et al.* 2014).

Anthropogenic Injury and Mortality

The PBR for the Nova Scotia stock sei whale is 0.5. Few instances of injury or mortality of sei whales due to entanglement or vessel strikes have been recorded in U.S. waters, possibly because sei whales typically inhabit waters farther offshore than most commercial fishing operations, or perhaps entanglements do occur but are less likely to be observed. The minimum annual rate of confirmed human-caused serious injury and mortality to Nova Scotian sei whales from 2007 to 2011 was 1.0 (Waring *et al.* 2014), which includes 0.4 fishery interaction records and 0.6 vessel collision records. Other impacts noted above for other baleen whales may also occur in this species (e.g., habitat degradation, etc.).

Sei whales are expected to be affected by climate change; however, no significant climate change-related impacts to sei whales have been observed to date. The impact of climate change on cetaceans is likely to be related to changes in sea temperatures, potential freshening of sea

water due to melting ice and increased rainfall, sea level rise, the loss of polar habitats and the potential decline of forage.

Of the main factors affecting distribution of cetaceans, water temperature appears to be the main influence on geographic ranges of cetacean species (MacLeod 2009). Sei whales currently range from sub-polar to tropical waters. An increase in water temperature may be a favorable affect on sei whales, allowing them to expand their range into higher latitudes (MacLeod 2009).

The indirect effects to sei whales, that may be associated with sea level rise, are the construction of sea-wall defenses and protective measures for coastal habitats, which may impact coastal marine species and may interfere with migration (Learmonth *et al.* 2006). The effect of sea level rise to sei whales is likely negligible.

The direct effects of increased CO₂ concentrations, and associated decrease in pH (ocean acidification), on marine mammals are unknown (Learmonth *et al.* 2006). Marine plankton is a vital food source for many marine species. Studies have demonstrated adverse impacts from ocean acidification on the ability of free-swimming zooplankton to maintain protective shells as well as a reduction in the survival of larval marine species. A decline in marine plankton could have serious consequences for the marine food web.

Summary of Sei Whale Status

The best estimate of abundance for the Nova Scotia stock of sei whales is 357 (Waring *et al.* 2014). There are insufficient data to determine trends of the Nova Scotian sei whale population. The minimum annual rate of confirmed human-caused serious injury and mortality to Nova Scotian sei whales from 2007 to 2011 was 1.0 (Waring *et al.* 2014). Information on the status of sei whale populations worldwide is similarly lacking. There are no abundance estimates for sei whales in the entire eastern North Pacific, however the best estimate of abundance for California, Oregon, and Washington waters out to 300 nautical miles is 126 (Carretta *et al.* 2011). The stock structure of sei whales in the Southern Hemisphere is unknown. Based on the information currently available, for the purposes of this Opinion, NMFS considers the population trend for sei whales to be undetermined.

3.2.2 Status of Sea Turtles

Sea turtles continue to be affected by many activities occurring on the nesting beaches and in the marine environment. Poaching, habitat modification and destruction, and nesting predation affect eggs, hatchlings, and nesting females while on land. Fishery interactions, vessel interactions, marine pollution, and non-fishery operations (*e.g.*, dredging, military activities, oil and gas exploration), for example, affect sea turtles in the neritic zone, which is defined as the marine environment extending from mean low water down to 200 meters (660 feet) in depth, generally corresponding to the continental shelf (Lalli and Parsons 1997; Encyclopedia Britannica 2010). Fishery interactions and marine pollution also affect sea turtles in the oceanic zone, which is defined as the open ocean environment where bottom depths are greater than 200 meters (Lalli

and Parsons 1997).¹¹ As a result, sea turtles still face many of the original threats that were the cause of their listing under the ESA several decades ago.

Leatherback, Kemp's ridley, and green sea turtles are listed under the ESA at the species level rather than as subspecies or distinct population segments (DPS), while loggerhead sea turtles are listed by DPS. Information on the range-wide status of each species is included, where appropriate. Additional background information on the range-wide status of these species, as well as a description and life history of the species, can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b, 2007c, 2007d), and recovery plans for the loggerhead sea turtle (NMFS and USFWS 1998a, 2008), leatherback sea turtle (NMFS and USFWS 1992b, 1998b), Kemp's ridley sea turtle (NMFS and USFWS 1992a), and green sea turtle (NMFS and USFWS 1991, 1998c).

3.2.2.1 Loggerhead Sea Turtle

The loggerhead is the most abundant species of sea turtle in U.S. waters. Loggerhead sea turtles are found in temperate and subtropical waters and occupy a range of habitats including offshore waters, continental shelves, bays, estuaries, and lagoons. They are exposed to a variety of natural and anthropogenic threats in the terrestrial and marine environment.

Listing History

Loggerhead sea turtles were listed as threatened throughout their global range on July 28, 1978. Since that time, several status reviews have been conducted to review the status and recommendations have been made regarding its ESA listing status. Based on a 2007 five-year status review of the species, which discussed the range of threats to loggerheads including climate change, NMFS and USFWS determined that loggerhead sea turtles should not be delisted or reclassified as endangered. However, the 2007 status review also determined that an analysis and review of the species should be conducted to determine whether DPSs should be identified for the loggerhead sea turtle (NMFS and USFWS 2007a). This initiative was supported by studies showing that genetic differences exist between loggerhead sea turtles that nest and forage in the different ocean basins (Bowen 2003; Bowen and Karl 2007). Differences in the maternally inherited mitochondrial DNA also exist between loggerhead nesting groups that occur within the same ocean basin (TEWG 2000; Pearce 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007; TEWG 2009; NMFS and USFWS 2008). Site fidelity of females to one or more nesting beaches in an area is believed to account for these genetic differences (TEWG 2000; Bowen 2003).

In part to evaluate those genetic differences, in 2008, NMFS and FWS established a Loggerhead Biological Review Team (BRT) to assess the global loggerhead population structure to determine whether DPSs exist and, if so, the status of each DPS. The BRT evaluated genetic

¹¹ As described in Bolten (2003), oceanographic terms have frequently been used incorrectly to describe sea turtle life stages. In both the sea turtle literature and past Opinions on the continued operation of NMFS-managed fisheries, the terms benthic and pelagic were used incorrectly to refer to the neritic and oceanic zones, respectively. The term benthic refers to occurring on the bottom of a body of water, whereas the term pelagic refers to in the water column. Sea turtles can be "benthic" or pelagic" in either the neritic or oceanic zones.

data, tagging and telemetry data, demographic information, oceanographic features, and geographic barriers to determine whether population segments exist. The BRT report was completed in August 2009 (Conant *et al.* 2009). In this report, the BRT identified the following nine DPSs as being discrete from other conspecific population segments and significant to the species: (1) North Pacific Ocean, (2) South Pacific Ocean, (3) North Indian Ocean, (4) Southeast Indo-Pacific Ocean, (5) Southwest Indian Ocean, (6) Northwest Atlantic Ocean, (7) Northeast Atlantic Ocean, (8) Mediterranean Sea, and (9) South Atlantic Ocean.

The BRT concluded that, although some DPSs are showing increasing trends at nesting beaches (Southwest Indian Ocean and South Atlantic Ocean), available information about anthropogenic threats to juveniles and adults in neritic and oceanic environments indicate possible unsustainable additional mortalities. According to an analysis using expert opinion in a matrix model framework, the BRT report stated that all loggerhead DPSs have the potential to decline in the foreseeable future. Based on the threat matrix analysis, the potential for future decline was reported as greatest for the North Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, and South Atlantic Ocean DPSs (Conant *et al.* 2009). The BRT concluded that the North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Southeast Indo-Pacific Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, and Mediterranean Sea DPSs were at risk of extinction. The BRT concluded that although the Southwest Indian Ocean and South Atlantic Ocean DPSs were likely not currently at immediate risk of extinction, the extinction risk was likely to increase in the foreseeable future.

On March 16, 2010, NMFS and USFWS published a proposed rule (75 FR 12598) that would divide the worldwide population of loggerhead sea turtles into nine DPSs, as described in the 2009 Status Review. Two of the DPSs were proposed to be listed as threatened and seven of the DPSs, including the Northwest Atlantic Ocean DPS, were proposed to be listed as endangered. NMFS and USFWS accepted comments on the proposed rule through September 13, 2010 (75 FR 30769, June 2, 2010). On March 22, 2011 (76 FR 15932), NMFS and USFWS extended the date by which a final determination would be made and solicited new information and analysis. This action was taken to address the interpretation of the existing data on status and trends and its relevance to the assessment of risk of extinction for the Northwest Atlantic Ocean DPS, as well as the magnitude and immediacy of the fisheries bycatch threat and measures to reduce this threat.

On September 22, 2011, NMFS and USFWS issued a final rule (76 FR 58868) determining that the loggerhead sea turtle population is composed of nine DPSs (as defined in Conant *et al.*, 2009). Five DPSs were listed as endangered (North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea), and four DPSs were listed as threatened (Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean). Note that the Northwest Atlantic Ocean (NWA) DPS and the Southeast Indo-Pacific Ocean DPS were originally proposed as endangered. The NWA DPS was determined to be threatened based on review of nesting data available after the proposed rule was published, information provided in public comments on the proposed rule, and further discussions within the agencies. The two primary factors considered were population abundance and population trend. NMFS and USFWS found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, that the overall nesting

population remains widespread, that the trend for the nesting population appears to be stabilizing, and that substantial conservation efforts are underway to address threats. This final listing rule became effective on October 24, 2011.

The September 2011 final rule also noted that critical habitat for the two DPSs occurring within U.S. waters (NWA DPS and North Pacific DPS) would be designated in a future rulemaking. Information from the public related to the identification of critical habitat, essential physical or biological features for this species, and other relevant impacts of a critical habitat designation was solicited. Currently, no critical habitat is designated for any DPS of loggerhead sea turtles, and therefore, no critical habitat for any DPS occurs in the action area.

Presence of Loggerhead Sea Turtles in the Action Area

The effects of this proposed action are only experienced within the Atlantic Ocean. NMFS has considered the available information on the distribution of the nine DPSs to determine the origin of any loggerhead sea turtles that may occur in the action area. As noted in Conant *et al.* (2009), the range of the four DPSs occurring in the Atlantic Ocean are as follows: NWA DPS – north of the equator, south of 60°N, and west of 40°W; Northeast Atlantic Ocean (NEA) DPS – north of the equator, south of 60°N, east of 40°W, and west of 5°36' W; South Atlantic DPS – south of the equator, north of 60°S, west of 20°E, and east of 60°W; Mediterranean DPS – the Mediterranean Sea east of 5°36'W. These boundaries were determined based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. While adults are highly structured with no overlap, there may be some degree of overlap by juveniles of the NWA, NEA, and Mediterranean DPSs on oceanic foraging grounds (Laurent *et al.* 1993, 1998; Bolten *et al.* 1998; LaCasella *et al.* 2005; Carreras *et al.* 2006, Monzón-Argüello *et al.* 2006; Revelles *et al.* 2007). Previous literature (Bowen *et al.* 2004) has suggested that there is the potential, albeit small, for some juveniles from the Mediterranean DPS to be present in U.S. Atlantic coastal foraging grounds. These conclusions must be interpreted with caution, however, as they may be representing a shared common haplotype and lack of representative sampling at Eastern Atlantic rookeries rather than an actual presence of Mediterranean DPS turtles in U.S. Atlantic coastal waters. A re-analysis of the data by the Atlantic loggerhead Turtle Expert Working Group has found that it is unlikely that U.S. fishing fleets are interacting with either the Northeast Atlantic loggerhead DPS or the Mediterranean loggerhead DPS (LaCasella *et al.* In Review). Given that the action area is a subset of the area fished by U.S. fleets, it is reasonable to assume that, based on this new analysis, no individuals from the Mediterranean DPS or Northeast Atlantic DPS would be present in the action area. Sea turtles of the South Atlantic DPS do not inhabit the action area of this consultation (Conant *et al.* 2009). The remainder of this consultation will only focus on the NWA DPS, listed as threatened.

Distribution and Life History

Ehrhart *et al.* (2003) provided a summary of the literature identifying known nesting habitats and foraging areas for loggerheads within the Atlantic Ocean. Detailed information is also provided in the five-year status review for loggerheads (NMFS and USFWS 2007a), the TEWG report (2009), and the final revised Recovery Plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008).

In the western Atlantic, waters as far north as southern Canada and the Gulf of Maine are used for foraging by juveniles and adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003; NMFS NEFSC 2011a, 2012, 2013). In U.S. Atlantic waters, loggerheads most commonly occur throughout the inner continental shelf from Florida to Cape Cod, MA and in the Gulf of Mexico from Florida to Texas, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Braun-McNeill *et al.* 2008; Mitchell *et al.* 2003). Loggerheads have been observed in waters with surface temperatures of 7°-30°C, but water temperatures $\geq 11^\circ\text{C}$ are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). The presence of loggerhead sea turtles in U.S. Atlantic waters is also influenced by water depth. Surveys of continental shelf waters north of Cape Hatteras, NC indicated that loggerhead sea turtles were most commonly sighted in waters with bottom depths ranging from 22 to 49 meters deep (Shoop and Kenney 1992). Loggerheads were observed in waters ranging in depth from 0 (*i.e.*, on the beach) to 4,481 meters (Shoop and Kenney 1992). More recent survey and satellite tracking data support that they occur in waters from the beach to beyond the continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; Mansfield 2006; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009).

Loggerhead sea turtles occur year-round in ocean waters off North Carolina, South Carolina, Georgia, and Florida. In these areas of the South Atlantic Bight, water temperature is influenced by the proximity of the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States (*e.g.*, Pamlico and Core Sounds) and also move up the U.S. Atlantic Coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2004), occurring in Virginia foraging areas as early as April/May and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some turtles may remain in Mid-Atlantic and Northeast areas until late fall. By December, loggerheads have migrated from inshore and more northern coastal waters to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (Shoop and Kenney 1992; Epperly *et al.* 1995b).

Recent studies have established that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009). One of the studies tracked the movements of adult post-nesting females and found that differences in habitat use were related to body size, with larger adults staying in coastal waters and smaller adults traveling to oceanic waters (Hawkes *et al.* 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse, with some remaining in neritic waters and others moving off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes *et al.* (2006) study, there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007).

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988; NMFS and USFWS 2008). Sub-adult and adult loggerheads are primarily coastal-dwelling and typically prey on benthic invertebrates, such as mollusks and decapod crustaceans, in hard bottom habitats (NMFS and USFWS 2008).

Table 6 (taken from the 2008 loggerhead recovery plan) highlights the key life history parameters for loggerheads nesting in the U.S.

Table 6 Typical values of life history parameters for loggerheads nesting in the U.S.

Life History Parameter	Data
Clutch Size	100-126 eggs ¹²
Egg incubation duration (varies depending on time of year and latitude)	42-75 days ^{13,14}
Pivotal temperature (incubation temperature that produces an equal number of males and females)	29.0°C ¹⁵
Nest productivity (emerged hatchlings/total eggs) x 100 (varies depending on site specific factors)	45-70% ^{2,3}
Clutch frequency (number of nests/female/season)	3-5.5 nests ¹⁶
Interesting interval (number of days between successive nests within a season)	12-15 days ¹⁷
Juvenile (<87 cm CCL) sex ratio	65-70% ¹⁸
Remigration interval (number of years between successive nesting migrations)	2.5-3.7 years ¹⁹
Nesting season	Late April-Early September
Hatching season	Late June-early November
Age at sexual maturity	32-25 years ²⁰
Life span	>57 years ²¹

Population Dynamics and Status

The majority of Atlantic nesting occurs on beaches of the southeastern United States (NMFS and USFWS 2007a). For the past decade, the scientific literature has recognized five distinct nesting groups, or subpopulations, of loggerhead sea turtles in the Northwest Atlantic, divided

¹² Dodd (1988).

¹³ Dodd and Mackinnon (1999, 2000, 2001, 2002, 2003, 2004).

¹⁴ Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=865).

¹⁵ Mrosovsky (1988).

¹⁶ Murphy and Hopkins (1984); Frazer and Richardson (1985); Ehrhart, unpublished data; Hawkes *et al.* (2005); Scott (2006); Tony Tucker, Mote Marine Laboratory, personal communication (2008).

¹⁷ Caldwell (1962); Dodd (1988).

¹⁸ National Marine Fisheries Service (2001); Allen Foley, FFWCC, personal communication (2005).

¹⁹ Richardson *et al.* (1978); Bjorndal *et al.* (1983); Ehrhart, unpublished data.

²⁰ Melissa Snover, NMFS, personal communication (2005).

²¹ Dahlen *et al.* (2000).

geographically as follows: (1) a northern group of nesting females that nest from North Carolina to northeast Florida at about 29°N; (2) a south Florida group of nesting females that nest from 29°N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle group of nesting females that nest around Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán group of nesting females that nest on beaches of the eastern Yucatán Peninsula, Mexico; and (5) a Dry Tortugas group that nests on beaches of the islands of the Dry Tortugas, near Key West, FL and on Cal Sal Bank (TEWG 2009). Genetic analyses of mitochondrial DNA, which a sea turtle inherits from its mother, indicate that there are genetic differences between loggerheads that nest at and originate from the beaches used by each of the five identified nesting groups of females (TEWG 2009). However, analyses of microsatellite loci from nuclear DNA, which represents the genetic contribution from both parents, indicates little to no genetic differences between loggerheads originating from nesting beaches of the five Northwest Atlantic nesting groups (Pearce and Bowen 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). These results suggest that female loggerheads have site fidelity to nesting beaches within a particular area, while males provide an avenue of gene flow between nesting groups by mating with females that originate from different nesting groups (Bowen 2003; Bowen *et al.* 2005). The extent of such gene flow, however, is unclear (Shamblin 2007).

The lack of genetic structure makes it difficult to designate specific boundaries for the nesting subpopulations based on genetic differences alone. Therefore, the Loggerhead Recovery Team recently used a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to reassess the designation of these subpopulations to identify recovery units in the 2008 Recovery Plan.

In the 2008 Recovery Plan, the Loggerhead Recovery Team designated five recovery units for the Northwest Atlantic population of loggerhead sea turtles based on the aforementioned nesting groups and inclusive of a few other nesting areas not mentioned above. The first four of these recovery units represent nesting assemblages located in the southeast United States. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the United States, but which occur within U.S. waters during some portion of their lives. The five recovery units representing nesting assemblages are: (1) the Northern Recovery Unit (NRU: Florida/Georgia border through southern Virginia), (2) the Peninsular Florida Recovery Unit (PFRU: Florida/Georgia border through Pinellas County, FL), (3) the Dry Tortugas Recovery Unit (DTRU: islands located west of Key West, FL), (4) the Northern Gulf of Mexico Recovery Unit (NGMRU: Franklin County, FL through Texas), and (5) the Greater Caribbean Recovery Unit (GCRU: Mexico through French Guiana, Bahamas, Lesser Antilles, and Greater Antilles).

The Loggerhead Recovery Team evaluated the status and trends of the Northwest Atlantic loggerhead population for each of the five recovery units, using nesting data available as of October 2008 (NMFS and USFWS 2008). The level and consistency of nesting coverage varies among recovery units, with coverage in Florida generally being the most consistent and thorough over time. Since 1989, nest count surveys in Florida have occurred in the form of statewide surveys (a near complete census of entire Florida nesting) and index beach surveys (Witherington *et al.* 2009). Index beaches were established to standardize data collection

methods and maintain a constant level of effort on key nesting beaches over time.

NMFS and USFWS (2008), Witherington *et al.* (2009), and TEWG (2009) analyzed the status of the nesting assemblages within the NWA DPS using standardized data collected over periods ranging from 10 to 23 years. These analyses used different analytical approaches, but all found that there had been a significant overall nesting decline within the NWA DPS. However, with the addition of nesting data from 2008 to 2012, the trend line changes, showing a strong positive trend since 2007 (<http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/>). The nesting data presented in the Recovery Plan (through 2008) are described below, with updated trend information through 2010 for two recovery units.

From the beginning of standardized index surveys in 1989 until 1998, the PFRU, the largest nesting assemblage in the Northwest Atlantic by an order of magnitude, had a significant increase in the number of nests. However, from 1998 through 2008, there was a 41% decrease in annual nest counts from index beaches, which represent an average of 70% of the statewide nesting activity (NMFS and USFWS 2008). From 1989 to 2008, the PFRU had an overall declining nesting trend of 26% (95% CI: -42% to -5%; NMFS and USFWS 2008). With the addition of nesting data through 2010, the nesting trend for the PFRU does not show a nesting decline statistically different from zero (76 FR 58868, September 22, 2011).

The NRU, the second largest nesting assemblage of loggerheads in the United States, has been declining at a rate of 1.3% annually since 1983 (NMFS and USFWS 2008). The trend was analyzed using nesting data available as of October 2008. The NRU dataset included 11 beaches with an uninterrupted 20-year time series; these beaches represent approximately 27% of NRU nesting in 2008. Through 2008, there was strong statistical data to suggest the NRU has experienced a long-term decline, but with the inclusion of nesting data through 2010, nesting for the NRU is showing possible signs of stabilizing (76 FR 58868, September 22, 2011).

Evaluation of long-term nesting trends for the NGMRU is difficult because of changed and expanded beach coverage. However, the NGMRU has shown a significant declining trend of 4.7% annually since index nesting beach surveys were initiated in 1997 (NMFS and USFWS 2008). The trend was analyzed using nesting data available as of October 2008.

No statistical trends in nesting abundance can be determined for the DTRU because of the lack of long-term data. Similarly, statistically valid analyses of long-term nesting trends for the entire GCRU are not available because there are few long-term standardized nesting surveys representative of the region. Additionally, changing survey effort at monitored beaches and scattered and low-level nesting by loggerheads at many locations currently precludes comprehensive analyses (NMFS and USFWS 2008).

Sea turtle census nesting surveys are important in that they provide information on the relative abundance of nesting each year, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 2008 Recovery Plan compiled information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (*i.e.*, nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead

nests per year (1989-2008) with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year (1989-2007) with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year (1995-2004, excluding 2002) with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year (1995-2007) with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated (1987-2001) (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there estimates of the number of nesting females per year for any nesting assemblage in this recovery unit. The above values for average nesting females per year were based upon 4.1 nests per female per Murphy and Hopkins (1984).

Genetic studies of juvenile and a few adult loggerhead sea turtles collected from Northwest Atlantic foraging areas (beach strandings, a power plant in Florida, and North Carolina fisheries) show that the loggerheads that occupy East Coast U.S. waters originate from these Northwest Atlantic nesting groups; primarily from the nearby nesting beaches of southern Florida, as well as the northern Florida to North Carolina beaches and from the beaches of the Yucatán Peninsula, Mexico (Rankin-Baransky *et al.* 2001; Witzell *et al.* 2002; Bass *et al.* 2004; Bowen *et al.* 2004). The contribution of these three nesting assemblages varies somewhat among the foraging habitats and age classes surveyed along the East Coast. The distribution is not random and bears a significant relationship to the proximity and size of adjacent nesting colonies (Bowen *et al.* 2004). Bass *et al.* (2004) attribute the differences in the proportions of sea turtles from loggerhead turtle nesting assemblages documented in different East Coast foraging habitats to a complex interplay of currents and the relative size and proximity of nesting beaches.

Unlike nesting surveys, in-water studies of sea turtles typically sample both sexes and multiple age classes. In-water studies conducted in some areas of the Northwest Atlantic provide data by which to assess the relative abundance of loggerhead sea turtles and changes in abundance over time (Maier *et al.* 2004; Morreale *et al.* 2005; Mansfield 2006; Ehrhart *et al.* 2007; Epperly *et al.* 2007). The TEWG (2009) used raw data from six in-water study sites to conduct trend analyses. They identified an increasing trend in the abundance of loggerheads from three of the four sites located in the southeast United States, no discernible trend at one site, and a decreasing at two sites in the northeast United States. The 2008 Loggerhead Recovery Plan also includes a full discussion of in-water population studies for which trend data have been reported, and a brief summary will be provided here.

Maier *et al.* (2004) used fishery-independent trawl data to establish a regional index of loggerhead abundance for the southeast coast of the United States (Winyah Bay, SC to St. Augustine, FL) during the period 2000-2003. A comparison of loggerhead catch data from this study with historical values suggested that in-water populations of loggerhead sea turtles along the southeast U.S. coast appear to be larger, possibly an order of magnitude higher than they were 25 years ago, but the authors caution a direct comparison between the two studies given differences in sampling methodology (Maier *et al.* 2004). A comparison of catch rates for sea turtles in pound net gear fished in the Pamlico-Albemarle Estuarine Complex of North Carolina between the years 1995-1997 and 2001-2003 found a significant increase in catch rates for loggerhead sea turtles for the latter period (Epperly *et al.* 2007). A long-term, on-going study of

loggerhead abundance in the Indian River Lagoon System of Florida found a significant increase in the relative abundance of loggerheads over the last four years of the study (Ehrhart *et al.* 2007). However, there was no discernible trend in loggerhead abundance during the 24-year time period of the study (1982-2006) (Ehrhart *et al.* 2007). At St. Lucie Power Plant, data collected from 1977 to 2004 show an increasing trend of loggerheads at the intake structures (FPL and Quantum Resources 2005).

In contrast to these studies, Morreale *et al.* (2005) observed a decline in the percentage and relative numbers of loggerhead sea turtles incidentally captured in pound net gear fished around Long Island, New York during the period 2002-2004 compared to the period 1987-1992. Only two loggerheads (of a total 54 turtles) were observed captured in pound net gear during the period 2002-2004, while the previous decade's study recorded 11 to 28 loggerheads per year (Morreale *et al.* 2005). No additional loggerheads were reported captured in pound net gear in New York through 2007, although two were found cold-stunned on Long Island Bay beaches in the fall of 2007 (Memo to the File, L. Lankshear, December 2007). Potential explanations for this decline include major shifts in loggerhead foraging areas and/or increased mortality in pelagic or early benthic stage/age classes (Morreale *et al.* 2005). Using aerial surveys, Mansfield (2006) also found a decline in the densities of loggerhead sea turtles in Chesapeake Bay over the period 2001-2004 compared to aerial survey data collected in the 1980s. Significantly fewer loggerheads ($p < 0.05$) were observed in both the spring (May-June) and the summer (July-August) of 2001-2004 compared to those observed during aerial surveys in the 1980s (Mansfield 2006). A comparison of median densities from the 1980s to the 2000s suggested that there had been a 63.2% reduction in densities during the spring residency period and a 74.9% reduction in densities during the summer residency period (Mansfield 2006). The decline in observed loggerhead populations in Chesapeake Bay may be related to a significant decline in prey, namely horseshoe crabs and blue crabs, with loggerheads redistributing outside of Bay waters (NMFS and USFWS 2008).

As with other turtle species, population estimates for loggerhead sea turtles are difficult to determine, largely given their life history characteristics. However, a recent loggerhead assessment using a demographic matrix model estimated that the loggerhead adult female population in the western North Atlantic ranges from 16,847 to 89,649, with a median size of 30,050 (NMFS SEFSC 2009). The model results for population trajectory suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. The pelagic stage survival parameter had the largest effect on the model results. As a result of the large uncertainty in our knowledge of loggerhead life history, at this point predicting the future populations or population trajectories of loggerhead sea turtles with precision is very uncertain. It should also be noted that additional analyses are underway which will incorporate any newly available information.

As part of the Atlantic Marine Assessment Program for Protected Species (AMAPPS), line transect aerial abundance surveys and turtle telemetry studies were conducted along the Atlantic Coast and annual reports for 2010, 2011, and 2012 have been produced. AMAPPS is a multi-agency initiative to assess marine mammal, sea turtle, and seabird abundance and distribution in the Atlantic. As presented in NMFS NEFSC (2011a), the 2010 survey found a preliminary total surface abundance estimate within the entire study area of about 60,000 loggerheads (CV=0.13)

or 85,000, if a portion of unidentified hard-shelled sea turtles were included (CV=0.10). Surfacing times were generated from the satellite tag data collected during the aerial survey period, resulting in a 7% (5%-11% inter-quartile range) median surface time in the South Atlantic area and a 67% (57%-77% inter-quartile range) median surface time to the north. The calculated preliminary regional abundance estimate is about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS NEFSC 2011a). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified turtle sightings. The density of loggerheads was generally lower in the north than the south; based on number of turtle groups detected, 64% were seen south of Cape Hatteras, NC, 30% in the southern Mid-Atlantic Bight, and 6% in the northern Mid-Atlantic Bight. These estimates of loggerhead abundance over the U.S. Atlantic continental shelf are considered very preliminary. A more thorough analysis will be completed pending the results of further studies related to improving estimates of regional and seasonal variation in loggerhead surface time (by increasing the sample size and geographical area of tagging) and other information needed to improve the biases inherent in aerial surveys of sea turtles (*e.g.*, research on depth of detection and species misidentification rate). This survey effort represents the most comprehensive assessment of sea turtle abundance and distribution in many years. Additional results from aerial surveys and research to improve the abundance estimates are anticipated through 2014, depending on available funds.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. The five-year status review and 2008 Recovery Plan provide a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007a, 2008). Among natural threats, hurricanes are known to be destructive to sea turtle nests. Sand accretion, rainfall, and wave action that result from these storms can appreciably reduce hatchling success. Other sources of natural mortality include cold-stunning, biotoxin exposure, and native species predation.

Anthropogenic factors that impact hatchlings and adult females on land, or the success of nesting and hatching include: beach erosion, beach armoring, and nourishment; artificial lighting; beach cleaning; beach pollution; increased human presence; recreational beach equipment; vehicular and pedestrian traffic; coastal development/construction; exotic dune and beach vegetation; removal of native vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (*e.g.*, raccoons, armadillos, and opossums), which raid nests and feed on turtle eggs (NMFS and USFWS 2007a, 2008). Although sea turtle nesting beaches are protected along large expanses of the Northwest Atlantic Coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerheads are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, transportation, marine

pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions.

A 1990 National Research Council (NRC) report concluded that for juveniles, subadults, and breeders in coastal waters, the most important source of human-caused mortality in U.S. Atlantic waters was fishery interactions. The sizes and reproductive values of sea turtles taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles (Wallace *et al.* 2008). The Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant *et al.* 2009). Attaining a more thorough understanding of the characteristics, as well as the quantity of sea turtle bycatch across all fisheries is of great importance.

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer-reviewed publications and NMFS documents (e.g., biological opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

Of the many fisheries known to adversely affect loggerheads, the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were considered to pose the greatest threat of mortality to neritic juvenile and adult age classes of loggerheads (NRC 1990; Finkbeiner *et al.* 2011). Significant changes to the South Atlantic and Gulf of Mexico shrimp fisheries have occurred since 1990, and the effects of these shrimp fisheries on ESA-listed species, including loggerhead sea turtles, have been assessed several times through section 7 consultations. There is also a lengthy regulatory history with regard to the use of Turtle Excluder Devices (TEDs) in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (Epperly and Teas 2002; NMFS 2002a; Lewison *et al.* 2003). A 2002 section 7 consultation on the U.S. South Atlantic and Gulf of Mexico shrimp fisheries estimated the total annual level of take for loggerhead sea turtles to be 163,160 interactions (the total number of turtles that enter a shrimp trawl, which may then escape through the TED or fail to escape and be captured) with 3,948 of those takes being lethal (NMFS 2002a).

In addition to improvements in TED design, interactions between loggerheads and the shrimp fishery had been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 South Atlantic and GOM Shrimp Opinion (NMFS 2002a) take estimates were based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of hurricanes in the Gulf of

Mexico have all impacted the shrimp fleets, in some cases reducing fishing effort by as much as 50% for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, loggerhead interactions and mortalities in the Gulf of Mexico were substantially less than were projected in the 2002 Opinion. In 2008, the NMFS Southeast Fisheries Science Center (SEFSC) estimated annual number of interactions between loggerheads and shrimp trawls in the Gulf of Mexico shrimp fishery to be 23,336, with 647 (2.8%) of those interactions resulting in mortality (Memo from Dr. B. Ponwith, Southeast Fisheries Science Center to Dr. R. Crabtree, Southeast Region, PRD, December 2008). In August 2010, NMFS reinitiated section 7 consultation on southeastern state and federal shrimp fisheries based on a high level of strandings, elevated nearshore sea turtle abundance as measured by trawl catch per unit of effort, and lack of compliance with TED requirements. The 2012 section 7 consultation on the shrimp fishery was unable to estimate the current total annual level of take for loggerheads. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least thousands and possibly tens of thousands of interactions annually, of which at least hundreds and possibly thousands are expected to be lethal (NMFS 2012a).

Loggerhead sea turtles are also known to interact with non-shrimp trawl, gillnet, longline, dredge, pound net, pot/trap, and hook and line fisheries. The reduction of sea turtle captures in fishing operations is identified in recovery plans and five-year status reviews as a priority for the recovery of all sea turtle species. In the threats analysis of the loggerhead Recovery Plan, trawl bycatch is identified as the greatest source of mortality. While loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawl gear was previously estimated for the period 1996-2004 (Murray 2006, 2008), a recent bycatch analysis estimated the number of loggerhead sea turtle interactions with U.S. Mid-Atlantic bottom trawl gear from 2005 to 2008 (Warden 2011a). NEFOP data from 1994 to 2008 were used to develop a model of interaction rates that were applied to 2005-2008 commercial fishing data to estimate the number of interactions for the trawl fleet. The number of predicted average annual loggerhead interactions for 2005-2008 was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls but being released through a TED. Of the 292 average annual observable loggerhead interactions, approximately 44 of those were adult equivalents. Warden (2011b) found that latitude, depth and SST were associated with the interaction rate, with the rates being highest south of 37°N in waters < 50 meters deep and SST > 15°C. This estimate is a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, estimated to be 616 sea turtles (CV=0.23, 95% CI over the nine-year period: 367-890) (Murray 2006, 2008).

There have been several published estimates of the number of loggerheads taken annually as a result of the dredge fishery for Atlantic sea scallops, ranging from a low of zero in 2005 (Murray 2007) to a high of 749 in 2003 (Murray 2004). Murray (2011) recently evaluated loggerhead sea turtle interactions in scallop dredge gear from 2001 to 2008. In that paper, the average number of annual observable interactions of hard-shelled sea turtles in the Mid-Atlantic scallop dredge fishery prior to the implementation of chain mats (January 1, 2001 through September 25, 2006) was estimated to be 288 turtles (CV = 0.14, 95% CI: 209-363) [equivalent to 49 adults], 218 of which were loggerheads [equivalent to 37 adults]. After the implementation of chain mats, the average annual number of observable interactions was estimated to be 20 hard-shelled sea turtles (CV = 0.48, 95% CI: 3-42), 19 of which were loggerheads. If the rate of observable interactions from dredges without chain mats is applied to trips with chain mats, the estimated number of

observable and inferred interactions of hard-shelled sea turtles after chain mats were implemented is 125 turtles per year (CV = 0.15, 95% CI: 88-163) [equivalent to 22 adults], 95 of which were loggerheads [equivalent to 16 adults]. Interaction rates of hard-shelled turtles were correlated with sea surface temperature, depth, and use of a chain mat. Results from this recent analysis suggest that chain mats and fishing effort reductions have contributed to the decline in estimated loggerhead sea turtle interactions with scallop dredge gear after 2006 (Murray 2011). Turtle Deflector Dredges (TDDs) are required in the scallop fishery as of May 1, 2013, and are expected to further decrease serious injuries to sea turtles.

An estimate of the number of loggerheads taken annually in U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2009a, b). From 1995 to 2006, the annual bycatch of loggerheads in U.S. Mid-Atlantic gillnet gear was estimated to average 350 turtles (CV=0.20, 95% CI over the 12-year period: 234 to 504). Bycatch rates were correlated with latitude, sea surface temperature, and mesh size. The highest predicted bycatch rates occurred in warm waters of the southern Mid-Atlantic in large-mesh (>7 inch/17.8 cm) gillnets (Murray 2009a). In the spring of 2000, a total of 275 loggerhead carcasses were recovered from North Carolina beaches. The cause of death for most of the turtles was unknown, but NMFS suspects that the mass mortality event was caused by a large-mesh gillnet fishery for monkfish and dogfish operating offshore in the preceding weeks (67 FR 71895, December 3, 2002).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) FMP are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each 3-year period starting in 2007 (NMFS 2004a). NMFS has mandated gear changes for the HMS fishery to reduce sea turtle bycatch and the likelihood of death from those incidental takes that would still occur (Garrison and Stokes 2012). In 2010, there were 40 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2012). All of the loggerheads were released alive, with 29 out of 40 (72.5%) released with all gear removed. A total of 344.4 (95% CI: 236.6-501.3) loggerhead sea turtles were estimated to have interacted with the longline fisheries managed under the HMS FMP in 2010 based on the observed bycatch events (Garrison and Stokes 2012). The 2010 estimate is considerably lower than those in 2006 and 2007 and is well below the historical highs that occurred in the mid-1990s (Garrison and Stokes 2012). This fishery represents just one of several longline fisheries operating in the Atlantic Ocean. Lewison *et al.* (2004) estimated that 150,000-200,000 loggerheads were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries as well as others).

Documented interactions also occur in other fishery gear types and by non-fishery mortality sources (*e.g.*, hopper dredges, power plants, vessel collisions), although quantitative/qualitative estimates are only available for activities on which NMFS has consulted (See section 4.3.1 below).

The most recent Recovery Plan for loggerhead sea turtles as well as the 2009 Status Review Report identifies global climate change as a threat to loggerhead sea turtles. For a complete discussion of how global climate change may affect the NWA loggerhead DPS, see Section 6.0.

Summary of Status for Loggerhead Sea Turtles

Loggerheads continue to be affected by many factors on nesting beaches and in the water. These include poaching, habitat loss, and nesting predation that affects eggs, hatchlings, and nesting females on land, as well as fishery interactions, vessel interactions, marine pollution, and non-fishery (*e.g.*, dredging) operations affecting all sexes and age classes in the water (NRC 1990; NMFS and USFWS 2007a, 2008). As a result, loggerheads still face many of the original threats that were the cause of their listing under the ESA. Of the nine DPSs defined in the NMFS and USFWS final rule (75 FR 12598), only the NWA DPS is considered in this Opinion.

NMFS convened a new Loggerhead Turtle Expert Working Group (TEWG) to review all available information on Atlantic loggerheads in order to evaluate the status of this species in the Atlantic. A final report from the Loggerhead TEWG was published in July 2009. In this report, the TEWG indicated that it could not determine whether the decreasing annual numbers of nests among the Northwest Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of adult females, decreasing numbers of adult females, or a combination of these factors. Many factors are responsible for past or present loggerhead mortality that could impact current nest numbers; however, no single mortality factor stands out as a likely primary factor. It is likely that several factors compound to create the current decline, including incidental capture in fisheries, power plant intakes, and dredging operations, lower adult female survival rates, increases in the proportion of first-time nesters, continued directed harvest, and increases in mortality due to disease. Regardless, the TEWG stated that “it is clear that the current levels of hatchling output will result in depressed recruitment to subsequent life stages over the coming decades” (TEWG 2009). However, the report does not provide information on the rate or amount of expected decrease in recruitment but goes on to state that the ability to assess the current status of loggerhead subpopulations is limited due to a lack of fundamental life history information and specific census and mortality data.

While several documents reported the decline in nesting numbers in the NWA DPS (NMFS and USFWS 2008, TEWG 2009), when nest counts through 2012 are analyzed, researchers found no demonstrable trend, indicating a reversal of the post-1998 decline (<http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/>). Loggerhead nesting has been on the rise since 2008, and Van Houton and Halley (2011) suggest that nesting in Florida, which contains by far the largest loggerhead rookery in the DPS, could substantially increase over the next few decades. For the purposes of this Opinion, we consider that loggerhead nesting in the NWA DPS will continue to show no discernible trend, and perhaps more importantly, no decline over the period that data are available.

In-water data is conflicting, with some sites showing an increase while others indicating a possible decrease. Given the limited sampling locations and durations, differences in methodology, and conflicting information to date, we anticipate that the in-water data results will continue to be variable. For the purposes of this Opinion, we interpret the in-water data for the NWA DPS to show no discernible trend.

In terms of population numbers, the 2010 AMAPPS aerial line transect surveys provided a preliminary regional abundance estimate of about 588,000 loggerheads along the U.S. Atlantic

coast, with an inter-quartile range of 382,000-817,000 (NEFSC 2011b). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified sea turtle sightings. The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. However, a more recent loggerhead population estimate prepared by Richards *et al.* (2011) using data from 2001-2010 states that the loggerhead adult female population in the Northwest Atlantic is 38,334 individuals (SD =2,287). They estimated adult female recovery unit sizes to range from a minimum of 258 females for the DTRU to a maximum of 45,048 females for the PFRU. For the purposes of this Opinion, we consider the number of adult female loggerheads in the NWA DPS to be 38,334 turtles. In order to consider a worst case scenario of impacts to the population (considering reproductive value), we are relying on adult female population numbers for consideration in the jeopardy analysis (section 9.4).

Based on the information presented above, for purposes of this Opinion, we consider that the status of NWA DPS of loggerheads over the next ten years will be no worse than it is currently. Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of pelagic immatures, benthic immatures, and sexually mature age classes from various fisheries and other marine activities (Conant *et al.* 2009). Recent actions have taken significant steps towards reducing the recurring sources of mortality and improving the status of all nesting stocks. For example, TED, chain mat, and TDD regulations represent a significant improvement in the baseline effects of trawl and dredge fisheries on loggerheads in the Northwest Atlantic, although shrimp trawling is still considered to be one of the largest sources of anthropogenic mortality on loggerheads (SEFSC 2009, NMFS 2012a).

3.2.2.2 Leatherback Sea Turtle

Leatherback sea turtles are widely distributed throughout the oceans of the world, including the Atlantic, Pacific, and Indian oceans, and the Mediterranean Sea (Ernst and Barbour 1972). Leatherbacks are the largest living turtles and range farther than any other sea turtle species. Their large size and tolerance of relatively low water temperatures allows them to occur in boreal waters such as those off Labrador and in the Barents Sea (NMFS and USFWS 1995).

In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). By 1995, this global population of adult females was estimated to have declined to 34,500 (Spotila *et al.* 1996). The most recent population size estimate for the North Atlantic alone is a range of 34,000-94,000 adult leatherbacks (TEWG 2007). Thus, there is substantial uncertainty with respect to global population estimates of leatherback sea turtles.

Pacific Ocean

Leatherback nesting has been declining at all major Pacific Basin nesting beaches for the last two decades (Spotila *et al.* 1996, 2000; NMFS and USFWS 1998b, 2007b; Sarti *et al.* 2000). The western Pacific major nesting beaches are in Papua New Guinea, Indonesia, Solomon Islands, and Vanuatu, with an approximate 2,700-4,500 total breeding females estimated from nest counts (Dutton *et al.* 2007). While there appears to be overall long-term population decline, the

Indonesian nesting aggregation at Jamursba-Medi has been stable since 1999, although there is evidence to suggest a significant and continued decline in leatherback nesting in Papua New Guinea and Solomon Islands over the past 30 years (NMFS 2011b). Leatherback sea turtles disappeared from India before 1930, have been virtually extinct in Sri Lanka since 1994, and appear to be approaching extinction in Malaysia (Spotila *et al.* 2000). In Fiji, Thailand, and Australia, leatherback sea turtles have only been known to nest in low densities and scattered sites.

The largest extant leatherback nesting group in the Indo-Pacific lies on the North Vogelkop coast of West Papua, Indonesia, with 3,000-5,000 nests reported annually in the 1990s (Suárez *et al.* 2000). However, in 1999, local villagers started reporting dramatic declines in sea turtles near their villages (Suárez 1999). Declines in nesting groups have been noted throughout the western Pacific region, where observers report that nesting groups are well below abundance levels observed several decades ago (*e.g.*, Suárez 1999). Leatherback sea turtles in the western Pacific are threatened by poaching of eggs, killing of nesting females, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, and egg predation by animals.

In the eastern Pacific Ocean, major leatherback nesting beaches are located in Mexico and Costa Rica, where nest numbers have been declining. According to reports from the late 1970s and early 1980s, beaches located on the Mexican Pacific coasts of Michoacán, Guerrero, and Oaxaca sustained a large portion, perhaps 50%, of all global nesting by leatherbacks (Sarti *et al.* 1996). A dramatic decline has been seen on nesting beaches in Pacific Mexico, where aerial survey data was used to estimate that tens of thousands of leatherback nests were laid on the beaches in the 1980s (Pritchard 1982). In the 2003-2004 season, only 120 nests on the four primary index beaches (combined) were counted (Sarti Martinez *et al.* 2007). Since the early 1980s, the Mexican Pacific population of adult female leatherback turtles has declined to slightly more than 200 during 1998-1999 and 1999-2000 (Sarti *et al.* 2000). Spotila *et al.* (2000) reported the decline of the leatherback nesting at Playa Grande, Costa Rica, which had been the fourth largest nesting group in the world and the most important nesting beach in the Pacific. Between 1988 and 1999, the nesting group declined from 1,367 to 117 female leatherback sea turtles. An analysis of the Costa Rican nesting beaches indicates a decline in nesting during 15 years of monitoring (1989-2004) with approximately 1,504 females nesting in 1988-1989 to an average of 188 females nesting in 2000-2001 and 2003-2004 (NMFS and USFWS 2007b), indicating that the reductions in nesting females were not as extreme as the reductions predicted by Spotila *et al.* (2000).

On September 26, 2007, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters along the U.S. West Coast. On December 28, 2007, NMFS published a positive 90-day finding on the petition and convened a critical habitat review team. On January 26, 2012, NMFS published a final rule to revise the critical habitat designation to include three particular areas of marine habitat. The designation includes approximately 16,910 square miles along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour, and 25,004 square miles from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The areas comprise approximately 41,914 square miles of marine habitat and include waters from the ocean surface down to a maximum depth of 262 feet. The designated critical habitat areas contain the physical or biological feature

essential to the conservation of the species that may require special management conservation or protection. In particular, the team identified one Primary Constituent Element: the occurrence of prey species, primarily scyphomedusae of the order Semaestomeae, of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

Leatherbacks in the eastern Pacific face a number of threats to their survival. For example, commercial and artisanal swordfish fisheries off Chile, Colombia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries are known to capture, injure, or kill leatherbacks in the eastern Pacific. Given the declines in leatherback nesting in the Pacific, some researchers have concluded that the leatherback is on the verge of extinction in the Pacific Ocean (*e.g.*, Spotila *et al.* 1996, 2000).

Indian Ocean

Leatherbacks nest in several areas around the Indian Ocean. These sites include Tongaland, South Africa (Pritchard 2002) and the Andaman and Nicobar Islands (Andrews *et al.* 2002). Intensive survey and tagging work in 2001 provided new information on the level of nesting in the Andaman and Nicobar Islands (Andrews *et al.* 2002). Based on the survey and tagging work, it was estimated that 400-500 female leatherbacks nest annually on Great Nicobar Island (Andrews *et al.* 2002). The number of nesting females using the Andaman and Nicobar Islands combined was estimated to be around 1,000 (Andrews and Shanker 2002). Some nesting also occurs along the coast of Sri Lanka, although in much smaller numbers than in the past (Pritchard 2002).

Mediterranean Sea

Casale *et al.* (2003) reviewed the distribution of leatherback sea turtles in the Mediterranean. Among the 411 individual records of leatherback sightings in the Mediterranean, there were no nesting records. Nesting in the Mediterranean is believed to be extremely rare, if it occurs at all. Leatherbacks found in Mediterranean waters originate from the Atlantic Ocean (P. Dutton, NMFS, unpublished data).

Atlantic Ocean

Distribution and Life History

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992). Leatherbacks are frequently thought of as a pelagic species that feed on jellyfish (*e.g.*, *Stomolophus*, *Chryaora*, and *Aurelia* species) and tunicates (*e.g.*, salps, pyrosomas) (Rebel 1974; Davenport and Balazs 1991). However, leatherbacks are also known to use coastal waters of the U.S. continental shelf, (James *et al.* 2005a; Eckert *et al.* 2006; Murphy *et al.* 2006), as well as the European continental shelf on a seasonal basis (Witt *et al.* 2007).

Tagging and satellite telemetry data indicate that leatherbacks from the western North Atlantic nesting beaches use the entire North Atlantic Ocean (TEWG 2007). For example, leatherbacks tagged at nesting beaches in Costa Rica have been found in Texas, Florida, South Carolina, Delaware, and New York (STSSN database). Leatherback sea turtles tagged in Puerto Rico, Trinidad, and the Virgin Islands have also been subsequently found on U.S. beaches of southern,

Mid-Atlantic, and northern states (STSSN database). Leatherbacks from the South Atlantic nesting assemblages (West Africa, South Africa, and Brazil) have not been re-sighted in the western North Atlantic (TEWG 2007).

The CeTAP aerial survey of the outer Continental Shelf from Cape Hatteras, NC to Cape Sable, Nova Scotia conducted between 1978 and 1982 showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in water depths ranging from 1 to 4,151 meters, but 84.4% of sightings were in waters less than 180 meters (Shoop and Kenney 1992). Leatherbacks were sighted in waters within a sea surface temperature range similar to that observed for loggerheads: from 7°-27.2°C (Shoop and Kenney 1992). However, leatherbacks appear to have a greater tolerance for colder waters than loggerhead sea turtles since more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). Studies of satellite-tagged leatherbacks suggest that they spend 10-41% of their time at the surface, depending on the phase of their migratory cycle (James *et al.* 2005b). The greatest amount of surface time (up to 41%) was recorded when leatherbacks occurred in continental shelf and slope waters north of 38°N (James *et al.* 2005b).

In 1979, the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands were designated as critical habitat for the leatherback sea turtle. NMFS is currently reviewing whether the addition of waters adjacent to a major nesting beach in Puerto Rico to the critical habitat designation is warranted. USFWS also plans to address this region during a future planned status review. On February 2, 2010, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters adjacent to a major nesting beach in Puerto Rico. NMFS published a 90-day finding on July 16, 2010, which found that the petition did not present substantial scientific information indicating that the revision was warranted. The original petitioners submitted a second petition on November 2, 2010 to revise the critical habitat designation to include waters adjacent to a major nesting beach in Puerto Rico, and this time included additional information on the usage of the waters. On May 5, 2011, NMFS determined that a revision to critical habitat off Puerto Rico may be warranted, but on June 4, 2012 issued a decision denying the petition due to a lack of reasonably defined physical or biological features that are essential to the leatherback sea turtle's conservation and that may require special management considerations or protection (77 FR 32909). Note that on August 4, 2011, USFWS issued a determination that revision to critical habitat along Puerto Rico should be made and will be addressed during the future planned status review.

Leatherbacks are a long-lived species. They were originally believed to mature at a younger age than loggerhead sea turtles, with a previous estimated age at sexual maturity of about 13-14 years for females with nine years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS SEFSC 2001). However, new sophisticated analyses suggest that leatherbacks in the Northwest Atlantic may reach maturity at 24.5-29 years of age (Avens *et al.* 2009). In the United States and Caribbean, female leatherbacks nest from March through July. In the Atlantic, most nesting females average between 150-160 centimeters curved carapace length (CCL), although smaller (<145 cm CCL) and larger nesters are observed (Stewart *et al.* 2007, TEWG 2007). They nest frequently (up to seven nests per year) during a nesting season and nest about every two to three years. They produce 100 eggs or more in each clutch and can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to

approximately 30%) of the eggs can be infertile. Leatherback hatchlings enter the water soon after hatching. Based on a review of all sightings of leatherback sea turtles of <145 centimeters CCL, Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 centimeters CCL.

Population Dynamics and Status

As described earlier, sea turtle nesting survey data is important because it provides information on the relative abundance of nesting, and the contribution of each population/subpopulation to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually, and as an indicator of the trend in the number of nesting females in the nesting group. The five-year review for leatherback sea turtles (NMFS and USFWS 2007b) compiled the most recent information on mean number of leatherback nests per year for each of the seven leatherback populations or groups of populations that were identified by the Leatherback TEWG as occurring within the Atlantic. These are: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil (TEWG 2007).

In the U.S., the Florida Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 nests in 1988 to between 800 and 900 nests in the early 2000s (NMFS and USFWS 2007b) to 1,712 recorded in 2012 (FWC 2013). Stewart *et al.* (2011) evaluated nest counts from 68 Florida beaches over 30 years (1979-2008) and found that nesting increased at all beaches with trends ranging from 3.1%-16.3% per year, with an overall increase of 10.2% per year. An analysis of Florida's index nesting beach sites from 1989 to 2006 shows a substantial increase in leatherback nesting in Florida during this time, with an annual growth rate of approximately 1.17 (TEWG 2007). The TEWG reports an increasing or stable nesting trend for five of the seven populations or groups of populations, with the exceptions of the Western Caribbean and West Africa groups. The leatherback rookery along the northern coast of South America in French Guiana and Suriname supports the majority of leatherback nesting in the western Atlantic (TEWG 2007), and represents more than half of total nesting by leatherback sea turtles worldwide (Hilterman and Govere 2004). Nest numbers in Suriname have shown an increase and the long-term trend for the Suriname and French Guiana nesting group also seems to show an increase (Hilterman and Govere 2004). In 2001, the number of nests in Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Govere 2004). The TEWG (2007) report indicates that a positive population growth rate was found for French Guinea and Suriname using nest numbers from 1967 to 2005, a 39-year period, and that there was a 95% probability that the population was growing. Given the magnitude of leatherback nesting in this area compared to other nest sites, negative impacts in leatherback sea turtles in this area could have profound impacts on the entire species.

The CeTAP aerial survey conducted from 1978 to 1982 estimated the summer leatherback population for the northeastern United States at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina) (Shoop and Kenney 1992). However, the estimate was based on turtles visible at the surface and does not include those that were below the surface out of view. Therefore, it likely underestimated the leatherback population. Estimates of leatherback abundance of 1,052 turtles (C.V. = 0.38) and 1,174 turtles (C.V. = 0.52) were obtained from surveys conducted from Virginia to the Gulf of St. Lawrence in 1995 and 1998,

respectively (Palka 2000). However, since these estimates were also based on sightings of leatherbacks at the surface, the author considered the estimates to be negatively biased, and suggested that the true abundance of leatherbacks may be 4.27 times higher (Palka 2000).

Threats

The five-year status review (NMFS and USFWS 2007b) and TEWG (2007) reports both provide summaries of natural as well as anthropogenic threats to leatherback sea turtles. Of the Atlantic sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, particularly trap/pot gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their diving and foraging behavior, their distributional overlap with the gear, their possible attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, and perhaps to the lightsticks used to attract target species in longline fisheries. Leatherbacks entangled in fishing gear generally have a reduced ability to feed, dive, surface to breathe, or perform any other behavior essential to survival (Balazs 1985). In addition to drowning from forced submergence, they may be more susceptible to boat strikes if forced to remain at the surface, and entangling lines can constrict blood flow resulting in tissue necrosis. The long-term impacts of entanglement on leatherback health remain unclear. Innis *et al.* (2010) conducted a health evaluation of leatherback sea turtles during direct capture (n=12) and disentanglement (n=7). They found no significant difference in many of the measured health parameters between entangled and directly captured turtles. However, blood parameters—including but not limited to sodium, chloride, and blood urea nitrogen—for entangled turtles showed several key differences that were most likely due to reduced foraging, associated seawater ingestion, and stress.

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer-reviewed publications and NMFS documents (*e.g.*, biological opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually after implementation of bycatch mitigation measures. Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations. The most recent section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of take for leatherbacks at present. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in a few hundred interactions annually, of which a subset are expected to be lethal (NMFS 2012a).

Leatherbacks have been documented interacting with longline, trap/pot, trawl, and gillnet fishing gear. For instance, an estimated 6,363 leatherback sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992 and 1999 (SEFSC 2001). Currently, the U.S. tuna and swordfish longline fisheries managed under the HMS FMP are estimated to capture 1,764 leatherbacks (no more than 252 mortalities) for each three-year period starting in 2007 (NMFS 2004a). In 2010, there were 26 observed interactions between leatherback sea turtles and

longline gear used in the HMS fishery (Garrison and Stokes 2012). All leatherbacks were released alive, with all gear removed in 14 (53.8%) of the 26 captures. A total of 170.9 (95% CI: 104.3-280.2) leatherback sea turtles are estimated to have interacted with the longline fisheries managed under the HMS FMP in 2010 based on the observed takes (Garrison and Stokes 2012). The 2010 estimate continues a downward trend since 2007 and remains well below the average prior to implementation of gear regulations (Garrison and Stokes 2012). Since the U.S. fleet accounts for only 5-8% of the longline hooks fished in the Atlantic Ocean, adding up the under-represented observed takes of the other 23 countries actively fishing in the area would likely result in annual take estimates of thousands of leatherbacks (SEFSC 2001). Lewison *et al.* (2004) estimated that 30,000-60,000 leatherbacks were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries).

Leatherbacks are susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990 to 2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer *et al.* 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer *et al.* 2002). From 2002 to 2011, NMFS received 159 reports of sea turtles entangled in vertical lines from Maine to Virginia, with 147 events confirmed (verified by photo documentation or response by a trained responder; NMFS 2008a). Of the 147 confirmed events during this period, 133 events involved leatherbacks, 13 involved loggerheads, and 1 involved a green sea turtle. NMFS identified the gear type and fishery for 93 of the 147 confirmed events, which included lobster (51²²), whelk/conch (23), black sea bass (10), crab (7), and research pot gear (2). A review of leatherback mortality documented by the STSSN in Massachusetts suggests that vessel strikes and entanglement in fixed gear (primarily lobster pots and whelk pots) are the principal sources of this mortality (Dwyer *et al.* 2002).

Leatherback interactions with the U.S. South Atlantic and Gulf of Mexico shrimp fisheries are also known to occur (NMFS 2002a). Leatherbacks are likely to encounter shrimp trawls working in the coastal waters off the U.S. Atlantic coast (from Cape Canaveral, FL through North Carolina) as they make their annual spring migration north. For many years, TEDs that were required for use in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were less effective for leatherbacks as compared to the smaller, hard-shelled turtle species, because the TED openings were too small to allow leatherbacks to escape. To address this problem, NMFS issued a final rule on February 21, 2003, to amend the TED regulations (68 FR 8456, February 21, 2003). Modified TEDs are now required in order to exclude leatherbacks as well as large benthic immature and sexually mature loggerhead and green sea turtles. With these gear modifications, Epperly *et al.* (2002) anticipated an average of 80 leatherback mortalities a year in shrimp gear interactions, but dropped the estimate to 26 leatherback mortalities in 2009 due to effort reduction in the southeast shrimp fishery (Memo from Dr. B. Ponwith, SEFSC, to Dr. R. Crabtree, SERO, January 5, 2011). The most recent Opinion, issued in 2012, does not give a numerical ITS for leatherbacks, but instead monitors TED compliance and fishery effort to monitor and limit take (NMFS 2012a).

Other trawl fisheries are also known to interact with leatherback sea turtles on a much smaller

²² One case involved both lobster and whelk/conch gear, but this animal is listed only under the lobster group.

scale. For example, NMFS fisheries observers documented leatherbacks taken in trips targeting *Loligo* squid off Delaware in 2001 and off Connecticut in 2009, and targeting little skate off Connecticut in 2011. TEDs are not currently required in this fishery. In November 2007, fisheries observers reported the capture of a leatherback sea turtle in bottom otter trawl gear fishing for summer flounder.

Gillnet fisheries operating in the waters of the Mid-Atlantic states are also known to capture, injure, and/or kill leatherbacks when these fisheries and leatherbacks co-occur. NEFOP data from 1994 to 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in pelagic drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 64% to 99% (Waring *et al.* 2000). In North Carolina, six additional leatherbacks were reported captured in gillnet sets in the spring (NMFS SEFSC 2001). In addition to these, in September 1995, two dead leatherbacks were removed from an 11-inch (28.2-cm) monofilament shark gillnet set in the nearshore waters off Cape Hatteras (STSSN unpublished data reported in NMFS SEFSC 2001). Murray (2009a) reports five observed leatherback captures in Mid-Atlantic sink gillnet fisheries between 1994 and 2008.

Fishing gear interactions can occur throughout the leatherback's range, including in Canadian waters. Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in salmon nets, herring nets, gillnets, trawl lines, and crab pot lines. Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo *et al.* 1994; Graff 1995). Gillnets are one of the suspected causes for the decline seen in the leatherback sea turtle population in French Guiana from 1973 to 1998 (Chevalier *et al.* 1999), and gillnets targeting green and hawksbill sea turtles in the waters of coastal Nicaragua also incidentally catch leatherback sea turtles (Lagueux *et al.* 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off Trinidad and Tobago, with mortality estimated to be between 50% and 95% (Eckert and Lien 1999). Many of the sea turtles do not die as a result of drowning, but rather because the fishermen butcher them to remove them from their nets (NMFS SEFSC 2001).

Leatherbacks may be more susceptible to marine debris ingestion than other sea turtle species due to the tendency of floating debris to concentrate in convergence zones that juveniles and adults use for feeding (Shoop and Kenney 1992; Lutcavage *et al.* 1997). Investigations of the necropsy results of leatherback sea turtles revealed that a substantial percentage (34% of the 408 leatherback necropsies recorded between 1985 and 2007) reported plastic within the turtles' stomach contents, and in some cases (8.7% of cases in which plastic was reported), blockage of the gut may have caused the mortality (Mrosovsky *et al.* 2009). An increase in reports of plastic ingestion was evident in leatherback necropsies conducted after the late 1960s (Mrosovsky *et al.* 2009). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items (*e.g.*, jellyfish) and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that plastic objects may resemble food items by their shape, color, size, or drifting movements, and induce a

feeding response in leatherbacks.

Global climate change has been identified as a factor that may affect leatherback habitat and biology (NMFS and USFWS 2007b); however, no significant climate change related impacts to leatherback sea turtle populations have been observed to date. Over the long term, climate change-related impacts will likely influence biological trajectories in the future on a century scale (Parmesan and Yohe 2003). Changes in marine systems associated with rising water temperatures, changes in ice cover, salinity, oxygen levels and circulation including shifts in ranges and changes in algal, plankton, and fish abundance could affect leatherback prey distribution and abundance. Climate change is expected to expand foraging habitats into higher latitude waters and some concern has been noted that increasing temperatures may increase the female:male sex ratio of hatchlings on some beaches (Mrosovsky *et al.* 1984 and Hawkes *et al.* 2007 in NMFS and USFWS 2007b). However, due to the tendency of leatherbacks to have individual nest placement preferences and deposit some clutches in the cooler tide zone of beaches, the effects of long-term climate on sex ratios may be mitigated (Kamel and Mrosovsky 2004 in NMFS and USFWS 2007b). Additional potential effects of climate change on leatherbacks include range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson *et al.* 2009). Leatherbacks have expanded their range in the Atlantic north by 330 kilometers in the last 17 years as warming has caused the northerly migration of the 15°C SST isotherm, the lower limit of thermal tolerance for leatherbacks (McMahon and Hays 2006). Leatherbacks are speculated to be the best able to cope with climate change of all the sea turtle species due to their wide geographic distribution and relatively weak beach fidelity. Leatherback sea turtles may be most affected by any changes in the distribution of their primary jellyfish prey, which may affect leatherback distribution and foraging behavior (NMFS and USFWS 2007b). Jellyfish populations may increase due to ocean warming and other factors (Brodeur *et al.* 1999; Attrill *et al.* 2007; Richardson *et al.* 2009). However, any increase in jellyfish populations may or may not impact leatherbacks as there is no evidence that any leatherback populations are currently food-limited.

As discussed for loggerheads, increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al.* 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Fish *et al.* 2005). This effect would potentially be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents. While there is a reasonable degree of certainty that climate change related effects will be experienced globally (*e.g.*, rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects of climate change on this species are not predictable or quantifiable at this time (Hawkes *et al.* 2009). Based on the most recent five-year status review (NMFS and USFWS 2007b), and following from the climate change discussion in the previous section on NWA DPS loggerheads, it is unlikely that impacts from climate change will have a significant effect on the status of leatherbacks over the scope of the action assessed in this Opinion, which is the next ten years. However, significant impacts from climate change in the future beyond ten years are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

Summary of Status for Leatherback Sea Turtles

In the Pacific Ocean, the abundance of leatherback sea turtles on nesting beaches has declined dramatically during the past 10 to 20 years. Nesting groups throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance due to human activities that have reduced the number of nesting females and reduced the reproductive success of females (for example, egg poaching) (NMFS and USFWS 2007b). No reliable long-term trend data for the Indian Ocean populations are currently available. While leatherbacks are known to occur in the Mediterranean Sea, nesting in this region is not known to occur (NMFS and USFWS 2007b).

Nest counts in many areas of the Atlantic Ocean show increasing trends, including beaches in Suriname and French Guiana that support the majority of leatherback nesting in this region (NMFS and USFWS 2007b). The species as a whole continues to face numerous threats in nesting and marine habitats. As with the other sea turtle species, mortality due to fisheries interactions accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like pollution and habitat destruction account for an unknown level of other anthropogenic mortality. The long-term recovery potential of this species may be further threatened by observed low genetic diversity, even in the largest nesting groups (NMFS and USFWS 2007b).

Based on its five-year status review of the species, NMFS and USFWS (2007b) determined that endangered leatherback sea turtles should not be delisted or reclassified. However, it also was determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified (NMFS and USFWS 2007b). Based on the information presented above, for purposes of this Opinion, we consider that the status of leatherbacks over the next ten years will be no worse than it is currently and that the status of the species in the Atlantic Ocean may actually be improving due to increased nesting.

4.0 ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that may affect the survival and recovery of right, humpback, fin, and sei whales, as well as loggerhead and leatherback sea turtles, in the action area. The activities generally fall into one of the following three categories: (1) fisheries, (2) other activities that cause death or otherwise impair a whale's and/or turtle's ability to function, and (3) recovery activities associated with reducing impacts to ESA-listed sea turtles and/or cetaceans.

Many of the fisheries and other activities causing death or injury to cetaceans and/or sea turtles that are identified in this section have occurred for years, even decades. Similarly, while some recovery activities have been in place for years (*e.g.*, nesting beach protection in portions of sea turtle nesting habitat), others have been undertaken more recently following new information on the impact of certain activities on the species.

The overall impacts that each state, federal, and private action or other human activity have on ESA-listed species is not fully known. However, to the extent that the impacts of such human activities (including activities that are not part of the proposed action such as lobster fishing in Canadian waters) have manifested themselves at the population level, such past impacts are subsumed in the information presented on the status of each species considered in this Opinion, recognizing that the benefits to each species as a result of recovery activities already implemented may not be evident in the status of the respective population for years, or even decades, given the relatively late age the species reach maturity, and depending on the age class(es) affected.

4.1 Fishery Operations

4.1.1 Federal Fisheries

ESA section 7 consultation has been conducted on all federal fisheries authorized under a federal fishery management plan. The action area of the American Lobster FMP overlaps areas of other fishery activity that may adversely affect threatened and endangered species. These fisheries include the Atlantic bluefish, Atlantic herring, Atlantic mackerel/squid/Atlantic butterfish, Atlantic sea scallop, highly migratory species, monkfish, Northeast multispecies, red crab, skate, spiny dogfish, summer flounder/scup/black sea bass, and tilefish. Given the broad action area for this consultation, and the broad area of operation for the fisheries, a portion of the fishing effort for each of these previously mentioned fisheries is expected to occur within the action area of this consultation.

ESA-listed cetaceans and sea turtles are known to be killed and injured as a result of being struck by vessels on the water. However, the operation of fishing vessels used in the aforementioned fisheries will have discountable effects on these species. Fishing vessels operate at relatively slow speeds, particularly when towing or hauling gear. Thus, large cetaceans and sea turtles in the path of a fishing vessel are more likely to have time to move away before being struck.

Gear used in the federal fisheries described below is expected to have an insignificant effect on cetacean or turtle prey. As described in section 3.0, right whales and sei whales feed on copepods (Horwood 2002, Kenney 2002). Copepods are very small organisms that will pass through fishing gear rather than being captured in it. Humpback whales and fin whales also feed on krill as well as small schooling fish (*e.g.*, sand lance, herring, mackerel) (Aguilar 2002, Clapham *et al.* 2002). Some fisheries described below do target fish (*i.e.*, herring, mackerel) that are food items for humpback and fin whales. Nevertheless, given the diversity of their diet, the harvesting of some humpback and fin whale prey as part of commercial fishery operations is not expected to have a significant effect on the availability of humpback and fin whale prey species.

Sea turtle prey items such as horseshoe crabs, other crabs, whelks, and fish are removed from the marine environment as fisheries bycatch in one or more of the aforementioned fisheries. None of these are typical prey species of leatherback sea turtles. Therefore, the aforementioned fisheries will not affect the availability of prey for leatherback sea turtles in the action area.

Neritic juveniles and adults of loggerhead sea turtles are known to feed on species that are caught as bycatch in numerous fisheries (Keinath *et al.* 1987, Lutcavage and Musick 1985, Dodd 1988, Burke *et al.* 1993, Burke *et al.* 1994, Morreale and Standora 2005, Seney and Musick 2005). While some of the bycatch is likely returned to the water dead or injured to the extent that the organisms will shortly die, they would still be available as prey for loggerheads, which are known to eat a variety of live prey and scavenge dead organisms (Keinath *et al.* 1987, Lutcavage and Musick 1985, Dodd 1988, Burke *et al.* 1993, Morreale and Standora 2005).

Gear used in the federal fisheries described below is believed to have the potential to adversely affect bottom habitat in the action area (NMFS 2003a). A panel of experts have previously concluded that the effects of even light weight otter trawl gear would include: (1) scraping or plowing of the doors on the bottom, sometimes creating furrows along their path; (2) sediment suspension resulting from the turbulence caused by the doors and the ground gear on the bottom; (3) removal or damage to benthic or demersal species; and (4) removal or damage to structure forming biota. The panel also concluded that the greatest impacts from otter trawls occur in high and low energy gravel habitats and in hard clay outcroppings, and that sand habitats were the least likely to be impacted (NREFHSC 2002). The action area does not include hard clay outcroppings, although gravel habitats may occur. The foraging distribution of loggerhead sea turtles in Mid-Atlantic and New England waters as far north as approximately Cape Cod, do not typically occur in gravel habitats. Leatherback sea turtles have a broader distribution in New England waters, which more likely includes clay outcroppings, but are pelagic feeders and should be less affected by alterations to benthic habitat. For these reasons and the lack of any evidence that fishing practices affect habitats in degrees that harm or harass ESA-listed species, NMFS finds while continued American lobster fishing efforts may potentially alter benthic habitats, these alterations will be insignificant to ESA-listed species.

Factors affecting food availability for leatherbacks are likely to be oceanographic conditions rather than bottom habitat. As is the case of leatherback sea turtles, prey availability (*i.e.*, copepods, schooling fish) for foraging right, humpback, fin and sei whales is associated with oceanographic conditions rather than bottom habitat (Baumgartner *et al.* 2003, IWC 1992, Pace and Merrick 2008, Perry *et al.* 1999) that may be temporarily disturbed by the use of bottom fishing gear.

The Atlantic bluefish, Atlantic mackerel/squid/butterfish, Atlantic sea scallop, highly migratory species, monkfish, Northeast multispecies, red crab, skate, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries employ gear in a time/area/manner that has been known to capture, injure, and kill sea turtles. Some of these fisheries also use gear known to injure and kill right, humpback, fin, or sei whales as a result of entanglements in the gear (Johnson *et al.* 2005, Waring *et al.* 2014, Cole and Henry 2013). A summary of the impacts of each of these fisheries that has been subject to section 7 consultation is provided below.

The only fishery that has been determined by NMFS to reduce the reproduction, numbers, or distribution of ESA-listed sea turtles, and reduce appreciably their likelihood of survival and recovery, is the pelagic longline component of the Atlantic highly migratory species fishery. On June 14, 2001, NMFS released a biological opinion that found that the continued operation of the Atlantic pelagic longline fishery was likely to jeopardize the continued existence of both

loggerhead and leatherback sea turtles. To avoid jeopardy to these species, a Reasonable and Prudent Alternative (RPA) was developed. The RPA required the closure of the Northeast Distant (NED) Statistical Area of the Atlantic Ocean to pelagic longlining and the enactment of a research program to develop or modify fishing gear and techniques to reduce sea turtle interactions and mortality associated with such interactions. On June 1, 2004, NMFS released another biological opinion on the Atlantic pelagic longline fishery that stated that the fishery was still likely to jeopardize the continued existence of leatherback sea turtles. Another RPA was then developed to attempt to remove jeopardy. The RPA required that NMFS (1) reduce post-release mortality of leatherbacks, (2) improve monitoring of the effects of the fishery, (3) confirm the effectiveness of the hook and bait combinations that are required as part of the proposed action, and (4) take management action to avoid long-term elevations in leatherback takes or mortality. The biological opinion specified an RPA that allows the continuation of the Atlantic highly migratory species fishery without jeopardizing ESA-listed species.

As described in Sections 1.0 and 2.1, consultation has also been previously conducted on the continued operation of the American lobster fishery. Pot/trap gear used in the American lobster fishery is known to entangle ESA-listed cetaceans and sea turtles, with some events resulting in injuries and death. Therefore, the environmental baseline for this action also includes the effects of the past operation of the American lobster fishery.

The *American lobster fishery* has been identified as causing injuries to and mortality of loggerhead and leatherback sea turtles as a result of entanglement in buoy lines of the pot/trap gear (NMFS 2012b). Loggerhead or leatherback sea turtles caught/wrapped in the buoy lines of lobster pot/trap gear can die as a result of forced submergence or incur injuries, such as severe constriction of a flipper, leading to death. Given the seasonal distribution of loggerhead sea turtles in Mid-Atlantic and New England waters and the operation of the lobster fishery, loggerhead sea turtles are expected to overlap with the placement of lobster pot/trap gear during the months of May through October in waters off New Jersey through Massachusetts. Compared to loggerheads, leatherback sea turtles have a similar seasonal distribution in Mid-Atlantic and New England waters, but with a more extensive distribution in the Gulf of Maine (Shoop and Kenney 1992; James *et al.* 2005a). Therefore, leatherback sea turtles are expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of New Jersey through Maine.

Given the distribution of lobster fishing effort, leatherback sea turtles are the most likely sea turtle to be affected, since they occur regularly in Gulf of Maine waters. The most recent biological opinion for this fishery, completed on August 3, 2012, concluded that operation of the federally-regulated portion of the lobster trap fishery may adversely affect loggerhead and leatherback sea turtles as a result of entanglement in the groundlines and/or buoy lines associated with this type of gear. An ITS was issued with the 2012 biological opinion, exempting the annual incidental take (lethal or non-lethal) of one loggerhead sea turtle and the annual incidental take (lethal or non-lethal) of five leatherback sea turtles (NMFS 2012b).

Pot/trap gear has also been identified as a gear type causing injuries and mortality of right, humpback, and fin whales (Johnson *et al.* 2005, Waring *et al.* 2014, Henry *et al.* 2011, 73 FR 73032, December 1, 2008). Large whales are known to become entangled in lines associated

with multiple gear types. For pot/trap gear, vertical lines (also known as buoy lines) attach buoys at the surface to the gear at the ocean bottom while groundlines attach the pots/traps in a series. Lines wrapped tightly around an animal can cut into the flesh, leading to injuries, infection, and death (Moore *et al.* 2004).

A right whale entanglement in pot/trap gear used in the inshore lobster fishery resulting in death occurred in 2001 (Waring *et al.* 2007). A mortality of a humpback whale in pot/trap gear in the state lobster fishery occurred in 2002 (Waring *et al.* 2007). Other mortalities and serious injuries to ESA-listed cetaceans as a result of pot/trap gear consistent with that used in the lobster fishery have occurred as reported in Moore *et al.* (2004), Johnson *et al.* (2005), and Glass *et al.* (2010). However, it cannot be determined in all cases whether the gear was set in state waters as part of a state lobster fishery or in federal waters. In all waters regulated by the ALWTRP, commercial pot/trap gear set by the American lobster fishery is required to follow regulations set by the plan.

American lobster occurs within U.S. waters from Maine to Virginia. They are most abundant from Maine to New Jersey, with abundance declining from north to south (ASMFC 1999). Most lobster trap effort occurs in the Gulf of Maine, constituting 76% of the U.S. landings between 1981 and 2007, and 87% since 2002. Lobster landings in the other New England states, as well as New York and New Jersey, account for most of the remainder of U.S. American lobster landings. However, declines in lobster abundance and landings have occurred from Rhode Island through New Jersey in recent years. The Mid-Atlantic states from Delaware through North Carolina have been granted *de minimus* status under the ASMFC's Interstate Fishery Management Plan (ISFMP). The ISFMP includes measures to constrain or reduce fishing effort in the lobster fishery. In fact, the ASFMC is currently evaluating additional management options to address a May 2010, technical committee report that determined there is a lobster recruitment failure in the SNE stock area. In response, the ASMFC adopted Addendum 17 to its Interstate Fishery Management Plan for American Lobster in February 2012. This addendum serves as the first phase to rebuild the SNE stock by adopting measures intended to reduce fishing exploitation by 10 % beginning in 2013. The management measures include a requirement for lobstermen to v-notch all legal-sized egg-bearing lobsters in LCMAs 2, 4 and 5; a minimum size increase for lobster harvested in offshore LCMA 3; and various closed seasons in LCMAs 2, 4, 5 and 6. The ASMFC is currently developing Addendum 18 which will serve as the next phase to rebuild the SNE stock. That addendum, expected to be formally adopted by the ASMFC in late 2012, proposes measures to address latent (unfished) effort and reduce the overall number of traps allocated in LCMAs 2 and 3 to scale the fishery to the size of the SNE resource. Some management tools include trap reductions, trap banking, and controlled growth using plans specialized for each affected management area. The ASMFC expects that additional action through subsequent addenda will be needed to complete the SNE rebuilding plan. NMFS is involved in the development of Addendum 18 through participation on the ASMFC's Lobster Management Board and will address the ASMFC's recommendations for federal action in Addendum 17. The trap reduction measures associated with these actions are of benefit to large whales and sea turtles by reducing the amount of gear (specifically buoy lines) in the water where whales and sea turtles also occur.

On December 16, 2013, we concluded formal intra-service consultation on the continued operation of fisheries managed under several fisheries as authorized by NMFS under their

respective seven Fishery Management Plans (FMPs) issued under the authority of the Magnuson-Stevens Fisheries Conservation Act (MSA) and implementing regulations. Fisheries considered in this Opinion were the: (1) Northeast multispecies (multispecies), (2) monkfish, (3) spiny dogfish, (4) Atlantic bluefish (bluefish), (5) Northeast skate complex (skate), (6) Atlantic mackerel/squid/butterfish (MSB), and (7) summer flounder/scup/black sea bass (FSB) fisheries (collectively referred to as “the seven fisheries” hereinafter). An ITS was provided with the 2013 biological opinion along with non-discretionary RPMs to minimize the impact of incidental take. As described in the ITS NMFS anticipates that the continued operation of the seven fisheries may result in the incidental take of sea turtles as follows:

- for loggerhead sea turtles from the NWA DPS, NMFS anticipates (a) the annual take of up to 269 individuals over a five-year average in gillnet gear, of which up to 167 per year may be lethal; (b) the annual take of up to 213 individuals over a four-year average in bottom trawl gear, of which up to 71 per year may be lethal; and (c) the annual take of up to one individual in trap/pot gear, which may be lethal or non-lethal;
- for leatherback sea turtles, NMFS anticipates (a) the annual observed take of up to four individuals in gillnet gear, of which up to three per year may be lethal; (b) the annual observed take of up to four individuals in bottom trawl gear, of which up to two per year may be lethal; and (c) the annual observed take of up to four individuals in trap/pot gear, which may be lethal or non-lethal;
- for Kemp’s ridley sea turtles, NMFS anticipates the annual observed take of up to four individuals in gillnet gear, of which up to three per year may be lethal, and the annual observed take of up to three individuals in bottom trawl gear, of which up to two per year may be lethal; and
- for green sea turtles, NMFS anticipates the annual observed take of up to four individuals in gillnet gear, of which up to three per year may be lethal, and the annual observed take of up to three individuals in bottom trawl gear, of which up to two per year may be lethal.

The anticipated level of incidental take of sea turtles for the recreational components of the bluefish, multispecies, and FSB fisheries cannot be estimated at this time.

ESA-listed cetaceans may also interact with gear used in these fisheries. The 2013 Opinion also stated the seven fisheries may adversely affect, but are not likely to jeopardize, the continued existence of North Atlantic right whales, humpback whales, fin whales, and sei whales. All gear used in the fisheries is required to be in compliance with the ALWTRP. A brief description of each fishery is provided below.

The *Atlantic bluefish fishery* has been operating in the U.S. Atlantic for at least the last half century, although its popularity did not heighten until the late 1970s and early 1980s (MAFMC and ASMFC 1998). Gillnets and bottom otter trawls are the predominant gear types used in the commercial bluefish fishery (MAFMC 2007a). In 2006, gillnet gear accounted for 32.4% of the total commercial trips targeting bluefish, and landed 72% of the commercial catch for that year

(MAFMC 2007a). Bottom otter trawls accounted for 44% of the total commercial trips targeting bluefish and landed 20.4% of the catch (MAFMC 2007a).

Although no interactions of ESA-listed sea turtles had been reported in bottom otter trawl gear for trips that were targeting bluefish (where greater than 50% of the catch was bluefish), interactions of loggerhead and Kemp's ridley sea turtles were observed in bottom otter trawl gear where bluefish were caught but constituted less than 50% of the catch (NMFS 1999).

A new estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the bluefish fishery has been published in a NMFS NEFSC Reference Document (Warden 2011). Using Northeast Fisheries Observer Program (NEFOP) data from 1996 to 2008 applied to VTR days fished, the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the bluefish fishery between 2005 and 2008 was estimated to be four (Warden 2011). Although NMFS was not aware until 2003 that sea turtle interactions with fishing gear targeting bluefish were likely to occur, there is no information to suggest that sea turtle interactions with bluefish fishing gear are a new event or are occurring at a greater rate than what has likely occurred in the past. To the contrary, the methods used to detect any sea turtle interactions with bluefish fishing gear were insufficient prior to increased observer coverage in recent years. In addition, there have been no known changes to the seasonal distribution of loggerhead sea turtles in the U.S. Atlantic (CeTAP 1982; Lutcavage and Musick 1985; Keinath *et al.* 1987; Thompson 1988; Shoop and Kenney 1992; Burke *et al.* 1993, 1994) with the exception of recent studies (Morreale *et al.* 2005; Mansfield 2006), which suggest a decrease in the use of some Mid-Atlantic loggerhead foraging areas for unknown reasons.

The commercial bluefish fishery does not typically operate in areas where and at times when large whales occur, however interactions between whales and the bluefish fishery are possible. Right, humpback, and fin whales are known to have been seriously injured and/or killed by gear types used by the bluefish fishery, specifically gillnet gear. Although the gillnet gear has never been traced back to the bluefish fishery specifically, often the gear responsible cannot be identified.

The *Atlantic mackerel/squid/butterfish fisheries* are managed under a single FMP that includes both the short-finned squid (*Illex illecebrosus*) and long-finned squid (*Loligo pealei*) fisheries. Bottom otter trawl gear is the primary gear type used to land *Loligo* and *Illex* squid. Based on NMFS dealer reports, the majority of *Loligo* and *Illex* squid are fished in Mid-Atlantic waters within the action area of this consultation where loggerheads also occur. While squid landings occur year round, the majority of *Loligo* squid landings occur in the fall through winter months while the majority of *Illex* landings occur from June through October (MAFMC 2007a); time periods that overlap in whole or in part with the distribution of loggerhead sea turtles in Mid-Atlantic waters. Gillnets account for a small amount of landings in the mackerel fishery, and all gillnet gear use by this fishery is subject to the requirements of the ALWTRP. Loggerhead sea turtles are captured in bottom-otter trawl gear used in the *Loligo* and *Illex* squid fisheries, and in gillnet gear used by the mackerel fishery. Loggerheads may be injured or killed as a result of forced submergence in the gear.

The federal *monkfish fishery* occurs in all waters under federal jurisdiction from Maine to the North Carolina/South Carolina border. The current commercial fishery operates primarily in the deeper waters of the Gulf of Maine, Georges Bank, and southern New England, and in the Mid-Atlantic. Monkfish have been found in depths ranging from the tide line to 900 meters with concentrations between 70 and 100 meters and at 190 meters. The directed monkfish fishery uses several gear types that may entangle protected species, including gillnet and trawl gear.

Gillnet gear used in the monkfish fishery is known to capture ESA-listed sea turtles. Two unusually large stranding events occurred in April and May 2000 during which 280 sea turtles (275 loggerheads and 5 Kemp's ridleys) washed ashore on ocean facing beaches in North Carolina. Although there was not enough information to specifically determine the cause of the sea turtle deaths, there was information to suggest that the turtles died as a result of entanglement with large-mesh gillnet gear. The monkfish gillnet fishery, which uses a large-mesh gillnet, was known to be operating in waters off North Carolina at the time the stranded turtles would have died. As a result, in March 2002, NMFS published new restrictions for the use of gillnets with larger than 8 inch (20.3 cm) stretched mesh in federal waters (3-200 nautical miles) off of North Carolina and Virginia. These restrictions were published in an Interim Final Rule under the authority of the ESA (67 FR 13098; March 21, 2002) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on endangered and threatened species of sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the Interim Final Rule, NMFS published a Final Rule on December 3, 2002, that established the restrictions on an annual basis.

An estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the monkfish fishery has been published in a 2011 NEFSC Reference Document (Warden 2011). Using NEFOP data from 1996-2008 applied to VTR days fished. The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the monkfish fishery between 2005 and 2008 was estimated to be two loggerhead sea turtles a year (Warden 2011).

The *Northeast multispecies fishery* operates throughout the year, with peaks in the spring and from October through February. Multiple gear types are used in the fishery including sink gillnet, trawl, and pot/trap gear, which are known to be a source of injury and mortality to right, humpback, and fin whales as well as loggerhead, Kemp's ridley, and leatherback sea turtles as a result of entanglement and capture in the gear (NMFS 2001a). The Northeast multispecies sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water as deep as 110 meters (360 feet). In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery has declined since extensive groundfish conservation measures have been implemented; particularly since implementation of Amendment 13 and Amendment 16 to the NE Multispecies FMP. Additional management measures (*i.e.*, Framework Adjustment 42) are expected to have further reduced effort in the fishery. The exact relationship between multispecies fishing effort and the number of endangered species interactions with gear used in the fishery is unknown. However, in general, less fishing effort results in less time that gear is in the water and therefore less opportunity for sea turtles or cetaceans to be captured or entangled in multispecies fishing gear.

New information estimating loggerhead bycatch in bottom trawl gear has recently been published in Warden (2011). Using NEFOP data from 1996 to 2008 applied to VTR days fished, the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the NE multispecies fishery between 2005 and 2008 was estimated to be five loggerhead sea turtles per year (Warden 2011).

The *skate fishery* has typically been composed of both a directed fishery and an indirect fishery. The bait fishery has a longer history and is a more directed skate fishery than the wing fishery. Vessels that participate in the bait fishery are primarily from southern New England and target primarily little (90%) and winter skate (10%). The wing fishery is primarily an incidental fishery that takes place throughout the region. For section 7 purposes, NMFS considers the effects to ESA-listed species of the directed skate fishery. Fishing effort that contributes to landings of skate for the indirect fishery is considered during section 7 consultation on the directed fishery in which skate bycatch occurs.

New information estimating loggerhead bycatch in bottom trawl gear has recently been published in Warden (2011). Using NEFOP data from 1996 to 2008 applied to VTR days fished, the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the skate fishery between 2005 to 2008 was estimated to be five loggerhead sea turtles per year (Warden 2011).

Bottom trawl gear accounts for 94.5% of directed skate landings. Gillnet gear is the next most common gear type, accounting for 3.5% of skate landings. New information estimating loggerhead bycatch in bottom trawl gear has recently been published in Warden (2011). Using NEFOP data from 1996 to 2008 applied to VTR days fished, the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the skate fishery between 2005 and 2008 was estimated to be seven loggerhead sea turtles per year (Warden 2011).

The *spiny dogfish fishery* in the U.S. EEZ is managed under the Spiny Dogfish FMP. The primary gear types for the spiny dogfish fishery are sink gillnets, otter trawls, bottom longline, and driftnet gear (NMFS NEFSC 2003). The predominance of any one gear type has varied over time (NMFS NEFSC 2003). In 2005, 62.1% of landings were taken by sink gillnet gear, followed by 18.4% in otter trawl gear, 2.3% in line gear, and 17.1% in gear defined as “other” (excludes drift gillnet gear) (NMFS NEFSC 2006). More recently, data from fish dealer reports in FY 2008 indicate that spiny dogfish landings came mostly from sink gillnets (68.2%), and hook gear (15.2%), with some landings from bottom otter trawls (4.9%), unspecified (7.7%), and other gear (3.9%) (MAFMC 2010). Sea turtles can be incidentally captured in all gear sectors of the spiny dogfish fishery, which can lead to injury and death from forced submergence. ESA-listed cetaceans are also known to be seriously injured or killed from interaction with sink gillnet gear.

New information estimating loggerhead bycatch in bottom trawl gear has recently been published in Warden (2011). Using NEFOP data from 1996 to 2008 applied to VTR days fished, the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the spiny dogfish fishery between 2005 and 2008 was estimated to be zero loggerhead sea turtles per year (Warden 2011).

The *summer flounder, scup, and black sea bass fisheries* are managed under one FMP. Bottom otter and beam trawl gear are used most frequently in the commercial fisheries for all three species (MAFMC 2007b). Gillnets, handlines, dredges, and pots/traps are also occasionally used (MAFMC 2007b). In 2006, the NEFSC released an estimate of loggerhead sea turtle interactions in bottom otter trawl gear fished in Mid-Atlantic waters during the period 1996-2004 (Murray 2006). Fifty-percent of the observed 66 interactions occurred on vessels targeting summer flounder. However, it should also be noted that some of the observed interactions occurred on vessels fishing with TEDs using an allowed (at that time) TED extension with a minimum 5.5 inch mesh (Murray 2006). Numerous problems were noted by observers with respect to the mesh used in the TED extension including entanglement of sea turtles in the mesh and blocking of the TED by debris (Murray 2006). NMFS addressed these problems in 1999 by requiring that webbing in the TED extension be no more than 3.5 inch stretched mesh (Murray 2006).

Significant measures have been developed to reduce sea turtles interactions in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which includes fisheries for other species like scup and black sea bass). TEDs are required throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, NC, and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, NC, and Cape Charles, VA. Effort in the summer flounder, scup, and black sea bass fisheries has also declined since the 1980s and since each fishery became managed under the FMP. Therefore, effects to sea turtles are expected to have declined as a result of the decline in fishing effort. Nevertheless, the fisheries primarily operate in Mid-Atlantic waters in areas and times when sea turtles occur. Thus, there is a continued risk of sea turtle captures causing injury and death in summer flounder, scup, and black sea bass fishing gear.

Sea turtle interactions with gear used in the *Atlantic herring fishery* have not been reported or observed by NMFS observers. However, in past consultations, NMFS concluded that sea turtle interactions with fishing gear used in the fishery are reasonably likely to occur due to the observed capture of sea turtles in other fisheries that use comparable gear. Purse seines, midwater trawls (single), and pair trawls are the three primary gears involved in the Atlantic herring fishery (NEFMC 2006). However, the gear type accounting for the majority of herring landings changed over the ten-year period from 1995 to 2005 (NEFMC 2006). During the 1990's, purse seine and mid-water trawl gear accounted for the majority of annual herring landings. Since 2000, pair trawl gear has accounted for the majority of annual herring landings (NEFMC 2006). An ITS was issued in the September 17, 1999 biological opinion anticipating the take of six (no more than three lethal) loggerheads, one leatherback, one green, and one Kemp's ridley.

An FMP for the Atlantic herring fishery was implemented on December 11, 2000. Three management areas, which may have different management measures, were established under the Herring FMP. In 2007, amendment 1 to the Herring FMP (72 FR 11252, March 12, 2007), made changes to the management of the herring fishery, including making it a limited access fishery (NEFMC 2006). As a result of these changes, effort in the fishery is expected to be reduced or constrained. The ASMFC's Atlantic Herring ISFMP provides measures for the management of the herring fishery in state waters that are complementary to the federal FMP. The most recent

reinitiated (due to the Atlantic salmon listing) consultation on the herring fishery was completed on February 9, 2010. After review and evaluation of observer data (no observed interactions of ESA-listed species, despite increased observer coverage in recent years) and information on where and when the fishery operates, NMFS concluded the consultation informally due to the discountable nature of sea turtle or Atlantic salmon interactions. An informal consultation was then completed on April 23, 2012, that considered the effects of the herring fishery on newly-listed Atlantic sturgeon. This consultation concluded that the herring fishery is not likely to interact with Atlantic sturgeon and did not change our previous determination or trigger the need for additional consultation.

Atlantic pelagic fisheries for swordfish, tuna, sharks, and billfish (highly migratory species or HMS) are known to incidentally capture sea turtles, particularly in the pelagic longline component. Pelagic longline, pelagic driftnet, bottom longline, and/or purse seine gear have all been documented to hook, capture, or entangle sea turtles. The Northeast swordfish driftnet portion of the fishery was prohibited during an emergency closure that began in December 1996, and was subsequently extended. A permanent prohibition on the use of driftnet gear in the swordfish fishery was published in 1999. We reinitiated consultation on the pelagic longline component of this fishery as a result of exceeded incidental take levels for loggerhead and leatherback sea turtles (NMFS 2004a). The resulting Opinion stated the long-term continued operation of the pelagic longline fishery for tuna and swordfish was likely to jeopardize the continued existence of leatherback sea turtles, but RPAs were implemented allowing for the continued authorization of the fishery that would not jeopardize leatherbacks. In 2006, the Atlantic HMS pelagic longline fishery had an estimated 771.6 interactions with loggerhead sea turtles and 381.3 interactions with leatherback sea turtles (Garrison *et al.* 2009).

The most recent formal section 7 consultation on the continued authorization of the Atlantic shark fisheries via the Consolidated HMS FMP resulted in the issuance of a non-jeopardy Opinion issued by NMFS on December 12, 2012. The Opinion included an ITS for loggerhead, Kemp's ridley, green, leatherback, and hawksbill sea turtles, all five Atlantic sturgeon DPSs, and smalltooth sawfish (NMFS 2001a).

The *Atlantic sea scallop* fishery has a long history of operation in Mid-Atlantic and New England waters (NEFMC 1982, 2003). The fishery operates in areas and at times that it has traditionally operated and uses traditionally fished gear, which includes dredges and bottom trawls (NEFMC 1982, 2003). Landings from Georges Bank and the Mid-Atlantic dominate the fishery (NEFSC 2007). On Georges Bank and in the Mid-Atlantic, scallops are harvested primarily at depths of 30-100 meters, while the bulk of landings from the Gulf of Maine are from relatively shallow nearshore waters (<40 meters) (NEFSC 2007).

The Scallop FMP was originally implemented on May 15, 1982 (NEFSC 2007). Amendment 4 to the FMP, implemented in 1994, changed the management strategy from meat count regulation to effort control for the entire U.S. EEZ (NEFSC 2007). The limited access program, first established under Amendment 4, remains the basic effort control measure for the scallop fishery. From 2004 through 2008, vessels that did not qualify for a full-time, part-time, or occasional limited access permit could have obtained an open access, general category scallop permit. Effort

(in terms of days fished) in the Mid-Atlantic is now about half of what it was prior to implementation of Amendment 4 to the Scallop FMP (NEFSC 2007).

An increase in active general category permits and landings from these vessels prompted the initiation of Amendment 11 to the Scallop FMP. In particular, it was noted that from 2000 to 2005 there was an increasing percentage of general category landings by vessels with homeports in the Mid-Atlantic region, and shifts in fishing effort by general category vessels to Mid-Atlantic fishing grounds (NEFMC 2007). In 2008, the implementation of Amendment 11 established a limited access general category (LAGC) program consisting of three permit types: Northern Gulf of Maine (NGOM), Incidental, and Individual Fishing Quota (IFQ). The IFQ program became effective March 1, 2010. The implementation of the LAGC fleet contributes to the management objectives of the fishery by reducing or constraining effort in the general category sector.

Loggerhead, Kemp's ridley, and green sea turtles have been reported by NMFS observers as being captured in scallop dredge and or trawl gear. The first reported capture of a sea turtle in the scallop fishery occurred in 1996 during an observed trip of a scallop dredge vessel. A single capture in scallop dredge gear was reported for each of 1997 and 1999, as well. In 2001, 13 sea turtle captures in scallop dredge gear were observed and/or reported by NMFS observers. All of these occurred in the re-opened Hudson Canyon and Virginia Beach Access Areas where observer coverage of the scallop fishery was higher in comparison to outside of the Access Areas. Although NMFS was not aware until 1996 that sea turtle interactions with scallop fishing gear occurred, there is no information to suggest that turtle interactions with scallop fishing gear are a new event or are occurring at a greater rate than what has likely occurred in the past. The methods used to detect any sea turtle interactions with scallop fishing gear (dredge or trawl gear) were insufficient prior to increased observer coverage in 1996. The average number of annual observable interactions of hard-shelled sea turtles in the Mid-Atlantic dredge fishery prior to the implementation of chain mats (January 1, 2001, through September 25, 2006) was estimated to be 288 turtles, of which 218 could be confirmed as loggerheads (Murray 2011). After the implementation of chain mats (September 26, 2006, through December 31, 2008), the average annual number of observable plus unobservable, quantifiable interactions in the Mid-Atlantic dredge fishery was estimated to be 125 turtles, of which 95 could be confirmed as loggerheads (Murray 2011). An estimate of loggerhead bycatch in Mid-Atlantic scallop trawl gear from 2005-2008 averaged 95 turtles annually (Warden 2011a). There have been no known changes to the seasonal distribution of loggerhead sea turtles in the Mid-Atlantic north of Cape Hatteras (CeTAP 1982; Lutcavage and Musick 1985; Keinath *et al.* 1987; Shoop and Kenney 1992; Burke *et al.* 1993, 1994) with the exception of recent studies (Morreale *et al.* 2005; Mansfield 2006) which suggest a decrease in the use of some Mid-Atlantic loggerhead foraging areas for unknown reasons. Therefore, it is likely that the effect of the scallop fishery on sea turtles, while only quantified and recognized within the 17 or so years, has been present for decades.

Formal section 7 consultation on the continued authorization of the scallop fishery was last reinitiated on February 28, 2012, with an Opinion issued by NMFS on July 12, 2012. In this Opinion, NMFS determined that the continued authorization of the Scallop FMP (including the seasonal use of turtle deflector dredges [TDDs] in Mid-Atlantic waters starting in 2013) may adversely affect but was not likely to jeopardize the continued existence of loggerhead,

leatherback, Kemp's ridley, and green sea turtles, or the five DPSs of Atlantic sturgeon, and issued an ITS. The number of loggerhead and hard-shelled sea turtles expected to interact with scallop dredge gear annually is based on an analysis of sea turtle interactions in the dredge fishery from 2001-2008 as presented in Murray (2011). The number of loggerheads expected to interact with scallop trawl gear annually is based on data presented in Warden (2011a). For the other sea turtle species and Atlantic sturgeon, annual estimated interactions are based on observer data from the NEFOP and/or other bycatch reports. In the ITS, the scallop fishery is estimated to interact annually with up to 301 loggerhead, two leatherback, three Kemp's ridley, and two green sea turtles, as well as one Atlantic sturgeon from any of the five DPSs. Of the loggerhead interactions, up to 112 per year are anticipated to be lethal from 2013 going forward. RPMs to minimize the impact of these incidental takes are also included in the Opinion, including an RPM to monitor fishing effort in the scallop dredge in the Mid-Atlantic during times when sea turtles are known to interact with the fishery (NMFS 2012c). Additional measures to minimize the impact of sea turtle interactions with the scallop fishery have been implemented through Frameworks 22 and 23 to the Scallop FMP and will be re-evaluated in future Frameworks.

A summary of the current *tilefish fishery* is provided in the 48th Northeast Regional Stock Assessment Report (NMFS NEFSC 2009). The management unit for the Tilefish FMP is all golden tilefish under U.S. jurisdiction in the Atlantic Ocean north of the Virginia/North Carolina border. Tilefish have some unique habitat characteristics, and are found in a warm water band (9°-14°C) approximately 76-365 meters (250 to 1,200 feet) deep on the outer continental shelf and upper slope of the U.S. Atlantic coast. Because of their restricted habitat and low biomass, the tilefish fishery in recent years has occurred in a relatively small area in the Mid-Atlantic Bight, south of New England and west of New Jersey. Bottom longline gear equipped with circle hooks is the primary gear type used in the tilefish fishery.

The effects of the Northeast and Mid-Atlantic tilefish fishery on ESA-listed species were considered during formal section 7 consultation on the implementation of a new Tilefish FMP, which concluded on March 13, 2001 with the issuance of a non-jeopardy biological opinion. The biological opinion included an ITS for loggerhead and leatherback sea turtles, exempting the annual incidental take of six loggerheads and one leatherback as a result of capture, entanglement, or hooking in bottom longline and/or bottom trawl gear associated with the fishery (NMFS 2001d).

Section 7 consultation was completed on the *red crab fishery* during the proposed implementation of the Red Crab FMP (NMFS 2002c). The biological opinion concluded that the action was not likely to result in jeopardy to any ESA-listed species under NMFS' jurisdiction. The fishery is a pot/trap fishery that occurs in deep waters along the continental slope. The primary fishing zone for red crab, as reported by the fishing industry, is at a depth of 400-800 meters (1,300-2,600 feet) along the continental shelf in the Northeast region, and is limited to waters north of 35°15.3'N (Cape Hatteras, NC) and south of the Hague Line. To address concerns that red crab could be overfished, an FMP was developed and became effective on October 21, 2002. In the 2002 biological opinion, an ITS was provided for leatherback and loggerhead sea turtles which exempts the incidental take of one loggerhead and one leatherback sea turtle annually as a result of entanglement in lines associated with the pot/trap gear utilized in

the fishery. Right, humpback, fin and sei whales are also at risk of entanglement in gear used by the red crab fishery. Gear used by this fishery is required to be in compliance with the ALWTRP. One exemption from the ALWTRP that affects the red crab fishery is the deep water exemption. The sinking groundline requirement does not apply to gear that is fished at depths greater than 280 fathoms. Whales and sea turtles in the action area are not known to commonly dive to depths greater than 275 fathoms. Therefore, this exemption is unlikely to have an adverse impact on entanglement risks.

Shrimp trawling in the southeastern U.S.

On May 8, 2012, NMFS completed a Section 7 consultation and issued an opinion on the continued implementation of the sea turtle conservation regulations applicable to shrimp trawling, as then proposed to be amended, and the continued authorization of Southeast U.S. shrimp fisheries in federal waters on threatened and endangered species and designated critical habitat (NMFS 2012a). The proposed action of the 2012 opinion included implementation of a final rule requiring TEDs in skimmer trawls, pusher-head trawls, and wing nets. On November 21, 2012, NMFS determined that a final rule requiring such was not warranted at that time and withdrew the proposal. The decision to not implement the final rule created a change to the proposed action analyzed in the 2012 opinion, with effects to listed species that have not previously been considered, thus triggered the need to reinitiate consultation. Consequently, on November 26, 2012, NMFS reinitiated consultation.

On April 18, 2014, NMFS completed a biological opinion that determined the shrimp trawl fishery may adversely affect but would not jeopardize the continued existence of any sea turtle species. Although the ITS in this Opinion does not provide actual estimates of incidental take for any sea turtle species, the effects section provides a qualitative assessment of likely impacts based on orders of magnitude, estimating that the shrimp fishery, as currently operating, would result in at least thousands and possibly tens of thousands of interactions annually, of which at least hundreds and possibly thousands are expected to be lethal for loggerhead sea turtles and a few hundred interactions with leatherback sea turtles are likely (NMFS 2014).

4.1.2 Non-federally Regulated Fisheries

Like federally authorized fisheries sea turtles may be vulnerable to capture, injury and mortality in fisheries occurring in state waters. The action area includes portions of some state waters from Maine through North Carolina. Captures of sea turtles in these fisheries have been reported (NMFS SEFSC 2001).

The amount of gear contributed to the environment by these fisheries is largely unknown. In most cases, there is limited observer coverage of these fisheries and the extent of interactions with ESA-listed species is unknown. Where available, specific information on sea turtle interactions in state fisheries is provided below.

Nearshore and inshore gillnet fisheries occur throughout the Mid-Atlantic in state waters from Connecticut through North Carolina; where sea turtles also occur. Captures of sea turtles in these fisheries have been reported (NMFS SEFSC 2001). Two 10-14 inch mesh gillnet fisheries, the black drum and sandbar shark gillnet fisheries, occur in Virginia state waters along the tip of

the eastern shore. These fisheries may interact with sea turtles given the gear type, but no interactions have been observed. Similarly, small mesh gillnet fisheries occurring in Virginia state waters are suspected to interact with sea turtles but no interactions have been observed. During May - June 2001, NMFS observed 2% of the Atlantic croaker fishery and 12% of the dogfish fishery (which represent approximately 82% of Virginia's total small mesh gillnet landings from offshore and inshore waters during this time), and no turtle interactions were observed (NMFS 2004b). In North Carolina, a large-mesh gillnet fishery for summer flounder in the southern portion of Pamlico Sound was found to interact with sea turtles. A Section 10 incidental take permit was issued to this fishery in 2001 based on take levels set by NMFS during the 2000 fishing season for large mesh gillnet fisheries in both shallow and deep water. The annual estimated lethal and live takes for the 2002-2004 fishing seasons was 24 lethal and 164 live takes of each Kemp's ridley, green, and loggerhead sea turtles. The permit was renewed for the 2005-2010 fishing years and new take estimates were derived from the 2001-2004 at-sea monitoring program. The new ITS exempted the take of 41, 168, and 41 for Kemp's ridley, green, and loggerhead turtles respectively.

An *Atlantic croaker* fishery using trawl and gillnet gear also occurs within the action area, and turtle interactions have been observed in the fishery. The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the Atlantic croaker fishery was estimated to be 70 (Warden 2011). Additional information on sea turtle interactions with gillnet gear, including gillnet gear used in the Atlantic croaker fishery, has also been recently published by Murray (2009a, 2009b). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the Atlantic croaker fishery, based on VTR data from 2002 to 2006, was estimated to be 11 per year with a 95% CI of 3-20 (Murray 2009b). ESA-listed cetaceans have also been known to interact with gillnet gear; thus, interaction may occur where the gear and the cetacean distributions overlap.

The *weakfish* fishery occurs in both state and federal waters, but the majority of commercially and recreationally caught weakfish are caught in state waters (ASMFC 2002). The dominant commercial gears include gillnets, pound nets, haul seines, and trawls, with the majority of landings occurring in the fall and winter months (ASMFC 2002). Weakfish landings were dominated by the trawl fishery through the mid-1980s after which gillnet landings began to account for most weakfish landed (ASMFC 2002). North Carolina has accounted for the majority of the annual landings since 1972 while Virginia ranks second, followed by New Jersey (ASMFC 2002). As described in section 3.2, sea turtle bycatch in the weakfish fishery has occurred (Warden 2011; Murray 2009a, 2009b). The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the weakfish fishery was estimated to be 1 loggerhead sea turtle (Warden 2011). Additional information on sea turtle interactions with gillnet gear, including gillnet gear used in the weakfish fishery, has also been recently published by Murray (2009a, 2009b). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the weakfish fishery, based on VTR data from 2002 to 2006, was estimated to be one per year (95% CI of 0-1) (Murray 2009b). ESA-listed cetaceans have also been known to interact with gillnet gear, thus interaction may occur where the gear and the cetacean distributions overlap.

A *whelk* fishery using pot/trap gear is known to occur in several parts of the action area, including waters off Maine, Connecticut, Massachusetts, Delaware, Maryland, and Virginia.

Landings data for Delaware suggests that the greatest effort in the whelk fishery for waters off that state occurs in the months of July and October; when sea turtles are present. Whelk pots, which unlike lobster traps are not fully enclosed, have been suggested as a potential source of entrapment for loggerhead sea turtles that may be enticed by the bait or whelks in the trap (Mansfield *et al.* 2001). Leatherback and loggerhead sea turtles as well as right, humpback, and fin whales are known to become entangled in lines associated with trap/pot gear used in several fisheries including lobster, whelk, and crab species (NMFS SEFSC 2001; Dwyer *et al.* 2002; NMFS 2007a).

Various *crab fisheries*, such as horseshoe crab and blue crab, also occur in federal and state waters. The crab fisheries may have detrimental impacts on sea turtles beyond entanglement in the fishing gear itself. Loggerheads are known to prey on crab species, including horseshoe and blue crabs. In a study of the diet of loggerhead sea turtles in Virginia waters from 1983-2002, Seney and Musick (2007) found a shift from horseshoe and blue crabs to fish, particularly menhaden and Atlantic croaker. The authors suggested that a decline in the crab species have resulted in the shift and loggerheads are likely foraging on fish captured in fishing nets or on discarded fishery bycatch (Seney and Musick 2007). The physiological impacts of this shift are uncertain although it was suggested as a possible explanation for the declines in loggerhead abundance noted by Mansfield (2006). Other studies have detected seasonal declines in loggerhead abundance coincident with seasonal declines of horseshoe and blue crabs in the same area (Maier *et al.* 2005). While there is no evidence of a decline in horseshoe crab abundance in the Southeast during the period 1995-2003, declines were evident in some parts of the Mid-Atlantic (ASMFC 2004; Eyster *et al.* 2007). Given the variety of loggerhead prey items (Dodd 1988; Burke *et al.* 1993; Bjorndal 1997; Morreale and Standora 1998) and the differences in regional abundance of horseshoe crabs and other prey items (ASMFC 2004; Eyster *et al.* 2007), a causation between loggerhead sea turtle abundance and horseshoe crab and blue crab availability cannot be made at this time. Nevertheless, the decline in loggerhead abundance in Virginia waters (Mansfield 2006), and possibly Long Island waters (Morreale *et al.* 2005), commensurate with noted declines in the abundance of horseshoe crab and other crab species, raises concerns that crab fisheries may be impacting the forage base for loggerheads in some areas of their range.

Sea turtle interactions in the *Virginia pound net fishery* have been observed. Pound nets with large-mesh leaders set in the Chesapeake Bay have been observed to (lethally) capture turtles as a result of entanglement in the pound net leader. As described in section 4.4.4 below, NMFS has taken regulatory action to address turtle interactions in the Virginia pound net fishery. Although no incidental captures have been documented from fish traps set off North Carolina, they are another potential anthropogenic impact to loggerheads and other sea turtles (NMFS SEFSC 2001).

Observations of state recreational fisheries have shown that loggerhead, leatherback, and green sea turtles are known to bite baited hooks, and loggerheads frequently ingest the hooks. Hooked sea turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties, and from commercial fishermen fishing for snapper, grouper, and sharks with both single rigs and bottom longlines (NMFS SEFSC 2001). A summary of known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the TEWG (1998, 2000) reports. Although no incidental captures have been documented in fish traps set off North Carolina, they

are another potential anthropogenic impact to loggerheads and other sea turtles (NMFS SEFSC 2001).

4.1.3 Lobster Fishing in Canadian and State Waters

The past and present impacts on ESA-listed species as a result of lobster fishing in Canadian and U.S. state waters to the extent not regulated as part of the American lobster FMP have been considered as part of the environmental baseline and in NMFS' integration and synthesis of effects on the ESA-listed species set forth below. Details regarding reported serious injuries and mortalities to ESA-listed whales from lobster fishing in U.S. federal, state, and Canadian waters is contained in Tables 8 through 11, which NMFS fully considered for the purpose of this biological opinion.

Between 2007 and 2011, six ESA-listed whales (3 fin, 2 humpback, and 1 sei) have been observed seriously injured or killed as a result of fishing gear identified to be Canadian. NMFS has considered the impacts of lobster fishing in Canadian and state waters in its analysis of whether the proposed action is likely to jeopardize the continued existence of the species, as explained in this biological opinion.

4.2 Military Vessel Activity and Operations

Potential sources of adverse effects to sea turtles from federal vessel operations in the action area include operations of the U.S. Navy (USN), U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), Army Corps of Engineers (ACOE), and NOAA. NMFS has previously conducted formal consultations with the USN, USCG, and NOAA on their vessel-based operations. NMFS has also conducted section 7 consultations with the Minerals Management Service (MMS) (now the Bureau of Ocean Energy Management, Regulation and Enforcement), Federal Energy Regulatory Commission (FERC), and Maritime Administration (MARAD) on vessel traffic related to energy projects in the Northeast Region and has implemented conservation measures. Through the section 7 process NMFS has and will continue to identify conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species.

Several biological opinion for USN activities (NMFS 1996, 1997, 2006b, 2008c, 2009a,b) and USCG (NMFS 1995, 1998c) contain details on the scope of vessel operations for these agencies and the conservation measures that are being implemented as standard operating procedures. In the U.S. Atlantic, the operation of USCG boats and cutters is not expected to jeopardize the continued existence of the ESA-listed species with an estimated take of no more than one individual sea turtle, of any species, per year (NMFS 1995, 1998c).

In June 2009, NMFS prepared a biological opinion on USN activities in each of their four training range complexes along the U.S. Atlantic coast—Northeast, Virginia Capes, Cherry Point, and Jacksonville (NMFS 2009b). That biological opinion found that no whales are likely to die or be wounded as a result of their exposure to U.S. Navy training in the Atlantic Ocean. However, the Virginia Capes Range Complex was assigned potential take in the form of harassment of fin, sei and humpback whales. Regarding impacts to sea turtles, the Virginia

Capes Range Complex and Jacksonville Range Complex were attributed with potential harassment of leatherback sea turtles and hard shell turtles, and the Virginia Capes Range Complex has been characterized as having the potential to harm loggerhead and Kemp's ridley turtles.

Military activities such as ordnance detonation also affect ESA-listed species. A section 7 consultation was conducted in 1997 for USN aerial bombing training in the ocean off the Southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs). The resulting biological opinion for this consultation determined that the activity was likely to adversely affect ESA-listed marine mammals and sea turtles in the action area, but would likely not jeopardize their continued existence. In the ITS included within the biological opinion, these training activities were estimated to have the potential to injure or kill, annually, 84 loggerheads, 12 leatherbacks, and 12 greens or Kemp's ridleys, in combination (NMFS 1997).

NMFS has also conducted more recent section 7 consultations on USN explosive ordnance disposal, mine warfare, sonar testing (*e.g.*, AFAST, SURTASS LFA), and other major training exercises (*e.g.*, bombing, gunfire, combat search and rescue, anti-submarine warfare, and torpedo and missile exercises) in the Atlantic Ocean. These consultations have determined that the proposed USN activities may adversely affect but would not jeopardize the continued existence of ESA-listed marine mammals and sea turtles (NMFS 2008c, 2009a,b). NMFS estimated that five loggerhead and six Kemp's ridley sea turtles were likely to be harmed as a result of training activities in the Virginia Capes Range Complex from June 2009 to June 2010, and that nearly 1,500 sea turtles, including 10 leatherbacks, were likely to experience harassment (NMFS 2009b).

Similarly, operations of vessels by other federal agencies within the action area (NOAA, EPA, and ACOE) may adversely affect ESA-listed marine mammals and sea turtles. However, vessel activities of those agencies are often limited in scope, as they operate a small number of vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk. For example, NOAA research vessels conducting fisheries surveys for the NEFSC are estimated to take no more than nine sea turtles per year (eight alive, one dead). This includes up to seven loggerheads as well as an additional loggerhead, leatherback, Kemp's ridley, or green sea turtle per year during bottom trawl surveys and one loggerhead, leatherback, Kemp's ridley, or green sea turtle per year during scallop dredge surveys (NMFS 2007b).

In addition to the NEFSC surveys which occur throughout the year, NMFS also funds the Northeast Area Monitoring and Assessment Program (NEAMAP) nearshore trawl surveys which are conducted for one month every spring and fall by the Virginia Institute of Marine Science (VIMS) in shallow, nearshore waters (up to 120 feet) from Cape Hatteras, NC to Montauk, NY. The 2012 surveys conducted by VIMS, and funded by NMFS through the Mid-Atlantic RSA Program, are expected to result in the annual capture of six NWA DPS loggerhead sea turtles, four Kemp's ridley sea turtles, one green sea turtle, one leatherback sea turtle, and no more than 32 Atlantic sturgeon. No mortalities of any ESA-listed species are expected.

4.3 Other Activities

4.3.1 Hopper Dredging

The construction and maintenance of federal navigation channels and sand mining (“borrow”) areas have also been identified as sources of sea turtle mortality. NMFS Northeast and Southeast regions have completed several ESA Section 7 consultations with Federal agencies to consider effects of these hopper dredging projects on listed sea turtles. The table below provides information on Biological Opinions considering dredging projects in the action area and the associated ITS for sea turtles (unless otherwise noted, take estimates are per dredge cycle):

Table 7. Information on Consultations conducted by NMFS for dredging projects that occur in the action area

Project	Date of Opinion	Loggerhead	Kemp's ridley	Green	Leatherback	Notes
ACOE Long Island, NY to Manasquan, NJ Beach Nourishment	12/15/1995	5 turtles total: combination of any species				
ACOE Sandy Hook Channel Dredging	6/10/1996	2	1	2	1	2 loggerheads/ green inclusive; and 1 Kemp's ridley/leatherback
ACOE Philadelphia District Dredging	11/26/1996	4	1	1	0	annual estimate
ACOE Continued Hopper Dredging of Channels and Borrow Areas in the SE U.S.	9/25/1997	35	7	7	0	annual estimate for the Southeast U.S. (North Carolina to Key West, Florida)
ACOE Maryland Coastal Beach Protection Project (several projects with different ITSs)	4/6/1998	10	1	2	0	total takes over 25-year Assateague Island project
		6	1	1	0	takes per dredge cycle for MD shoreline protection project

ACOE Atlantic Coast of Maryland Shoreline Protection Project	11/30/2006	1 (≤ 0.5 million cy); 2 (> 0.5 to ≤ 1 million cy); 3 (> 1 to ≤ 1.5 million cy); 4 (> 1.5 to ≤ 1.6 million cy)	2			over life of project (through 2044), ~10-12 million cy will be dredged with an anticipated 24 turtles killed (2 Kemp's ridleys, 22 loggerheads)
U.S. Navy Shoreline Restoration and Protection Project, JEB Little Creek/ Fort Story, VA Beach	7/13/2012	1 loggerhead or Kemp's ridley		0	0	
U.S. Navy Shoreline Protection Sys Repairs, Naval Air Station Oceana, Dam Neck Annex, VA Beach	7/20/2012	1 loggerhead or Kemp's ridley		0	0	
NASA Wallops Isl Shoreline Restoration/ Infrastructure Protection Program	8/3/2012	up to 9	no more than 1			total takes over 50-year project life
ACOE Sandbridge Shoals Hurricane Protection Project Dredging (2012-2013)	9/7/2012	6	1 Kemp's ridley or green		0	takes are only expected to occur in hopper dredge operations from Apr 1 - Nov 30; all hopper dredge takes expected to be lethal
ACOE Dredging of Chesapeake Bay Entrance Channels and Beach Nourishment	10/16/2012	937 non-lethal captures, 452 mortalities	275 non-lethal captures, 48 mortalities	38 non-lethal captures, 11 mortalities	0	total takes over 50-year project life
Relocation Trawling: up to 938 captures (37 mortalities) of loggerheads, 275 captures (11 mortalities) of Kemp's ridleys, and 37 captures (2 mortalities) of green sea turtles						

ACOE NY and NJ Harbor Deepening	10/25/2012	1 loggerhead or Kemp's ridley	0	0	total takes over 50-year project life
ACOE Sea Bright Offshore Borrow Area Beach Nourishment	3/7/2014	Port Monmouth: 1 loggerhead or Kemp's ridley; Union Beach: 1 loggerhead or Kemp's ridley; Elberon to Loch Arbour: 5 loggerheads and 1 loggerhead or Kemp's ridley (all lethal or non-lethal)	0	0	total takes over 50-year project life

4.3.2 Maritime Industry

Private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with ESA-listed species. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on listed species may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. It is important to note that minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so it is more likely to become vulnerable to effects such as entanglements. Listed species may also be affected by fuel oil spills resulting from vessel accidents. Fuel oil spills could affect animals directly or indirectly through the food chain. Fuel oil spills involving fishing vessels are common events, but typically involve only small amounts of material. Larger fuel oil spills may result from accidents, although these events would be rare. No direct adverse effects on listed species from fishing vessel fuel oil spills have been documented.

4.3.3 Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local, or private action, may affect ESA-listed species in the action area. Sources of pollutants in coastal regions of the action area include atmospheric loading of pollutants such as PCBs, storm water runoff from coastal towns, cities and villages, runoff into rivers emptying into bays, groundwater discharges and sewage treatment effluent, and oil spills. Marine debris (*e.g.*, discarded fishing line or lines from boats) can entangle cetaceans or sea turtles causing serious injury or mortality. Turtles commonly ingest plastic or mistake debris for food, as observed with the leatherback sea turtle. Jellyfish are a preferred prey for leatherbacks, and similar looking plastic bags are often found in the turtle's stomach contents (Magnuson *et al.* 1990).

Nutrient loading from land-based sources, such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effect to larger embayments is unknown. Contaminants could indirectly affect ESA-listed species if the pollution reduces the food available to marine animals.

4.3.4 Coastal Development

Beachfront development, lighting, and beach erosion control all are ongoing activities along the Mid- and South Atlantic coastlines of the U.S. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

4.3.5 Catastrophic Events

Commercial vessel traffic/shipping imposes the potential for oil/chemical spills. With human population rising and commerce becoming increasingly globalized, so too does the demand for more ships. The pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo *et al.* 1986). There have been a number of documented oil spills in the northeastern U.S. Oil spills outside the action area also have the potential to affect ESA-listed species that occur within the action area. For instance, on April 20, 2010 the BP Deepwater Horizon oil spill occurred in the Gulf of Mexico off the coast of Louisiana. As ESA-listed species (*e.g.*, loggerhead and Kemp's ridley sea turtles) are known to migrate through, forage, and/or nest along the coastal waters of the Gulf of Mexico, the oil spill is likely to affect their populations; however, because all the information on sea turtle and other ESA-listed species' stranding, deaths, and recoveries has not yet been documented, the effects of the oil spill on their populations cannot be determined at this time.

4.4 Reducing Threats to ESA-listed Whales and Sea Turtles

4.4.1 Education and Outreach Activities

Education and outreach activities are considered some of the primary tools we can use to reduce the threats to all protected species. For example, NMFS has been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques and has issued guidelines for recreational fishermen and boaters on how to avoid the likelihood of interactions with marine mammals. NMFS is engaged in a number of education and outreach activities aimed specifically at increasing mariner awareness of the threat of ship strike to right whales. NMFS intends to continue these outreach efforts in an attempt to reduce interactions with protected species, and to reduce the likelihood of injury to protected species when interactions do occur.

4.4.2 Sea Turtle Stranding and Salvage Network (STSSN)

There is an extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts that collects data on dead sea turtles and rescues and rehabilitates live stranded turtles, reducing mortality of injured or sick animals. Data collected by the STSSN are used to monitor stranding levels and identify areas where unusual or elevated mortality is occurring, and to identify sources of mortality. These data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live turtles when encountered (either via the

stranding network through incidental takes or in-water studies). Tagging studies help improve our understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

4.4.3 Sea Turtle Disentanglement Network (STDN)

NMFS Northeast Region established the Northeast Sea Turtle Disentanglement Network (STDN) in 2002 in response to the high number of leatherback sea turtles found entangled in pot gear along the U.S. Northeast Atlantic coast. The STDN is considered a component of the larger STSSN program and operates in all states in the region. The STDN responds to entangled sea turtles in order to disentangle and release live animals, thereby reducing serious injury and mortality. In addition, the STDN collects data on these events, providing valuable information for management purposes. The NMFS Northeast Regional Office oversees the STDN program and manages the STDN database.

4.4.4 Regulatory Measures for Sea Turtles

4.4.4.1 Large-Mesh Gillnet Requirements in the Mid-Atlantic

Since 2002, NMFS has regulated the use of large mesh gillnets in federal waters off North Carolina and Virginia (67 FR 13098, March 21, 2002) to reduce the impact of these fisheries on ESA-listed sea turtles. These restrictions were revised in 2006 (73 FR 24776, April 26, 2006). Currently, gillnets with stretched mesh size 7 inches (17.8 cm) or larger are prohibited in the Exclusive Economic Zone during the following times and in the following areas: (1) north of the NC/SC border to Oregon Inlet, NC at all times, (2) north of Oregon Inlet to Currituck Beach Light, NC from March 16 through January 14, (3) north of Currituck Beach Light, NC to Wachapreague Inlet, VA from April 1 through January 14, and (4) north of Wachapreague Inlet, VA to Chincoteague, VA from April 16 through January 14.

NMFS has also issued regulations to address the interaction of sea turtles in gillnet gear fished in Pamlico Sound, NC. Waters of Pamlico Sound are closed to fishing with gillnets with a stretched mesh size larger than 4 ¼ inch (10.8 cm) from September 1 through December 15 each year to protect sea turtles. The closed area includes all inshore waters of Pamlico Sound, and all contiguous tidal waters, south of 35E 46.3' N, north of 35E 00' N, and east of 76E 30' W.

4.4.4.2 TED Requirements in Trawl Fisheries

Turtle Excluder Devices (TEDs) are required in the shrimp and summer flounder fisheries. TEDs allow sea turtles to escape the trawl net, reducing injury and mortality resulting from capture in the net. Approved TEDs are required in the shrimp trawl fishery operating in the Atlantic and Gulf areas unless the trawler is fishing under one of the exemptions (*e.g.*, skimmer trawl, try net) and all requirements of the exemption (50 CFR 223.206) are met. On February 21, 2003, NMFS issued a final rule to amend the TED regulations to enhance their effectiveness in reducing sea turtle mortality resulting from shrimp trawling in the Atlantic and Gulf areas of the southeastern United States by requiring an escape opening designed to exclude leatherbacks

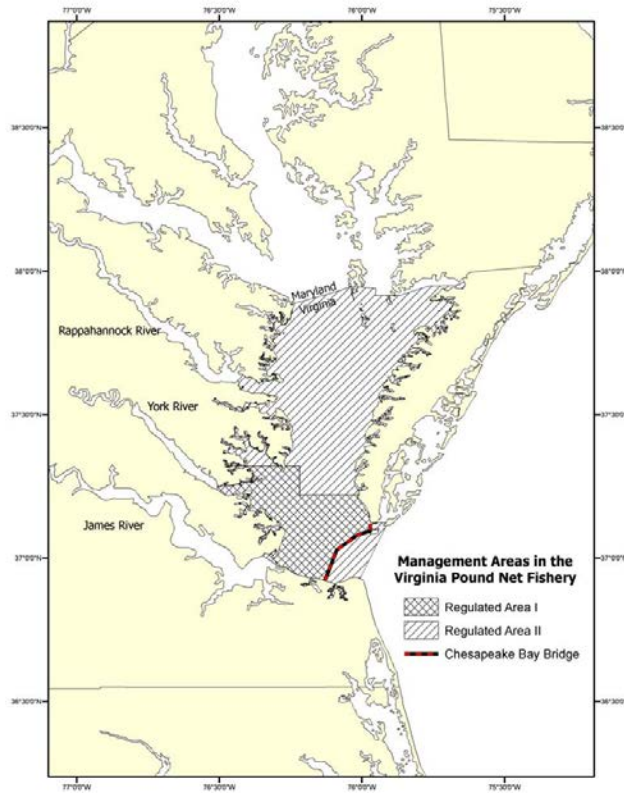
as well as large loggerhead and green turtles (68 FR 8456; February 21, 2003). In 2011, NMFS published a Notice of Intent to prepare an Environmental Impact Statement (EIS) and to conduct scoping meetings. NMFS is considering a variety of regulatory measures to reduce the bycatch of threatened and endangered sea turtles in the shrimp fishery of the southeastern United States in light of new concerns regarding the effectiveness of existing TED regulations in protecting sea turtles (76 FR 37050, June 24, 2011).

TEDs are also required for summer flounder trawlers in the summer flounder fishery-sea turtle protection area. This area is bounded on the north by a line extending along 37° 05'N (Cape Charles, VA) and on the south by a line extending out from the North Carolina-South Carolina border. Vessels north of Oregon Inlet, NC are exempt from the TED requirement from January 15 through March 15 each year (50 CFR 223.206). The TED requirements for the summer flounder trawl fishery do not require the use of the larger escape opening. NMFS is considering increasing the size of the TED escape opening currently required in the summer flounder fishery and implementing sea turtle conservation requirements in other trawl fisheries and in other areas (72 FR 7382, February 15, 2007; 74 FR 21630, May 8, 2009).

4.4.4.3 Sea Turtle Conservation Requirements in the Virginia Pound Net Fishery

NMFS has issued several regulations to help protect sea turtles from entanglement in and impingement on Virginia pound net gear (66 FR 33489, June 22 2001; 67 FR 41196; June 17, 2002; 68 FR 41942, July 16, 2003; 69 FR 24997, May 5, 2004). Currently, all offshore pound leaders in Pound Net Regulated Area I (see Figure 5 below) must meet the definition of a modified pound net leader from May 6 through July 15. The modified leader has been found to be effective in reducing sea turtle interactions as compared to the unmodified leader. Nearshore pound net leaders in Pound Net Regulated Area I and all pound net leaders in Pound Net Regulated Area II (see Figure 5 below) must have mesh size less than 12 inches (30.5 cm) stretched mesh and may not employ stringers (50 CFR 223.206) from May 6 through July 15 each year. A pound net leader is exempt from these measures only if it meets the definition of a modified pound net leader. In addition, there are monitoring and reporting requirements in this fishery (50 CFR 223.206). Since the 2010 fishing season, the state of Virginia has required modified pound net leaders (as defined by federal regulations) east of the Chesapeake Bay Bridge year round, and in offshore leaders in Regulated Area I (also as defined by Federal regulations) from May 6 to July 31. This is a 16 day extension of the federal regulations in this area.

Figure 5. Managements Areas in the Virginia Pound Net Fishery



4.4.4.4 Sea Turtle Conservation Requirements in the HMS Fishery

NMFS SERO completed the most recent biological opinion on the FMP for the Atlantic HMS fisheries for swordfish, tuna, and shark on June 1, 2004, and concluded that the Atlantic HMS fisheries, particularly the pelagic longline fisheries, were likely to jeopardize the continued existence of leatherback sea turtles. An RPA was provided to avoid jeopardy to leatherback sea turtles as a result of operation of the HMS fisheries. Although the biological opinion did not conclude jeopardy for loggerhead sea turtles, the RPA is also expected to benefit this species by reducing mortalities resulting from interactions with the gear. A number of requirements have been put in place as a result of the biological opinion and subsequent research. These include measures related to the fishing gear, bait, disentanglement gear and training. Since 2004, bycatch estimates for both loggerheads and leatherbacks in pelagic longline gear have been well below the average prior to implementation of gear regulations under the RPA (Garrison and Stokes 2012).

In 2008, NMFS SERO completed a section 7 consultation on the continued authorization of HMS Atlantic shark fisheries specifically. To protect declining shark stocks, NMFS sought to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles.

NMFS requires the use of specific gears and release equipment in the pelagic longline component of the HMS fishery in order to minimize lethal impacts to sea turtles. Sea turtle handling and release protocols for the HMS fishery are described in detail in NMFS SEFSC (2008). Sea turtle handling and release placards are required to be posted in the wheelhouse of certain commercial fishing vessels. NMFS has also initiated an extensive outreach and education program for commercial fishermen that engage in these fisheries in order to minimize the impacts of this fishery on sea turtles. As part of the program, NMFS has distributed sea turtle identification and resuscitation guidelines to HMS fishermen who may incidentally hook, entangle, or capture sea turtles during their fishing activities and has also conducted hands on workshops on safe handling, release, and identification of sea turtles.

4.4.4.5 Modified Gear in the Atlantic Sea Scallop Fishery

To reduce serious injury and mortality to sea turtles resulting from capture in the sea scallop dredge bag, we have required the use of a chain-mat modified dredge in the Atlantic sea scallop fishery since 2006 (71 FR 50361, August 25, 2006; 71 FR 66466, November 15, 2006; 73 FR 18984, April 8, 2008; 74 FR 20667, May 5, 2009). Federally permitted scallop vessels south of 41°09'N from the shoreline to the outer boundary of the EEZ are required to modify their dredge gear by adding an arrangement of horizontal and vertical chains (a “chain mat”) over the opening of the dredge bag from of May 1 through November 30 each year. This modification is not expected to reduce the overall number of sea turtle interactions with gear. However, it is expected to reduce the severity of the interactions.

Beginning May 1, 2013, all limited access scallop vessels, as well as Limited Access General Category vessels with a dredge width of 10.5 feet or greater, must use a Turtle Deflector Dredge (TDD) in the Mid-Atlantic (west of 71°W) from May 1 through October 31 each year (77 FR 20728, April 6, 2012). The purpose of the TDD requirement is to deflect sea turtles over the dredge frame and bag rather than under the cutting bar, so as to reduce sea turtle injuries due to contact with the dredge frame on the ocean bottom (including being crushed under the dredge frame). The TDD has specific components that are defined in the regulations. When combined with the effects of chain mats, which decrease captures in the dredge bag, the TDD should provide greater sea turtle benefits by reducing serious injury and mortality due to interactions with the dredge frame, compared to a standard New Bedford dredge.

4.4.4.6 Sea Turtle Handling and Resuscitation Requirements

We published as a final rule (66 FR 67495, December 31, 2001) requiring people participating in scientific research or fishing activities to handle and resuscitate (as necessary) incidentally caught sea turtles as prescribed in the regulations (50 CFR 223.206). These measures help to prevent mortality of turtles caught in fishing or scientific research gear.

4.4.4.7 Exception for Injured, Dead, or Stranded Specimens

Any agent or employee of NMFS, USFWS, USCG, or any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and

wildlife, when acting in the course of his or her official duties, is allowed to take threatened or endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled sea turtle, or dispose of or salvage a dead sea turtle (50 CFR 223.206(b); 50 CFR 222.310). This take exemption extends to our Sea Turtle Stranding and Salvage Network.

4.4.5 Atlantic Large Whale Take Reduction Plan (Plan)

The Plan reduces the risk of serious injury to or mortality of large whales due to incidental entanglement in U.S. commercial trap/pot and gillnet fishing gear. The Plan focuses on the critically endangered North Atlantic right whale, but is also intended to reduce entanglement of endangered humpback and fin whales. The Plan is required by the Marine Mammal Protection Act (MMPA) and has been developed by NMFS. The Plan covers the U.S. Atlantic EEZ from Maine through Florida (26°46.5'N). The requirements are year-round in the Northeast, and seasonal in the Mid and South Atlantic.

The Plan was developed in collaboration with the Atlantic Large Whale Take Reduction Team (Team), which consists of fishing industry representatives, environmentalists, state and federal officials, and other interested parties. The Plan is an evolving plan that changes as NMFS and the Team learn more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. Regulatory actions are directed at reducing serious entanglement injuries and mortalities of right, humpback, and fin whales from fixed gear fisheries (*i.e.*, trap/pot and gillnet fisheries). The non-regulatory component of the Plan is composed of four principal parts: (1) gear research and development, (2) disentanglement, (3) the Sighting Advisory System (SAS), and (4) education/outreach. These components will be discussed in more detail below. The first Plan went into effect in 1997.

4.4.5.1 Regulatory Measures to Reduce the Threat of Entanglement on Whales

The regulatory component of the Plan includes a combination of broad fishing gear modifications and time-area restrictions supplemented by progressive gear research to reduce the chance that entanglements will occur, or that whales will be seriously injured or die as a result of an entanglement. The long-term goal, established by the 1994 Amendments to the MMPA, is to reduce entanglement related serious injuries and mortalities of right, humpback and fin whales to insignificant levels approaching zero within five years of its implementation. Despite these measures, entanglements, some of which resulted in serious injuries or mortalities, continued to occur. Data on whale distribution, gear distribution and configuration, and all gear observed on or taken off whales was examined. The Plan is an evolving plan, and revisions are made to the regulations as new information and technology becomes available. Because serious injury and mortality of right, humpback, and fin whales have continued to occur due to gear entanglements, new and revised regulatory measures have been issued since the original plan was developed.

The Team initially concluded that all parts of gillnet and trap/pot gear can and have caused entanglements. Initial measures in the Plan addressed both parts of the gear, and since then, the Team has identified the need to further reduce risk posed by both vertical and horizontal portions of gear. Research and testing has been ongoing to identify risk reduction measures that are

feasible. The 2014 regulations recently placed in effect focused on reducing the risk associated with vertical (buoy line) lines. Prior to that, the regulations implemented in 2009 focused on reducing the risk associated with horizontal (ground line) lines.

It is anticipated that the recent regulations implementing the vertical line strategy prioritized risk reduction in areas where there is the greatest co-occurrence of vertical lines and large whales. There are two ways to achieve a reduced risk: (1) maintain the same number of active lines but decrease the risk from each one (not currently feasible), or (2) reduce the number of lines in the water column.

Whale distribution data were used to help prioritize areas for implementation of future vertical line action(s). These data were overlaid with the vertical line distribution data to look at the combined densities by area. A model was developed and was constructed to allow gear configurations to be manipulated and determine what relative co-occurrence reductions (as a proxy for risk) can be achieved by gear configuration changes and/or effort reductions by area. This co-occurrence analysis is an integral component of the vertical line strategy that will further minimize the risk of large whale entanglement and associated serious injury and death. The actions and timeframe for the implementation of the vertical line strategy are as follows:

- Vertical line model development for all areas to gather as much information as possible regarding the distribution and density of vertical line fishing gear. Status: completed;
- Compile and analyze whale distribution and density data in a manner to overlay with vertical line density data. Status: completed;
- Development of vertical line and whale distribution co-occurrence overlays. Status: completed;
- Develop an ALWTRP monitoring plan designed to track implementation of vertical line strategy, including risk reduction. Status: completed, with annual interim reports beginning in July 2012.
- Analyze and develop potential management measures. Time frame: completed throughout 2012;
- Develop and publish proposed rule to implement risk reduction from vertical lines. Time frame: completed July 2013;
- Develop and publish final rule to implement risk reduction from vertical lines. Time frame: completed June 2014;
- Implement final rule to implement risk reduction from vertical lines. Time frame: phased-in implementation beginning September 2014 through June 2015;

The Plans measures vary by designated area that roughly approximate the federal Lobster Management Areas (FLMAs) designated in the Federal lobster regulations. The major requirements of the Plan are:

- No buoy line floating at the surface.
- No wet storage of gear (all gear must be hauled out of the water at least once every 30 days. In Federal waters in the Southeast trap/pots must be returned to shore at the end of every trip).
- Surface buoys and buoy line need to be marked to identify the vessel or fishery.
- All buoys, flotation devices, and/or weights must be attached to the buoy line with a weak link. This measure is designed so that if a large whale does become entangled, it could exert enough force to break the weak link and break free of the gear, reducing the risk of injury or mortality.
- All groundline must be made of sinking line (year-round in the Northeast; seasonal in the Mid- and South Atlantic).
- All buoy lines need to be marked three times (top, middle, bottom) with three 12” marks. This measure is intended to help managers learn more about where and when entanglements occur.
- Minimum trap per trawl requirements based on area fished and miles from shore.

In addition to gear modification requirements, the Plan prohibits all trap/pot and gillnet fishing in the Great South Channel from April 1 to June 30. Cape Cod Bay is also closed to gillnet fishing from January 1 to May 15. A larger area encompassing the Outer Cape and portions of Massachusetts Bay is closed to trap/pot fishing from January 1 to April 30. These time periods coincide with the presence of right whales in these areas.

4.4.5.2 Non-regulatory Components of the ALWTRP

4.4.5.2.1 Gear Research and Development

Gear research and development is a critical component of the Plan, with the aim of finding new ways of reducing the number and severity of protected species-gear interactions while still allowing for fishing activities. At the outset, the gear research and development program followed two approaches: (a) reducing the number of lines in the water while still allowing fishing, and (b) devising lines that are weak enough to allow whales to break free and at the same time strong enough to allow continued fishing. Development of gear modifications are ongoing and are primarily used to minimize risk of large whale entanglement.

4.4.5.3 Plan Monitoring

The NMFS, in consultation with the Team, has developed a monitoring plan for the Plan. While the number of serious injuries and mortalities caused by entanglements is higher than our goal, it is still a relatively small number, which makes monitoring difficult. Specifically, we want to know if the most recent management measures for groundline(which became fully effective April 2009), and vertical line (which will be fully implemented in June 2015) have resulted in a reduction in entanglement related serious injuries and mortalities of right, humpback and fin whales. Because these are relatively rare events and the data obtained from each event is sparse,

this is a difficult question to answer. The NEFSC has identified proposed metrics that will be used to monitor progress. They project that five years of data would be required before a change may be able to be detected. Therefore, data from 2010 to 2014 may be required to answer this question. The first analysis of that data would not be able to occur until 2016 due to the availability of the five years of data after the ground line regulations have been in place.

In addition, the NOAA Fisheries Greater Atlantic Regional Fisheries Office Protected Resources Division webpage (www.nero.noaa.gov/protected/whaletrp/reports/index.html) maintains an annual catalog of a series of monitoring metrics identified in the Plan Monitoring Strategy. These include serious injury/mortality, disentanglements, strandings, population abundance, sightings distribution, commercial fishing effort, law enforcement updates, and public and industry outreach. The intent of consolidating these monitoring strategy outputs into a single resource is to identify how they affect conservation outcomes.

4.4.5.2.2 Large Whale Disentanglement Program

Entanglement of marine mammals in fishing gear and/or marine debris is a significant problem throughout the world's oceans. NMFS created and manages a Whale Disentanglement Network, purchasing equipment to be located at strategic spots along the Atlantic coastline, supporting training for fishermen and biologists, purchasing telemetry equipment, etc. This has resulted in an expanded capacity for disentanglement along the Atlantic seaboard including offshore areas. Along the U.S. eastern seaboard, reports of entangled humpback whales and North Atlantic right whales, and to a lesser extent fin whales and sei whales, have been received. In 1984 the Provincetown Center for Coastal Studies (PCCS) in partnership with NMFS developed a technique for disentangling free-swimming large whales from life threatening entanglements. Over the next decade, PCCS and NMFS continued working on the development of the technique to safely disentangle both anchored and free swimming large whales. In 1995 NMFS issued a permit to PCCS to disentangle large whales. Additionally, NMFS and PCCS have established a large whale disentanglement program, also referred to as the Atlantic Large Whale Disentanglement Network (ALWDN), based on successful disentanglement efforts by many researchers and partners. Memorandums of Agreement were also issued between NMFS and other federal government agencies to increase the resources available to respond to reports of entangled large whales anywhere along the U.S. eastern seaboard. NMFS has established agreements with many coastal states to collaboratively monitor and respond to entangled whales. As a result of the success of the disentanglement network, NMFS believes whales that may otherwise have succumbed to complications from entangling gear have been freed and have survived.

4.4.5.2.3 Sighting Advisory System (SAS)

Although the Sighting Advisory System (SAS) was developed primarily as a method of locating right whales and alerting mariners to right whale sighting locations in a real time manner, the SAS also addresses entanglement threats. Fishermen can obtain SAS sighting reports and make necessary adjustments in operations to decrease the potential for interactions with right whales. Some of these sighting efforts have resulted in successful disentanglement of right whales. The SAS is discussed further in section 4.4.7.5.

4.4.5.2.4 Educational Outreach

Education and outreach activities are considered some of the primary tools needed to reduce the threats to all protected species from human activities, including fishing activities. Outreach efforts for fishermen under the Plan are fostering a more cooperative relationship between all parties interested in the conservation of threatened and endangered species. Type of outreach/education include website updates, attendance at industry meetings and outreach events, publications in industry trade journals, training for observer program and Coast Guard and state/Federal enforcement agents.

4.4.6 Ship Strike Reduction Program

The Ship Strike Reduction Program is currently focused on protecting the North Atlantic right whale, but the operational measures are expected to reduce the incidence of ship strike on other large whales to some degree. The program consists of five basic elements and includes both regulatory and non-regulatory components: 1) operational measures for the shipping industry, including speed restrictions and routing measures, 2) section 7 consultations with federal agencies that maintain vessel fleets, 3) education and outreach programs, 4) a bilateral conservation agreement with Canada, and 5) continuation of ongoing measures to reduce ship strikes of right whales (*e.g.*, SAS, ongoing research into the factors that contribute to ship strikes, and research to identify new technologies that can help mariners and whales avoid each other).

4.4.7 Regulatory Measures to Reduce Vessel Strikes to Large Whales

4.4.7.1 Restricting Vessel Approach to Right Whales

In one recovery action aimed at reducing vessel-related impacts, including disturbance, NMFS published a proposed rule in August 1996 restricting vessel approach to right whales (61 FR 41116, August 7, 1996) to a distance of 500 yards. The Recovery Plan for the North Atlantic right whale identified anthropogenic disturbance as one of many factors that had some potential to impede right whale recovery (NMFS 2005a). Following public comment, NMFS published an interim final rule in February 1997 codifying the regulations. With certain exceptions, the rule prohibits both boats and aircraft from approaching any right whale closer than 500 yards. Exceptions for closer approach are provided for the following situations, when: (a) compliance would create an imminent and serious threat to a person, vessel, or aircraft; (b) a vessel is restricted in its ability to maneuver around the 500-yard perimeter of a whale; (c) a vessel is investigating or involved in the rescue of an entangled or injured right whale; or (d) the vessel or aircraft is participating in a permitted activity, such as a research project. If a vessel operator finds that he or she has unknowingly approached closer than 500 yards, the rule requires that a course be steered away from the whale at slow, safe speed. In addition, all aircraft, except those involved in whale watching activities, are exempted from these approach regulations. This rule is expected to reduce the potential for vessel collisions and other adverse vessel-related effects in the environmental baseline.

4.4.7.2 Mandatory Ship Reporting System (MSR)

In April 1998, the USCG submitted, on behalf of the US, a proposal to the International Maritime Organization (IMO) requesting approval of a mandatory ship reporting system (MSR) in two areas off the east coast of the U.S., the right whale feeding grounds in the Northeast, and the right whale calving grounds in the Southeast. The USCG worked closely with NMFS and other agencies on technical aspects of the proposal. The package was submitted to the IMO's Subcommittee on Safety and Navigation for consideration. It was then submitted to the Marine Safety Committee at IMO and approved in December 1998. The USCG and NOAA play important roles in helping to operate the MSR system, which was implemented on July 1, 1999. Ships entering the northeast and southeast MSR boundaries are required to report the vessel identity, date, time, course, speed, destination, and other relevant information. In return, the vessel receives an automated reply with the most recent right whale sightings or management areas and information on precautionary measures to take while in the vicinity of right whales.

4.4.7.3 Vessel Speed Restrictions

A key component of NOAA's right whale ship strike reduction program is the implementation of speed restrictions for vessels transiting the US Atlantic in areas and seasons where right whales predictably occur in high concentrations. The Northeast Implementation Team (NEIT)-funded report "Recommended Measures to Reduce Ship Strikes of North Atlantic Right Whales" found that seasonal speed and routing measures could be an effective means of reducing the risk of ship strike along the U.S. East Coast. Based on these recommendations, NMFS published an Advance Notice of Proposed Rulemaking (ANPR) in June 2004 (69 FR 30857; June 1, 2004), and subsequently published a proposed rule on June 26, 2006 (71 FR 36299; June 26, 2006). NMFS published regulations on October 10, 2008 to implement a 10-knot speed restriction for all vessels 19.8 meters (65 feet) or longer in Seasonal Management Areas (SMAs) along the East Coast of the U.S. Atlantic seaboard at certain times of the year (73 FR 60173; October 10, 2008).

SMAs are supplemented by Dynamic Management Areas (DMAs) that are implemented for 15 day periods in areas in which right whales are sighted outside of SMA boundaries. When NOAA aerial surveys or other reliable sources report aggregations of three or more right whales in a density that indicates the whales are likely to persist in the area, NOAA calculates a buffer zone around the aggregation and announces the boundaries of the zone to mariners via various mariner communication outlets, including NOAA Weather Radio, USCG Broadcast Notice to Mariners, MSR return messages, email distribution lists, and the Right Whale Sighting Advisory System (SAS). NOAA requests mariners route around these zones or transit through them at 10 knots or less. Compliance with these zones is voluntary.

Lagueux et al. (2011) and Wiley et al. (2011) concluded that NMFS's 2008 10-knot vessel speed restrictions reduced the risk of lethal strikes of right whales by 38.5% and 56.7% in waters off the southeast U.S. coast and New England, respectively. The research used to initiate vessel speed restrictions to reduce vessel collisions with right whales, and studies subsequent to implementation of the regulations support continued use of the restrictions (Silber and Bettridge 2012). Therefore, on December 9, 2013, NMFS published a final rule (78 FR 73726) eliminating the expiration date (or "sunset clause") contained in 2008 regulations requiring vessel speed

restrictions to reduce the likelihood of lethal vessel collisions with North Atlantic right whales. The 2008 speed regulations would have expired on December 9, 2013, unless the sunset clause was removed.

4.4.7.4 Vessel Routing Measures to Reduce the Co-occurrence of Ships and Whales

Another critical, non-regulatory component of NOAA's right whale ship strike reduction program involves the development and implementation of routing measures that reduce the co-occurrence of vessels and right whales, thus reducing the risk of vessel collisions. Recommended routes were developed for the Cape Cod Bay feeding grounds and Southeast calving grounds by overlaying right whale sightings data on existing vessel tracks, and plotting alternative routes where vessels could expect to encounter fewer right whales. Full implementation of these routes was completed at the end of November 2006. The routes are now charted on all NOAA electronic and printed charts, published in US Coast Pilots, and sent to mariners through USCG Notices to Mariners.

Through a joint effort between NOAA and the USCG, the U.S. also submitted a proposal to the IMO to shift the northern leg of the existing Boston Traffic Separation Scheme (TSS) 12 degrees to the north. Overlaying sightings of right whales and all baleen whales on the existing TSS revealed that the existing TSS directly overlaps with areas of high whale densities, while an area slightly to the north showed a considerable decrease in sightings. Separate analyses by the SBNMS and the NEFSC both indicated that the proposed TSS would overlap with 58% fewer right whale sightings and 81% fewer sightings of all large whales, thus considerably reducing the risk of collisions between ships and whales. The proposal was submitted to the IMO in April 2006, and was adopted by the Maritime Safety Committee in December 2006. The shift took effect on July 1, 2007. In 2009, this TSS was modified by narrowing the width of the north-south portion by one mile to reduce the threat of ship collisions with endangered right whales and other whale species.

In 2009 NOAA and the USCG established the Great South Channel as an Area to be Avoided (ATBA). This is a voluntary seasonal ATBA for ships weighing 300 gross tons or more. The ATBA will be in effect each year from April 1 to July 31, when right whales are known to congregate around the Great South Channel. Implementing this ATBA coupled with narrowing the TSS by one nautical mile will reduce the relative risk of right whale ship strikes by an estimated 74% during April-July (63% from the ATBA and 11% from the narrowing of the TSS).

4.4.7.5 Sighting Advisory System (SAS)

The right whale Sighting Advisory System (SAS) was initiated in early 1997 as a partnership among several federal and state agencies and other organizations to conduct aerial and ship board surveys to locate right whales and to alert mariners to right whale sighting locations in a near real time manner. The SAS surveys and opportunistic sightings reports document the presence of right whales and are provided to mariners via fax, email, NAVTEX, Broadcast Notice to Mariners, NOAA Weather Radio, several websites, and the Traffic Controllers at the Cape Cod Canal. Fishermen and other vessel operators can obtain SAS sighting reports, and

make necessary adjustments in operations to decrease the potential for interactions with right whales. The SAS has also served as the only form of active entanglement monitoring in the Cape Cod Bay and Great South Channel feeding areas. Some of these sighting efforts have resulted in successful disentanglement of right whales. SAS flights have also contributed sightings of dead floating animals that can occasionally be retrieved to increase our knowledge of the biology of the species and effects of human impacts.

In 2009, with the implementation of the new ship strike regulations and the DMA program, the SAS alerts were modified to provide current SMA and DMA information to mariners on a weekly basis in an effort to maximize compliance with all active right whale protection zones.

4.4.8 Marine Mammal Health and Stranding Response Program (MMHSRP)

NMFS was designated the lead agency to coordinate the MMHSRP which was formalized by the 1992 Amendments to the MMPA. The program consists of the following components, all of which contribute important information on endangered large whales through stranding response and data collection:

- All coastal states established volunteer stranding networks and are authorized through Letters of Authority from NMFS regional offices to respond to marine mammal strandings.
- Biomonitoring helps assess the health and contaminant loads of marine mammals, but also to assist in determining anthropogenic impacts on marine mammals, marine food chains and marine ecosystem health.
- The Analytical Quality Assurance (AQA) was designed to ensure accuracy, precision, level of detection, and intercomparability of data in the chemical analyses of marine mammal tissue samples.
- NMFS established a Working Group on Marine Mammal Unusual Mortality Events to provide criteria to determine when a UME is occurring and how to direct responses to such events. The group meets annually to discuss many issues including recent mortality events involving endangered species both in the United States and abroad.
- The National Marine Mammal Tissue Bank provides protocols and techniques for the long-term storage of tissues from marine mammals for retrospective contaminant analyses. Additionally, a serum bank and long-term storage of histopathology tissue are being developed.

4.4.9 Harbor Porpoise Take Reduction Plan (HPTRP)

NMFS has implemented the HPTRP to decrease interactions between harbor porpoises and commercial gillnet gear in waters off New England and the Mid-Atlantic. The HPTRP includes time and area closures and gear modification requirements. Gear modifications vary by region

and include restriction on twine size, gillnet floatline length, tie-down usage, and requirements to equip gillnets with pingers (New England only), among others. Pingers are acoustic deterrent devices that broadcast a 10 kHz (+/- 2 kHz) sound underwater at 132 dB(+/- 4 dB) re one micropascal at one meter, lasting 300 milliseconds (+/- 15 milliseconds), and repeating every 4 seconds (+/- 0.2 seconds). Time and area closures implemented by the HPTRP may decrease the chance of interactions between ESA-listed species that are present in the area at the time of the closure and gillnet gear. The HPTRP is an evolving plan and amendments have been made as members of the take reduction team, including fishermen, environmental organizations, researchers, and representatives from state and federal government, identify the need for improvements by monitoring the progress of the plan and learning more about harbor porpoise abundance and bycatch rates. NMFS published a final rule amending the original plan on February 19, 2010 (75 FR 7383). In New England, amendments included the expansion of seasonal and temporal requirements within some existing HPTRP management areas, incorporation of additional management areas, and establishment of a consequence closure area strategy as an incentive to increase compliance and reduce bycatch levels in areas with historically high levels of harbor porpoise bycatch. In the Mid-Atlantic, amendments included the establishment of an additional management area, and modification to tie-down requirements for large mesh gillnet gear. Consequence closure areas are specified areas of historically high levels of harbor porpoise bycatch that will seasonally close if bycatch rates over two consecutive management seasons exceed a specific rate. When triggered, consequence closure areas will remain in effect until bycatch levels achieve the zero mortality rate goal or until the HPTRT and NMFS develop and implement new measures.

On October 4, 2013 NMFS published a final rule (78 FR 61821) removing the consequence closure strategy from the HPTRP. This action was necessary to prevent the improper triggering of consequence closure areas based on target harbor porpoise bycatch rates that no longer accurately reflect actual bycatch in New England sink gillnets due to fisherywide changes in fishing practices. NMFS will continue working the Team to consider what additional management measures may be necessary to ensure compliance with the pinger requirements. The final rule also incorporated a research provision and amended some existing regulatory text for minor corrections and clarifications. For more information on the HPTRP including time and area closures visit: www.nero.noaa.gov/hptrp.

4.4.10 Bottlenose Dolphin Take Reduction Plan (BDTRP)

Gear restrictions are currently implemented under the BDTRP, affecting small, medium, and large-mesh gillnets, along the Atlantic coast from New Jersey to Florida. The regulatory requirements reduce soak times and modify fishing practices to limit bycatch of bottlenose dolphins. These regulations may also benefit ESA-listed species that are present in the area when BDTRP regulatory measures are in effect. The take reduction team meets periodically to monitor implementation and effectiveness of the plan. For more information on the BDTRP visit: <http://www.nmfs.noaa.gov/pr/interactions/trt/bdtrp.htm>.

4.4.11 Atlantic Trawl Gear Take Reduction Strategy (ATGTRS)

NMFS convened an Atlantic Trawl Gear Take Reduction Team (ATGTRT) in 2006 to address the incidental mortality and serious injury of long-finned pilot whales (*Globicephala melas*), short-finned pilot whales (*Globicephala macrorhynchus*), common dolphins (*Delphinus delphis*), and white sided dolphins (*Lagenorhynchus acutus*) incidental to bottom and mid-water trawl fisheries operating in both the Northeast and Mid-Atlantic regions. Because none of the marine mammal stocks of concern to the ATGTRT are classified as a “strategic stock,” nor do they currently interact with a Category I fishery it was determined that development of a take reduction plan was not necessary.

In lieu of a take reduction plan, the ATGTRT agreed to develop an ATGTRS. The ATGTRS identifies informational and research tasks as well as education and outreach needs the ATGTRT believes are necessary to provide the basis for decreasing mortalities and serious injuries of marine mammals to insignificant levels approaching zero mortality and serious injury rates. The ATGTRS also identifies several potential voluntary measures that can be adopted by certain trawl fishing sectors to potentially reduce the incidental capture of marine mammals. These voluntary measures are as follows:

- Reducing the numbers of turns made by the fishing vessel and tow times while fishing at night; and
- Increasing radio communications between vessels about the presence and/or incidental capture of a marine mammal to alert other fishermen of the potential for additional interactions in the area.

While these measures have been recommended to reduce take of the four species of marine mammals listed above, ESA-listed species may also benefit from implementation of these measures, although interactions between trawl gear and endangered large whales have not been documented.

5.0 CLIMATE CHANGE

In addition to the information on climate change presented in the *Status of the Species* section for whales and sea turtles, the discussion below presents further background information on global climate change as well as past and predicted future effects of global climate change throughout the range of the ESA-listed species considered in this Opinion. Below is the available information on predicted effects of climate change in the action area and how listed whales and sea turtles may be affected by those predicted environmental changes over a time span of the proposed action for which we can realistically analyze impacts, yet are discussed and considered for longer time periods when feasible. Climate change is also relevant to the *Environmental Baseline* and *Cumulative Effects* sections of this Opinion, but rather than include partial discussions in several sections of this Opinion, we are synthesizing this additional information into one discussion.

5.1 Background Information on Global Climate Change

The global mean temperature has risen 0.76°C (1.36°F) over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC 2007a). Precipitation has increased nationally by 5%-10%, mostly due to an increase in heavy downpours (NAST 2000). In comparison, ocean temperatures have only increased by about 0.1°C (0.18°F) in the last century, with the changes occurring from the surface to depths of about 700 meters (2,300 feet).

There is a high confidence, based on substantial new evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. Ocean acidification resulting from massive amounts of carbon dioxide and other pollutants released into the air can have major adverse impacts on the calcium balance in the oceans. Changes to the marine ecosystem due to climate change include shifts in ranges and changes in algal, plankton, and fish abundance (IPCC 2007b); these trends are most apparent over the past few decades. Information on future impacts of climate change in the action area is discussed below.

Climate model projections exhibit a wide range of plausible scenarios for both temperature and precipitation over the next century. Both of the principal climate models used by the National Assessment Synthesis Team (NAST) project warming in the southeast by the 2090s, but at different rates (NAST 2000): the Canadian model scenario shows the southeast U.S. experiencing a high degree of warming, which translates into lower soil moisture as higher temperatures increase evaporation; the Hadley model scenario projects less warming and a significant increase in precipitation (about 20%). The scenarios examined, which assume no major interventions to reduce continued growth of world greenhouse gases (GHG), indicate that temperatures in the U.S. will rise by about 3°-5°C (5°-9°F) on average in the next 100 years, which is more than the projected global increase (NAST 2000). A warming of about 0.2°C (0.4°F) per decade is projected for the next two decades over a range of emission scenarios (IPCC 2007). This temperature increase will very likely be associated with more extreme precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Climate warming has resulted in increased precipitation, river discharge, and glacial and sea-ice melting (Greene *et al.* 2008).

The past three decades have witnessed major changes in ocean circulation patterns in the Arctic, and these were accompanied by climate associated changes as well (Greene *et al.* 2008). Shifts in atmospheric conditions have altered Arctic Ocean circulation patterns and the export of freshwater to the North Atlantic (Greene *et al.* 2008, IPCC 2006). With respect specifically to the North Atlantic Oscillation (NAO), changes in salinity and temperature are expected to be the result of changes in the earth's atmosphere caused by anthropogenic forces (IPCC 2006). The NAO impacts climate variability throughout the Northern Hemisphere (IPCC 2006). Data from the 1960s through 2006 show that the NAO index increased from minimum values in the 1960s to strongly positive index values in the 1990s, but declined since (IPCC 2006). This warming extends more than 1000 meters (0.62 miles) deep—deeper than anywhere in the world oceans—and is particularly evident under the Gulf Stream/ North Atlantic Current system (IPCC 2006). On a global scale, large discharges of freshwater into the North Atlantic subarctic seas can lead to intense stratification of the upper water column and a disruption of North Atlantic Deepwater

(NADW) formation (Greene *et al.* 2008; IPCC 2006). There is evidence that the NADW has already freshened significantly (IPCC 2006). This in turn can lead to a slowing down of the global ocean thermohaline (large-scale circulation in the ocean that transforms low-density upper ocean waters to higher density intermediate and deep waters and returns those waters back to the upper ocean), which can have climatic ramifications for the whole earth system (Greene *et al.* 2008).

While predictions are available regarding potential effects of climate change globally, it is more difficult to assess the potential effects of climate change over the next few decades on smaller geographic scales, such as the Hudson River or Chesapeake Bay, especially as climate variability is a dominant factor in shaping coastal and marine systems. The effects of future change will vary greatly in diverse coastal regions for the U.S. Additional information on potential effects of climate change specific to the action area is discussed below. Warming is very likely to continue in the U.S. over the next 25 to 50 years regardless of reduction in GHG emissions due to emissions that have already occurred (NAST 2000); therefore, it is also expected to continue during the operation of the seven fisheries. It is very likely that the magnitude and frequency of ecosystem changes will increase in the next 25 to 50 years, and it is possible that changes will accelerate. Climate change can cause or exacerbate direct stress on ecosystems through high temperatures, a reduction in water availability, and altered frequency of extreme events and severe storms. Water temperatures in streams and rivers are likely to increase as the climate warms and are very likely to have both direct and indirect effects on aquatic ecosystems. Changes in temperature will be most evident during low flow periods when they are of greatest concern (NAST 2000). In some marine and freshwater systems, shifts in geographic ranges and changes in algal, plankton, and fish abundance are associated with high confidence with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation (IPCC 2007).

A warmer and drier climate is expected to result in reductions in stream flows and increases in water temperatures. Consequences could be a decrease in the amount of DO in surface waters and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing rate (Murdoch *et al.* 2000). Because many rivers are already under a great deal of stress due to excessive water withdrawal or land development, and this stress may be exacerbated by changes in climate, anticipating and planning adaptive strategies may be critical (Hulme 2005). A warmer-wetter climate could ameliorate poor water quality conditions in places where human-caused concentrations of nutrients and pollutants currently degrade water quality (Murdoch *et al.* 2000). Increases in water temperature and changes in seasonal patterns of runoff will very likely disturb fish habitat and affect recreational uses of lakes, streams, and wetlands. Surface water resources in the southeast are intensively managed with dams and channels and almost all are affected by human activities; in some systems water quality is either below recommended levels or nearly so. A global analysis of the potential effects of climate change on river basins indicates that due to changes in discharge and water stress, the area of large river basins in need of reactive or proactive management interventions in response to climate change will be much higher for basins impacted by dams than for basins with free-flowing rivers (Palmer *et al.* 2008). Human-induced disturbances also influence coastal and marine systems, often reducing the ability of the systems to adapt so that systems that might ordinarily be capable of responding to variability and

change are less able to do so. Because stresses on water quality are associated with many activities, the impacts of the existing stresses are likely to be exacerbated by climate change.

While debated, researchers anticipate: 1) the frequency and intensity of droughts and floods will change across the nation; 2) a warming of about 0.2°C (0.4°F) per decade; and 3) a rise in sea level (NAST 2000). A warmer and drier climate will reduce stream flows and increase water temperature resulting in a decrease of DO and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing. Sea level is expected to continue rising: during the 20th century global sea level has increased 15 to 20 centimeters (6 to 8 inches).

As there is significant uncertainty in the rate and timing of change, as well as the effect of any changes that may be experienced in the action area due to climate change, it is difficult to predict the impact of these changes on whales and sea turtles. The lobster fishery is expected to continue in the near and mid-term future in similar areas, at similar times, and with similar levels of effort, but there is no way to predict at this point in time whether the fishery resources and other environmental conditions will continue to support fisheries that are similar to the proposed action in the long-term future or indefinitely. Since the distribution of effort in the lobster fishery and the status of the resource can change over just a few years, we will primarily consider the effects of climate change on the listed species over the next ten years. Longer-term effects of the fishery and climate change on ESA-listed species, whatever they may be, are speculative and difficult to extrapolate beyond ten years.

5.2 Effects of Climate Change on Individual Species

5.2.1 Right, Humpback, Fin, and Sei Whales

Whales have persisted for millions of years and throughout this time have experienced wide variations in global climate conditions and have successfully adapted to these changes. Climate change at historical rates (thousands of years) is not thought to have been a problem for whales. The impact of climate change on cetaceans is likely to be related to changes in sea temperatures, potential freshening of sea water due to melting ice and increased rainfall, sea level rise, the loss of polar habitats and potential shifts in the distribution and abundance of prey species. Of the main factors affecting distribution of cetaceans, water temperature appears to be the main influence on geographic ranges of cetacean species (MacLeod 2009). Depending on habitat preferences, changes in water temperature due to climate change may affect the distribution of certain species of cetaceans. For instance, sei, fin, and humpback whales are distributed in all water temperature zones, therefore, it is unlikely that their range will be directly affected by an increase in water temperatures (MacLeod 2009). However, North Atlantic right whales, which currently have a range of sub-polar to sub-tropical, may respond to an increase in water temperature by shifting their range northward, with both the northern and southern limits moving pole-ward.

In regards to marine mammal prey species, there are many potential direct and indirect effects that global climate change may have on prey abundance and distribution, which in turn, poses potential behavioral and physiological effects to marine mammals. For example, Greene *et al.* (2003) described the potential oceanographic processes linking climate variability to the

reproduction of North Atlantic right whales. Climate-driven changes in ocean circulation have had a significant impact on the plankton ecology of the Gulf of Maine, including effects on *Calanus finmarchicus*, a primary prey resource for right whales.

More information is needed in order to determine the potential impacts global climate change will have on the timing and extent of population movements, abundance, recruitment, distribution and species composition of prey (Learmonth *et al.* 2006). Changes in climate patterns, ocean currents, storm frequency, rainfall, salinity, melting ice, and an increase in river inputs/runoff (nutrients and pollutants) will all directly affect the distribution, abundance and migration of prey species (Waluda *et al.* 2001; Tynan and DeMaster 1997; Learmonth *et al.* 2006). These changes will likely have several indirect effects on marine mammals, which may include changes in distribution, including displacement from ideal habitats, decline in fitness of individuals, population size due to the potential loss of foraging opportunities, abundance, migration, community structure, susceptibility to disease and contaminants, and reproductive success (MacLeod 2009). Global climate change may also result in changes to the range and abundance of competitors and predators that will also indirectly affect marine mammals (Learmonth *et al.* 2006).

In the immediate future (2013-2023), it is unlikely that a shift in range will be observed due the extremely small increase, if any, in water temperature predicted to occur in this period. If any shift does occur, it is likely to be minimal and thus, it seems unlikely that this small increase in temperature will cause a significant effect to whales or a significant modification to the number of whales likely to be present in the action area over the life of the proposed action.

5.2.2 Sea Turtles

5.2.2.1 Loggerhead Sea Turtles

Both the 2009 Recovery Plan and the 2009 Status Review for loggerhead sea turtles identify global climate change as a threat to loggerhead sea turtles. In the future, increasing temperatures, sea level rise, changes in ocean productivity, and increased frequency of storm events are expected as a result of climate change and are all potential threats for loggerheads. Increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al.* 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Daniels *et al.* 1993; Fish *et al.* 2005; Baker *et al.* 2006). The BRT noted that the loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis *et al.* 2006; Baker *et al.* 2006; both in Conant *et al.* 2009). Along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels may cause severe effects on nesting females and their eggs as nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. However, if global temperatures increase and there is a range shift northwards, beaches not currently used for nesting may become available for loggerhead sea

turtles, which may offset some loss of accessibility to beaches in the southern portions of the range.

Climate change has the potential to result in changes at nesting beaches that may affect loggerhead sex ratios. Loggerhead sea turtles exhibit temperature-dependent sex determination. Rapidly increasing global temperatures may result in warmer incubation temperatures and highly female-biased sex ratios (*e.g.*, Glen and Mrosovsky 2004; Hawkes *et al.* 2009); however, to the extent that nesting can occur at beaches further north where sand temperatures are not as warm, these effects may be partially offset. The BRT specifically identified climate change as a threat to loggerhead sea turtles in the neritic/oceanic zone where climate change may result in future trophic changes, thus impacting loggerhead prey abundance and/or distribution. In the threats matrix analysis, climate change was considered for oceanic juveniles and adults and eggs/hatchlings. The report states that for oceanic juveniles and adults, “although the effect of trophic level change from...climate change...is unknown it is believed to be very low.” For eggs/hatchlings, the report states that total mortality from anthropogenic causes, including sea level rise resulting from climate change, is considered to be low relative to the entire life stage.

Van Houtan and Halley (2011) recently developed climate based models to investigate loggerhead nesting (considering juvenile recruitment and breeding remigration) in the North Pacific and Northwest Atlantic. These models found that climate conditions/ oceanographic influences explain loggerhead nesting variability, with climate models alone explaining an average 60% (range 18%-88%) of the observed nesting changes over the past several decades. In terms of future nesting projections, modeled climate data show a future positive trend for Florida nesting, with increases through 2040 as a result of the Atlantic Multidecadal Oscillation signal.

In addition, atmospheric warming could cause habitat alteration for food resources such as crabs and other invertebrates. It may increase hurricane activity, leading to an increase in debris in nearshore and offshore waters, which may result in an increase in entanglement, ingestion, or drowning. Increased hurricane activity may cause damage to nesting beaches or inundate nests with sea water. Atmospheric warming may change convergence zones, currents and other oceanographic features that are relevant to loggerhead sea turtles, as well as change rain regimes and levels of nearshore runoff.

5.2.2.2 Leatherback Sea Turtle

Although leatherbacks are probably already beginning to be affected by impacts associated with anthropogenic climate change in several ways, no significant climate change-related impacts to leatherback turtle populations have been observed to date (PIRO BO 2012). However, over the long term, climate change related impacts will likely influence biological trajectories in the future on a century scale (Parmesan and Yohe 2003). Changes in marine systems associated with rising water temperatures, changes in ice cover, salinity, oxygen levels and circulation including shifts in ranges and changes in algal, plankton, and fish abundance could affect leatherback prey distribution and abundance. Climate change is expected to expand foraging habitats into higher latitude waters and some concern has been noted that increasing temperatures may increase the female to male sex ratio of hatchlings on some beaches (Morosovsky *et al.* 1984 and Hawkes *et al.* 2007 in NMFS and USFWS 2007b). However, due to the tendency of leatherbacks to have

individual nest placement preferences and deposit some clutches in the cooler tide zone of beaches, the effects of long-term climate on sex ratios may be mitigated (Kamel and Mrosovsky 2004 in NMFS and USFWS 2007b). Additional potential effects of climate change on leatherbacks include range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson *et al.* 2009). Leatherbacks have expanded their range in the Atlantic north by 330 kilometers in the last 17 years as warming has caused the northerly migration of the 15°C sea surface temperature (SST) isotherm, the lower limit of thermal tolerance for leatherbacks (McMahon and Hays 2006). Leatherbacks are speculated to be the best able to cope with climate change of all the sea turtle species due to their wide geographic distribution and relatively weak beach fidelity. Leatherback sea turtles may be most affected by any changes in the distribution of their primary prey, jellyfish, which may affect leatherback distribution and foraging behavior (NMFS and USFWS 2007b). Jellyfish populations may increase due to ocean warming and other factors (Brodeur *et al.* 1999; Attrill *et al.* 2007; Richardson *et al.* 2009), which may or may not impact leatherbacks as there is no evidence that any leatherback populations are currently food-limited. Even though there may be a benefit to leatherbacks due to climate change influence on productivity, we do not know what impact other climate-related changes may have such as increasing sand temperatures, sea level rise, and increased storm events.

As discussed for loggerheads, increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al.* 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Fish *et al.* 2005). This effect would potentially be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents.

5.2.2.5 Sea Turtle Summary

As described above, sea turtles are most likely to be affected by climate change due to increasing sand temperatures at nesting beaches, which in turn would result in increased female:male sex ratio among hatchlings; sea level rise, which could result in a reduction or shift in available nesting beach habitat and increased risk of nest inundation; changes in the abundance and distribution of forage species, which could result in changes in the foraging behavior and distribution of sea turtle species; and, changes in water temperature, which could possibly lead to a northward shift in their range.

Over the time period of this action considered in this Opinion, sea surface temperatures are expected to rise less than 1°C. It is unknown if that is enough of a change to contribute to shifts in the range or distribution of sea turtles. Theoretically, we expect that as waters in the action area warm, more sea turtles could be present or sea turtles could be present for longer periods of time. However, if temperature affected the distribution of sea turtle forage in a way that decreased forage in the action area, sea turtles may be less likely to occur in the action area.

It has been speculated that the nesting range of some sea turtle species may shift northward. Nesting in the Mid-Atlantic generally is extremely rare and no nesting has been documented at any beach in the Northeast. In 2010, one green sea turtle came up on the beach in Sea Isle City,

NJ; however, it did not lay any eggs. In August 2011, a loggerhead came up on the beach in Stone Harbor, NJ but did not lay any eggs. On August 18, 2011, a green sea turtle laid one nest at Cape Henlopen Beach in Lewes, DE near the entrance to Delaware Bay. The nest contained 190 eggs and was transported indoors to an incubation facility on October 7. A total of 12 eggs hatched, with eight hatchlings surviving. In December, seven of the hatchlings were released in Cape Hatteras, NC. It is important to consider that in order for nesting to be successful in the Mid-Atlantic, fall and winter temperatures need to be warm enough to support the successful rearing of eggs and sea temperatures must be warm enough for hatchlings not to die when they enter the water. Predicted increases in water temperatures between now and 2023 are not great enough to allow successful rearing of sea turtle eggs in the any new parts of the action area. Therefore, it is unlikely that over the time period considered here, that there would be an increase in nesting activity in the action area.

As noted above, sea level rise has the potential to remove possible beach nesting habitat. A recent study by the U.S. Geological Survey found that sea levels in a 620-mile “hot spot” along the East Coast are rising three to four times faster than the global average (Sallenger *et al.* 2012). The disproportionate sea level rise is due to the slowing of Atlantic currents caused by fresh water from the melting of the Greenland Ice Sheet. Sharp rises in sea levels from North Carolina to Massachusetts could threaten wetland and beach habitats, and negatively affect sea turtle nesting along the North Carolina coast. If warming temperatures moved favorable nesting sites northward, it is possible that rises in sea level could constrain the availability of nesting sites on existing beaches. In the next 100 years, the study predicted that sea levels will rise an additional 20-27 centimeters (8-11 inches) along the Atlantic coast “hot spot” (Sallenger *et al.* 2012).

Warming sea temperatures are likely to result in a shift in the seasonal distribution of sea turtles in the action area, such that sea turtles may begin northward migrations from their southern overwintering grounds earlier in the spring and thus would be present in the action area earlier in the year. Likewise, if water temperatures were warmer in the fall, sea turtles could remain in the action area later in the year. In the next ten years, the expected small increase in temperature is unlikely to cause a significant effect to sea turtles or a significant modification to the number of sea turtles likely to be present in the action area.

Changes in water temperature may also alter the forage base and thus, foraging behavior of sea turtles. Changes in the foraging behavior of sea turtles in the action area could lead to either an increase or decrease in the number of sea turtles in the action area, depending on whether there was an increase or decrease in the forage base and/or a seasonal shift in water temperature. For example, if there was a decrease in sea grasses in the action area resulting from increased water temperatures or other climate-change related factors, it is reasonable to expect that there may be a decrease in the number of foraging green sea turtles in the action area. Likewise, if the prey base for loggerhead or leatherback sea turtles was affected, there may be changes in the abundance and distribution of these species in the action area. However, as noted above, because we do not know the adaptive capacity of these individuals or how much of a change in temperature would be necessary to cause a shift in distribution, it is not possible to predict changes to the foraging behavior of sea turtles over the next ten years. If sea turtle distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact on the availability of food. Similarly, if sea turtles shifted to areas where different forage was available

and sea turtles were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. The greatest potential for effect to forage resources would be if sea turtles shifted to an area or time where insufficient forage was available; however, the likelihood of this happening seems low because sea turtles feed on a wide variety of species and in a wide variety of habitats.

6.0 EFFECTS OF THE PROPOSED ACTION ON ESA-LISTED CETACEANS AND SEA TURTLES

Pursuant to Section 7(a)(2) of the ESA (16 USC 1536), federal agencies are required to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This Opinion examines the likely effects of the proposed action on listed species within the action area to determine if continued operation of the American Lobster FMP over the next ten years is likely to jeopardize the continued existence of any listed species. This analysis is done after careful review of the listed species status and the factors that affect the survival and recovery of those species, as described above.

In this section of the Opinion, we assess the direct and indirect effects of the proposed action on ESA-listed marine mammals and sea turtles. The purpose of the assessment is to determine if it is reasonable to conclude that the fishery is likely to have direct or indirect effects on threatened and endangered species that appreciably reduce their likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution. Since the proposed action will not affect designated critical habitat, we are only assessing whether the action under consideration is likely to jeopardize the continued existence of any listed species.

6.1 Approach to the Assessment

We generally approach jeopardy analyses in three steps. The first step identifies the probable direct and indirect effects of an action on the physical, chemical, and biotic environment of the action area, including the effects on individuals of threatened or endangered species. The second step determines the reasonableness of expecting threatened or endangered species to experience reductions in reproduction, numbers or distribution in response to these effects. The third step determines if any reductions in a species' reproduction, numbers or distribution (identified in the second step of our analysis) will appreciably reduce a listed species' likelihood of surviving and recovering in the wild.

The final step of the analysis - relating reductions in a species' reproduction, numbers, or distribution to reductions in the species likelihood of surviving and recovering in the wild - is the most difficult step because (a) the relationship is not linear; (b) to persist over geologic time, most species have evolved to withstand some level of variation in their birth and death rates without a corresponding change in their likelihood of surviving and recovering in the wild; and (c) our knowledge of the population dynamics of other species and their response to human perturbation is usually too limited to support anything more than rough estimates. Nevertheless, our analysis must distinguish between anthropogenic reductions in a species' reproduction, numbers, and distribution that can reasonably be expected to affect the species likelihood of survival and recovery in the wild and other (natural) declines. To comply with direction from

the U.S. Congress to provide the “benefit of the doubt” to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], jeopardy analyses are designed to avoid concluding that actions have no effect on listed species or critical habitat when, in fact, there is an effect.

In order to identify, describe, and assess the effects to ESA-listed cetaceans and sea turtles resulting from fishing gear used in the American lobster fishery, we have reviewed information on: (1) entanglements of right, humpback, fin, and sei whales and loggerhead and leatherback sea turtles in fishing gear of known and/or unknown origin (Johnson *et al.* 2005, Waring *et al.* 2014, Cole and Henry 2013, STDN 2014); (2) information on the entanglement of right, humpback, fin, and sei whales and loggerhead and leatherback sea turtle species in pot/trap gear in other fisheries where the American lobster fishery also operates (Waring *et al.* 2014, Cole and Henry 2013, STDN 2014); (3) life history information for cetaceans and sea turtles, and (4) the effects of fishing gear entanglements on cetaceans and sea turtles that has been published in a number of documents. These sources include status reviews and biological reports (NMFS and USFWS 1995, 2007a, 2007b; TEWG 1998, 2000, 2007, 2009; NMFS SEFSC 2001, Moore *et al.* 2004, Johnson *et al.* 2005, Waring *et al.* 2014, Cole and Henry 2013), recovery plans (NMFS 1991a, b, NMFS and USFWS 1992, 2008; USFWS and NMFS 1992, NMFS 2005a, NMFS and USFWS 2008), commercial fishery databases (NMFS fisheries statistics database) and numerous other sources of information from the published literature as cited within this Opinion. Below, we first describe available information on past interactions between listed whales, sea turtles and lobster gear and then describe anticipated future effects of the continued operation of the fishery.

6.1.1 Description of the use of the Action Area by ESA-listed Species

Western North Atlantic right whales occur from the southeastern U.S. (waters off of Georgia and Florida) to Canada (Kenney 2002, Waring *et al.* 2014). Generally, they follow an annual pattern of migration from foraging areas to calving areas in Florida. However, only a portion of the known North Atlantic right whale population has been observed on the calving grounds. Results from winter surveys and passive acoustic studies suggest that animals may be dispersed in several areas including Cape Cod Bay (Brown *et al.* 2002) and offshore waters of the southeastern U.S. (Waring *et al.* 2014).

Generally, Atlantic humpback whales calve and mate in the West Indies after foraging in the northwestern Atlantic during the summer months. Sightings of humpbacks in the New England area are most frequent from mid-March through November, but small numbers of individuals may remain in the area between Cape Cod and Jeffrey’s bank year-round (CeTAP 1982). The Mid-Atlantic may also be an important feeding ground for juvenile humpbacks. Since 1989, observations of juvenile humpbacks in the Mid-Atlantic have been in January through March (Swingle *et al.* 1993).

Fin whales are believed to use the North Atlantic water primarily for feeding and more southern waters for calving. Movement of fin whales from the Labrador/Newfoundland region south into the West Indies during the fall have been reported (Clark 1995). However, neonate strandings

along the U.S. Mid-Atlantic coast from October through January indicate a possible offshore calving area (Hain *et al.* 1992).

The sei whale is often found in the deeper waters characteristic of the continental shelf edge region (Hain *et al.* 1985), and NMFS aerial surveys found substantial numbers of sei whales in this region, south of Nantucket, in the spring of 2001. Spring is the period of greatest sei whale abundance in New England waters, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (CeTAP 1982). NMFS aerial surveys in 1999, 2000 and 2001 found concentrations of sei and right whales along the northern edge of Georges Bank in the spring. In years of greater abundance of copepod prey sources, sei whales are reported in more inshore locations, such as the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986) (Waring *et al.* 2014).

As described in sections 3.2.1 – 3.2.2, the occurrence of loggerhead and leatherback sea turtles in New England waters and Mid-Atlantic waters north of Cape Hatteras, NC is temperature dependent (Keinath *et al.* 1987, Shoop and Kenney 1992, Musick and Limpus 1997, Morreale and Standora 1998, Mitchell *et al.* 2003, Braun-McNeill and Epperly 2004, James *et al.* 2005b, Morreale and Standora 2005). In general, turtles move up the coast from southern wintering areas as water temperatures warm in the spring (Keinath *et al.* 1987, Shoop and Kenney 1992, Musick and Limpus 1997, Morreale and Standora 1998, Mitchell *et al.* 2003, Braun-McNeill and Epperly 2004, James *et al.* 2005b, Morreale and Standora 2005). The trend is reversed in the fall as water temperatures cool. By December, turtles have passed Cape Hatteras, returning to more southern waters for the winter (Keinath *et al.* 1987, Shoop and Kenney 1992, Musick and Limpus 1997, Morreale and Standora 1998, Mitchell *et al.* 2003, Braun-McNeill and Epperly 2004, James *et al.* 2005b, Morreale and Standora 2005). Recreational anglers have reported sightings of sea turtles in waters defined as inshore waters (bays, inlets, rivers, or sounds; Braun-McNeill and Epperly 2004) as far north as New York as early as March-April, but in relatively low numbers (Braun-McNeill and Epperly 2004). Greater numbers of loggerheads are found in Virginia's inshore, nearshore and offshore waters from May through November and in New York's inshore, nearshore and offshore waters from June through October (Keinath *et al.* 1987, Morreale and Standora 1993, Braun-McNeill and Epperly 2004). The hard-shelled turtles appear to be temperature limited becoming much less abundant in areas north of Cape Cod. Leatherback sea turtles have a similar seasonal distribution but have a more extensive range in the Gulf of Maine compared to the hard-shelled species (Shoop and Kenney 1992, Mitchell *et al.* 2003, STSSN database).

Extensive survey effort of the continental shelf from Cape Hatteras, NC, to Nova Scotia, Canada, in the 1980's (CeTAP 1982) revealed that loggerheads were observed at the surface in waters from the beach to waters with bottom depths of up to 4,481 m. However, they were generally found in waters where bottom depths ranged from 22-49 m deep (the median value was 36.6 m; Shoop and Kenney 1992). Leatherbacks were sighted at the surface in waters with bottom depths ranging from 1-4,151 m deep (Shoop and Kenney 1992). However, 84.4% of leatherback sightings occurred in waters where the bottom depth was less than 180 m (Shoop and Kenney 1992), whereas 84.5% of loggerhead sightings occurred in waters where the bottom depth was

less than 80 m (Shoop and Kenney 1992). Neither species was commonly found in waters over Georges Bank, regardless of season (Shoop and Kenney 1992).

The American lobster fishery is expected to overlap with the distribution of endangered sea turtles in May in nearshore and offshore waters off of North Carolina and Virginia, and until June in nearshore and offshore waters off of New York. Given the seasonal distribution of sea turtles and the times and areas when the American lobster fishery operates, both species of sea turtles are likely to overlap with operation of the fishery from May to November in Mid-Atlantic waters, and waters of southern Georges Bank.

6.1.2 Description of ESA-listed Species Interactions in Lobster Trap/pot Gear

Lobster pot/traps are left in the water for a discrete period, after which time the traps are hauled and the catch retrieved. While the gear is in the water, whales or sea turtles may become entangled in the lines of the pot/trap gear. Johnson *et al.* (2005) noted that any part of the trap gear (the buoy line, groundline, and surface system line) creates a risk of entanglement. Determining which part of fixed gear creates the most entanglement risk for ESA-listed species is difficult due to uncertainties surrounding the nature of the entanglement event, as well as unknown biases associated with reporting effort and the lack of information about the types and amounts of gear being used (Johnson *et al.* 2005). The vertical and ground lines of several different fisheries have been found to entangle ESA-listed species in the region. In many events, the animal was entangled in more than one set of pot gear. The animal may be entangled in the line of one set, which then becomes tangled with the bottom gear or vertical line of a second or third set of gear.

Large whales and sea turtles cannot get caught in the trap itself since the opening is far smaller than any of these species. In addition, with the possible exception of loggerhead sea turtles, these species would not be expected to be attracted to the bait used in lobster traps since the bait is inconsistent with their typical prey (*i.e.*, zooplankton, jellyfish, live fish, crabs).

We have also determined that the continued operation of the lobster fishery will not have any adverse effects on the availability of prey for humpback, fin, and sei whales. Like right whales, sei whales feed on copepods (Perry *et al.* 1999). As indicated above, the lobster fishery will not affect the availability of copepods for foraging sei whales because copepods are very small organisms that will pass through lobster fishing gear rather than being captured in it. Dense aggregations of late stage and diapausing *Calanus finmarchicus* in the Gulf of Maine and Georges Bank region will not be affected by the lobster fishery. In addition, the physical and biological conditions and structures of the Gulf of Maine and Georges Bank region and the oceanographic conditions in Jordan, Wilkinson, and Georges Basin that aggregate and distribute *Calanus finmarchicus* are not affected by the lobster fishery.

Humpback and fin whales feed on krill as well as small schooling fish (*e.g.*, sand lance, herring, mackerel) (Aguilar 2002; Clapham 2002). Lobster fishing gear operates on or very near the bottom. Fish species caught in lobster gear are species that live in benthic habitat (on or very near the bottom) such as flounders versus schooling fish such as herring and mackerel that occur

within the water column. The herring fishery does land potential forage fish for humpback and fin whales, which is made unavailable to the whales and imported to the lobster fishery. Approximately 70% of herring landed in New England is used as bait in the lobster fishery (Grabowski *et al.* 2010); however, there are no data currently that would suggest that baleen whales that feed on small pelagic fish are food limited. Therefore, the continued operation of the lobster fishery is not expected to affect the availability of prey for foraging humpback or fin whales. In addition, the lobster fishery does not operate in low latitude waters where the overwhelming majority of calving and nursing occurs for these large whale species (Aguilar 2002; Clapham 2002; Horwood 2002; Kenney 2002; Sears 2002). Therefore, the continued operation of the lobster fishery will not affect the oceanographic conditions that are conducive for calving and nursing.

Many protected species exhibit feeding behavior that increases their susceptibility to entanglements, which is described in more detail below. The effects of entanglement can range from no injury to death.

6.1.2.1 Large Whale Interactions in Lobster Trap/pot Gear

Serious injury has been defined in 50 CFR 229.2 as an injury that is likely to lead to mortality. Previously, NMFS Regional Offices and Science Centers utilized regional techniques for assessing and quantifying the serious injuries of marine mammals based on the results of a 1997 workshop (Angliss and DeMaster 1998). Although these regional techniques helped to accomplish the MMPA's mandates, NMFS recognizes the need for a nationally consistent and transparent process of determining SI for effective conservation of marine mammal stocks and management of human activities impacting these stocks. NMFS convened a Serious Injury Technical Workshop in 2007 to review performance under existing processes, and gather the best available and current scientific information (Andersen *et al.*, 2008).

Based on results of the 2007 workshop and input from marine mammal scientists, veterinary experts, and the MMPA Scientific Review Groups, NMFS has developed a policy and procedural directives describing national guidance and criteria for distinguishing serious from non-serious injuries of marine mammals (76 FR 42116, July 18, 2011). The directives serve as the basis for analyzing marine mammal injury reports (*e.g.*, observer, disentanglement, and stranding program reports) and incorporating the results into marine mammal stock assessment reports (SAR) and marine mammal conservation management regimes (*e.g.*, MMPA List of Fisheries (LOF), take reduction plans (TRP), ship speed regulations). The directives will ensure the consistent interpretation of what constitutes a serious injury and addresses the issues of accounting for injury cases where the outcome cannot be determined as well as accounting for successful mitigation efforts. The national standard federal register notice was published on January 23, 2012 (77 FR 3233, January 23, 2012). Historic serious injury information has changed the NEFSC SI/M data, and the new information is presented in the 2013 SAR. Therefore, this Opinion will use the NEFSC SI/M data which incorporates the new policy and procedural directives.

The 2013 SAR categorize entanglement events into four categories. If the gear is recovered and able to be identified, it will be categorized as an entanglement attributed to gear used in the United States or Canada. Entanglement events that result in the gear not being identified will be categorized as “Unassigned first sighted in Canada” or “Unassigned first sighted in US.”

NOAA Stock Assessment Reports (SAR) for Marine Mammals supplies the information needed to:

- Identify and assess the status of marine mammal stocks;
- Make findings and determinations required to authorize take of marine mammals;
- Evaluate the effects of human activities or natural environmental variability on marine mammals;
- Provide a scientific basis to design conservation measures to minimize the impacts of human activities; and
- Promote recovery of depleted stocks of marine mammals

The objective of this Opinion is to assess potential impacts to ESA-listed species due to the proposed action, which in this case is the continuation of the American lobster fishery. Thus, in analyzing whether the proposed federal action is likely to jeopardize any ESA-listed whale species, NMFS has focused on the impact of entanglement events that are of undetermined origin or confirmed U.S. origin since these events are directly attributed to U.S. fisheries or cannot be ruled out as resulting from U.S. fisheries. NMFS nevertheless has analyzed the impact of the proposed action in the context of the environmental baseline, which includes the impact of lobster fishing in Canadian waters and state waters to the extent not regulated as part of the FMP. By focusing on the impact of entanglements with known U.S. gear or gear of “unknown” origin, which may in fact be foreign gear, we are taking a more conservative approach that is meant to comply with direction from the U.S. Congress to provide the “benefit of the doubt” to threatened and endangered species [House of Representatives Conference Report No.697, 96th Congress, Second Session, 12 (1979)].

Table 8 summarizes documented fishing gear interactions with large whales in the Atlantic for 2007-2011, showing the number of documented entanglements, and how many of those had led to serious injury or mortality (NEFSC 2014). Under the new criteria, the sums of serious injury values by species are a combination of confirmed human-caused serious injury and a prorating of poorly documented injury events based on observed ratios of survival by injury type. Confirmed entanglements with insufficient information available to place the event in any of the L1-L4 criteria with a high degree of certainty, resulted in a serious injury value of 0.75 (Waring *et al*, 2014).

Table 8. Gear analysis for entangled/entrapped North Atlantic right whales, humpback whales, fin whales, and sei whales for the years 2007-2011. For the purposes of this evaluation, entanglement/entrapment events with gear determined to be from Canadian fisheries were not included. Results of gear analyses were the criteria used to categorize these events to U.S., Canada, or undefined origin; For this analysis, animals entangled in gear of undefined origin are assumed to be entangled in gear from U.S. fisheries. Confirmed serious injury/mortality (SI/M) events are presented in parentheses.

	Entanglement events with gear of U.S. and unidentified origins	# of North Atlantic right whale events	Mean annual North Atlantic right whale events	# of humpback whale events	Mean annual humpback whale events	# of fin whale events	Mean annual fin whale events	# of sei whale events	Mean annual sei whale events
Gillnet	10 (3.75)	2	0.4	8 (3.75)	1.6 (0.75)	0	0	0	0
Lobster	9 (2)	1	0.2	8(2)	1.6 (0.4)	0	0	0	0
Other pot/trap	3 (2)	3(2)	0.6 (0.4)	0	0	0	0	0	0
Hook and line	18 (2.25)	1 (0.75)	0.2 (0.15)	16 (1.5)	3.2 (0.3)	1	0.2	0	0
Unknown	101 (61)	32 (13.5)	6.4 (2.7)	57 (38)	11.4 (7.6)	11 (8.5)	2.2 (1.7)	1 (1)	0.2 (0.2)
Total	141 (71)	39 (16.25)	7.8 (3.25)	89 (45.25)	17.8 (9.05)	12 (8.5)	2.4 (1.7)	1 (1)	0.2 (0.2)

Since many entanglement events go unobserved and because the gear type, fishery, and/or country of origin for observed entanglement events are often not traceable, identified entanglement events are assumed to be an under-representation of actual numbers of entanglements.

There is information that needs to be considered when SI/M and identified gear are looked at together. The identified gear is only looking at gear recovered or identified in the field by markings from the entanglement case. Frequently, entangled whales have numerous physical body locations of entanglement trauma without gear present; this means that the original entanglement configuration is no longer present and has changed since the first observation. Portions of the gear such as weak links and even the physical struggle of the initial entanglement could break free portions of the gear. For example, if an entanglement case had recovered sinking groundline, it is possible that the animal could have become entangled in other parts of the gear and carried off a significant portion of the entire set, with the sinking line being the only part recovered. Also, although uncommon, gear is sometimes lost during disentanglement operations.

Large whale data for 2012, 2013 and 2014 are presented below. These data are preliminary and often change before they are finalized when cases are looked at more thoroughly, therefore, these

data will not be considered in this Opinion. Expected changes to this data include the addition or deletion of cases and altering the determination or status of any case. Cases include animals that had gear present. Deceased animals that had entanglement trauma but no gear present are not included in these numbers. Reported numbers should be considered a minimum number and not comprehensive.

2012 Preliminary Large Whale Data

Table 9. 2012* Preliminary Large Whale Entanglement Summary¹ United States and Canadian Waters

	Reports of Individual Animals with Previously Unreported Entanglements²
Right Whale	5
Humpback Whale	27
Finback Whale	2
Sei Whale	0
Minke Whale	9
Sperm Whale	0
Unknown Beaked Whale	0
Bryde's Whale	0
Unknown	0
TOTAL	43
* Up to and including July 1, 2014	

¹ This is preliminary data and has not been formally disseminated by the National Marine Fisheries Service. It does not represent and should not be construed to represent any agency determination or policy. Additional information gathered after the release of this summary may alter, add or delete cases.

² Numbers include live and dead animals

As of July 1, 2014, there were 43 whales with previously unreported entanglements that were reported and confirmed entangled by survey aircraft, fishermen, whale watch vessels and various other sources within the United States and Canadian waters in 2012. The reports of animals within Canadian waters should not be considered comprehensive due to uncertainty. Of the 43 individuals, 21 of the animals were assessed and responded to; the remaining animals were not responded to due to the fact that they were lost by the reporting platform, were not found by the responder (typically because no one stood by), conditions (sea state, time of day, range offshore) did not allow a response, animal was deceased or were reported to have a minor entanglement or shed the gear during the initial observation of the animal.

Breakdowns of the first and important sightings of new entangled cases are listed below (identification of individual is unknown unless stated):

- **Right whale #3821 on 01/07/12, partially disentangled**
- Right whale # 1719 on 1/19/12, gear shed
- Humpback whale on 1/26/12
- Minke whale on 2/4/12
- **Right whale #3996 on 2/15/12**
- **Humpback whale on 3/11/12, partially disentangled**
- **Humpback whale on 4/7/12, disentangled**
- **Humpback whale (same animal as 4/7/12; new case) on 4/13/12, partially disentangled**
- Humpback whale on 4/29/12
- **Humpback whale “Basmati” on 5/17/12, gear shed**
- Humpback whale “Etch-A-Sketch” on 6/9/12, gear shed
- Humpback whale “Apex” on 6/9/12
- **Humpback whale “Sabot” on 6/18/12, partially disentangled**
- **Minke whale on 6/21/12**
- **Humpback whale “Dome” on 6/22/12, gear shed**
- Minke whale on 7/1/12
- **Humpback whale “Hiatus” on 7/5/12, disentangled**
- **Humpback whale “Serengeti” on 7/6/12, disentangled**
- **Humpback whale “Piano” on 7/8/12, gear shed**
- **Minke whale on 7/13/12, partially disentangled**
- Finback whale on 7/16/12
- Minke whale on 7/17/12
- Right whale on 7/19/12, deceased
- **Humpback whale on 7/29/12**
- Finback whale (Blue Ocean Society #0631) on 7/30/12
- Minke whale on 8/2/12
- Humpback whale “Aphid” on 8/4/12
- Minke whale on 8/5/12, deceased
- Humpback whale “Doric” on 8/17/12, gear shed
- **Humpback whale “Hiatus” on 8/18/12, partially disentangled**
- Humpback whale (2011 calf of “Wizard”) on 8/21/12
- **Minke whale on 8/22/12, disentangled**
- **Humpback whale “Forceps” on 8/24/12**
- Humpback whale “Cardhu” on 8/27/12, gear shed
- Humpback whale “Reflection” on 9/3/12, gear shed
- **Humpback whale on 9/16/12, disentangled**
- **Humpback whale “Goalpost” on 9/17/12, gear shed**
- Humpback whale “Zelle” on 9/23/12, gear shed

- Humpback whale (2009 calf of Thumper) on 9/24/12
- Minke whale on 10/4/12, deceased
- **Humpback whale (2012 calf of Tornado) on 10/23/12, disentangled**
- **Humpback whale on 11/27/12, disentangled**
- Right whale #4193 on 12/18/12, deceased

* Cases in bold are when a disentangling response was possible. Some gear may have been removed in previous sightings which could have led to a gear free status or the whale with some entangling gear remaining. Gear remaining on a whale does not necessarily mean the whale is in a life-threatening entanglement.

2013 Preliminary Large Whale Data

Table 10. 2013* Preliminary Large Whale Entanglement Summary¹ United States and Canadian Waters

	Reports of Individual Animals with Previously Unreported Entanglements²
Right Whale	3
Humpback Whale	8
Finback Whale	0
Sei Whale	0
Minke Whale	4
Sperm Whale	0
Unknown Beaked Whale	0
Bryde's Whale	0
Unknown	0
TOTAL	15
* Up to and including July 1, 2014	

¹ This is preliminary data and has not been formally disseminated by the National Marine Fisheries Service. It does not represent and should not be construed to represent any agency determination or policy. Additional information gathered after the release of this summary may alter, add or delete cases.

² Numbers include live and dead animals

As of July 1, 2014, there were 15 whales with previously unreported entanglements that were reported and confirmed entangled by survey aircraft, fishermen, whale watch vessels and various other sources within the United States and Canadian waters in 2013. The reports of animals within Canadian waters should not be considered comprehensive due to uncertainty. Of the 15 individuals, 6 of the animals were assessed and responded to; the remaining animals were not

responded to due to the fact that they were lost by the reporting platform, were not found by the responder (typically because no one stood by), conditions (sea state, time of day, range offshore) did not allow a response, animal was deceased or were reported to have a minor entanglement or shed the gear during the initial observation of the animal.

Breakdowns of the first and important sightings of new entangled cases are listed below (identification of individual is unknown unless stated):

- Humpback whale on 1/6/13
- Humpback whale “Thumper” on 6/5/13, gear shed
- Humpback whale “Thicket” on 6/20/13, gear shed
- Minke whale on 7/1/13, deceased
- **Right whale #3123 on 7/12/13, partially disentangled**
- Minke whale on 7/23/13
- Right whale #1311 on 8/11/13, deceased
- Minke whale on 8/17/13
- **Humpback whale on 9/16/13, partially disentangled**
- **Right whale #3946 on 9/20/13, gear shed**
- Humpback whale on 9/28/13, deceased
- **Humpback whale “Foggy” on 9/29/13, partially disentangled**
- **Minke whale on 10/4/13, partially disentangled**
- Humpback whale on 10/4/13
- **Humpback whale on 11/14/13, disentangled**

* Cases in bold are when a disentanglement response was possible. Some gear may have been removed in previous sightings which could have led to a gear free status or the whale with some entangling gear remaining. Gear remaining on a whale does not necessarily mean the whale is in a life-threatening entanglement.

2014 Preliminary Large Whale Data

Table 11. 2014* Preliminary Large Whale Entanglement Summary¹ United States and Canadian Waters

	Reports of Individual Animals with Previously Unreported Entanglements²
Right Whale	3
Humpback Whale	2
Finback Whale	1
Sei Whale	0
Minke Whale	2
Sperm Whale	0
Unknown Beaked Whale	0
Bryde's Whale	0
Unknown	0
TOTAL	8
* Up to and including July 1, 2014	

¹ This is preliminary data and has not been formally disseminated by the National Marine Fisheries Service. It does not represent and should not be construed to represent any agency determination or policy. Additional information gathered after the release of this summary may alter, add or delete cases.

² Numbers include live and dead animals

As of July 1, 2014, there were 8 whales with previously unreported entanglements that were reported and confirmed entangled by survey aircraft, fishermen, whale watch vessels and various other sources within the United States and Canadian waters in 2014. The reports of animals within Canadian waters should not be considered comprehensive due to uncertainty. Of the 8 individuals, 3 of the animals were assessed and responded to; the remaining animals were not responded to due to the fact that they were lost by the reporting platform, were not found by the responder (typically because no one stood by), conditions (sea state, time of day, range offshore) did not allow a response, animal was deceased or were reported to have a minor entanglement or shed the gear during the initial observation of the animal.

Breakdowns of the first and important sightings of new entangled cases are listed below (identification of individual is unknown unless stated):

- **Right whale #4057 on 2/16/14, partially disentangled**
- Right whale on 4/1/14

- **Minke whale on 4/7/14, disentangled**
- Humpback whale on 6/2/14
- Minke whale on 6/9/14, deceased
- **Humpback whale “Hangslide” on 6/9/14, partially disentangled**
- Finback whale on 6/23/14
- Right whale on 6/29/14

* Cases in bold are when a disentanglement response was possible. Some gear may have been removed in previous sightings which could have led to a gear free status or the whale with some entangling gear remaining. Gear remaining on a whale does not necessarily mean the whale is in a life-threatening entanglement.

Because whales often free themselves of gear following an entanglement event, scarring may be another useful indicator in monitoring fisheries interactions with large whales. A study conducted by Robbins (2009) analyzed entanglement scars observed in photographs taken during 2003-2006. This analysis suggests high rates of entanglements of Gulf of Maine humpback whales in fishing gear. In an analysis of the scarification of right whales, 358 of 493 (72.6%) whales examined during 1980-2004 were scarred at least once by fishing gear (Knowlton *et al.* 2008). Further research using the North Atlantic Right Whale Catalogue has indicated that, annually, between 14% and 54% of right whales have been involved in entanglements (Knowlton *et al.* 2008). On November 9, 2009, NMFS convened a workshop of the Atlantic Large Whale Take Reduction Team Scarring Rates Work Group to examine the potential of utilizing scarring rates as an ALWTRP monitoring metric. Workshop conclusions recommended continued research on analyzing scarring rates for use in ALWTRP monitoring. NMFS continues to support and monitor research on methods to determine how analyses of scarring rates can best support conservation objectives, as outlined in the ALWTRP Monitoring Strategy that has been developed by NMFS.

As noted previously, observed entanglement events are not a complete count of all entanglements that occur on an annual basis. We do not currently have an accepted method to extrapolate those observed events to obtain a complete count. For that reason, the observed entanglement events (and therefore the number of entanglement related serious injuries or mortalities) are an underestimate. Recently, a methodology has been proposed for humpback whales that uses scar-based entanglement rates to extrapolate total entanglement mortality (Robbins *et al.* 2009). Robbins *et al.* (2009) used scar-based inference to estimate the annual frequency of non-lethal entanglement in the Gulf of Maine humpback whale population. For the period 1997-2006, annual estimates averaged 12.1%. The fraction of entanglements that were non-lethal was calculated using NMFS serious injury and mortality determinations. For the period 2002-2006, there were 49 (76.6%) non-lethal entanglements documented and 15 (23.4%) that were considered serious injuries or mortalities. Robbins *et al.* (2009) assumed a minimum population estimate of 549 whales and a scar based entanglement rate of 18.8% to calculate that approximately 103 Gulf of Maine humpback whales survived entanglement in 2003. If the survivors represented 76.6% of the entanglements that occurred that year then there were an additional approximately 32 entanglements that resulted in serious injury or mortality. While documented entanglement related serious injuries or mortalities are approximately 3%, this

method for estimating actual entanglement related serious injuries or mortalities results in an estimate of 23.4%, which is significantly higher. The authors note that it is a crude, preliminary estimate of entanglement mortality and state that the approach and its input values require further examination and refinement.

While this approach does provide a methodology for estimating the total number of entanglements, including those that result in serious injury or mortality, given its preliminary nature and questions regarding the approach and the input values, we have not utilized the results for humpbacks in this Opinion and furthermore have not attempted to apply the approach to North Atlantic right whales or other large whales.

While we are not utilizing this approach for attempting to estimate the overall number or rate of serious injuries or mortalities caused by entanglement, we recognize the importance of attempting to calculate a reasonable and scientifically supportable estimate. We also note that the estimate using this approach indicates that the magnitude of the impact may be significantly higher than is documented and provides further support for ongoing efforts to implement and enhance risk reduction measures.

6.1.2.2 Sea Turtle Interactions in Lobster Trap/pot Gear

Sea turtles are known to become entangled in lobster trap/pot gear. Sea turtles incidentally captured in fishing gear are required to be reported to NMFS on Vessel Trip Reports (VTRs); however, this requirement does not apply to the federal lobster fishery. Any fishing vessel with a federal finfish and/or shellfish permit must report the catch, location of catch, method of catch and interactions with ESA-listed species on a form. In 2008, approximately 61% of federal Lobster Permit holders had to report their catch on VTRs by virtue of holding another Federal finfish and/or shellfish permit. Compliance with the regulations that states federally permitted fishermen must report sea turtle interactions on their VTRs is believed to be very low (as evidenced by the lack of reported interactions that have been documented on vessels with observers in recent years). VTR reported interactions do not accurately indicate the frequency of turtle interactions. Additionally, no dedicated observer programs exist to provide estimates of interactions and mortality from the lobster trap/pot fisheries. The VTR form has the potential to provide the best estimation of interaction levels, but is unreliable for the lobster fishery because of the lack of required reporting and low levels of compliance when reporting is required.

In response to the high number of leatherback sea turtles found entangled in the vertical lines of pot gear in the Northeast U.S., NMFS' NER established the Northeast Region Sea Turtle Disentanglement Network (STDN). Formally established in 2002, the STDN is a component of the National Sea Turtle Stranding and Salvage Network (STSSN). The STDN works to reduce serious injuries and mortalities caused by entanglements. The STDN operates as an event response network, not as an active observer program. The STDN receives the majority of reports from private boaters and recreational fishermen who encounter entangled turtles in the water. These reports may come directly from the reporting individual or routed through the US Coast Guard (USCG), state agencies (*e.g.*, Maine Marine Patrol, Massachusetts Environmental Police) or local harbor-masters. The level of reporting from the public depends on many factors,

including the location and visibility of the turtle and the knowledge of the public regarding who to call when reporting an entanglement. Additionally, since the majority of entanglements are reported by recreational boaters, these data may be skewed to show more coastal entanglements in waters that are easily accessible and highly utilized by boaters. Reports may also be skewed towards entanglements in buoy lines due to those entanglements being visible at the surface. Given the limitations on the STDN dataset, it is difficult to correlate the number of entanglements reported to the STDN and the actual number of entanglements that are occurring in coastal and off-shore waters. The data presented below are a summary of the existing STDN entanglement data. Since this dataset is the most complete and best available consolidation of sea turtle entanglement data in the Northeast region, it will be used to estimate sea turtle interactions in the American lobster fishery.

There are few recorded interactions of loggerheads with American lobster fishery gear. As summarized in past biological opinions for the lobster fishery, there have been three loggerheads reported entangled in lobster gear. One dead turtle was reported in New Jersey in July 1983; one was reported as released alive in New York in August 1987; and one was reported dead, entangled by the right flipper, in a pot line located in New Jersey in July 1991. In addition, for 1980-2000 there was one loggerhead (alive) entangled in lobster gear in Massachusetts (SEFSC STSSN database). More recent data (2002-2013) has confirmed reports of 20 loggerhead entanglements in vertical line gear. Eight of the entanglements were in whelk pot gear, and seven entanglements were confirmed to be from a crab fishery. Gear from five of the loggerhead entanglements was never identified.

Between 2002 and 2013, a total of 263 sea turtle entanglements in vertical line gear were reported to the STDN and NMFS GARFO. Of the 263 reports, 246 were classified with a probable or confirmed, high confidence rating. Of the 246 confirmed and probable events, 225 events involved leatherback sea turtles, 20 involved loggerhead sea turtles, and 1 involved a green turtle.

The American lobster fishery has been verified as the gear/fishery involved in 80 leatherback entanglements in the Northeast Region between 2002 and 2013 (STDN 2014). All of the 80 entanglements involved vertical line of the gear. These probable/confirmed entanglements have occurred in ME, MA, RI, CT, NY and NJ. Collectively these entanglements have occurred in the following months:

May (1-MA)
June (2-ME, 2-MA, 2-RI),
July (7-ME, 19-MA, 2-RI, 2 NY)
August (1-ME, 20-MA, 1-RI, 1-CT, 1-NJ)
September (2-ME, 13-MA)
October (4-MA)

Gear has been verified through the buoy/gear identification numbers, which can be traced in the various state agency and federal permit systems. Of the 80 confirmed or probable sets of gear, 2 have been verified as MA recreational lobster pot gear. Twelve sets of gear have been identified

to a fisherman with both State (1-ME, 10-MA, 1-NY) and federal permits for lobster pot gear. Four of the entanglements involved gear from fishermen with state permits (2-ME, 1-MA, 1-RI) and possibly federal permits, but this could not be confirmed. In one case, gear was confirmed as Federal, but it was unknown whether it was also state-permitted gear. In 16 of the entanglements, it was unknown if the gear came from a state, federal, or recreational fishery. All other lobster gear (45 cases) has been confirmed to be state commercial (3-ME, 39-MA, 1-CT, 1-RI, 1-NY) coastal lobster pot gear.

6.1.3 Factors Affecting Cetacean Entanglement in Lobster Gear

Any line rising into the water column has the potential to entangle a whale (Johnson *et al.* 2005). The general scenario that leads to a whale becoming entangled in gear begins with a whale encountering a line. It may then move along that line until it comes up against something such as a buoy. The buoy can then be caught in the whale's baleen, against a pectoral fin, or on some other body part. When the animal feels the resistance of the gear, it is likely to thrash, which may cause it to become further entangled in the lines associated with trap gear. For large whales, there are generally three areas of entanglement: (1) the gape of the mouth, (2) around the flippers, and (3) around the tail stock. Right whales spend a substantial amount of time feeding below the surface; this species feeds by swimming continuously with their mouths open. They also roll and lift their flippers about the water's surface, behaviors that may add to entanglement risk, especially from vertical buoy lines and surface system lines. Humpback whales commonly use their mouths, flippers, and tails to aid in feeding. Thus, while foraging, all body parts are at risk of entanglement.

Susceptibility to entanglement depends on a species' physical characteristics and behavior. The probability that a marine mammal will initially survive an entanglement in fishing gear depends on the species and age of the marine mammal involved. This is due in part to variations in size, diving behavior, and foraging behavior, as well as to location and time of the entanglement. If the gear attached to the line is too heavy for the whale, drowning may result immediately. But many whales have been observed swimming with portions of the line, with or without additional fishing gear, wrapped around a pectoral fin, the tail stock, the neck or the mouth. Documented cases show that entangled animals may travel for extended periods of time and over long distances before freeing themselves, being disentangled by humans, or dying as a result of the entanglement (Angliss and Demaster 1998). Entanglement may lead to exhaustion and starvation due to increased drag (Wallace 1985). Other effects include infections and deformations. A sustained stress response, such as repeated or prolonged entanglement in gear, makes marine mammals less able to fight infection or disease, and may make them more prone to ship strikes. Younger animals are particularly at risk if the entangling gear is tightly wrapped since the gear will become more constricting as they grow. The majority of large cetaceans that become entangled are juveniles (Angliss and Demaster 1998).

The location of the fishery in relation to the species is also a factor influencing the likelihood that gear entanglement will occur. For example, the majority of the lobster fishery effort is concentrated in northeastern waters and peaks in the summer and early fall months when whales use New England waters for feeding and nursing young. Atlantic large whales are at risk of

becoming entangled in fishing gear because the whales feed and travel in many of the same ocean areas in the action area. As described in detail in sections 3.1.1-3.1.4, North Atlantic right whales, humpback whales, and fin whales occur in Mid-Atlantic and New England waters over the continental shelf. Sei whales are also observed over the continental shelf although they typically occur over the continental slope or in basins situated between banks (Waring *et al.* 2011). All four species follow a similar pattern of foraging at high latitudes (*e.g.*, southern New England and Canadian waters) in the spring and summer months and calving in lower latitudes (*i.e.*, off of Florida for right whales and in the West Indies for humpback whales) in the winter months (CeTAP 1982, Hain *et al.* 1992, Clark 1995, Perry *et al.* 1999, Horwood 2002, Kenney 2002). Consequently, entanglement risk from lobster pot gear may occur at low levels throughout the year along the Atlantic coast, but the greatest risk occurs during the summer and fall in New England waters when whales and lobster trap gear are both more concentrated in these waters.

The American lobster fishery operates throughout the year, with peak fishing during the spring and summer. Since the highest abundances of North Atlantic right, humpback, fin, and sei whale populations occur from March through November in New England waters and peak abundances of sei whales have been identified during the spring season, the presence of these whales overlaps peak fishing periods with the American lobster fishery. Humpback and fin whales use the Mid-Atlantic waters during October-March with seemingly increasing frequency, and low numbers of whales may reside in New England waters through the winters. Because of substantial interannual and geographic variation in whale occurrences and lack of complete data for seasonal distributions, the potential exists for whale interactions with the American lobster fishery throughout the seasons and extent of the action area. However, given the seasonal distribution of ESA-listed whales and the times and areas when the American lobster fishery operates, North Atlantic right, humpback, fin, and sei whales are most likely to overlap with operation of the fishery from May through November in New England waters and throughout the fall and winter in Mid-Atlantic waters.

6.1.4 Factors Affecting Sea Turtle Entanglements in Lobster Gear

The primary effect on sea turtles from lobster gear is entanglement in buoy lines. Sea turtles can also become entangled in groundline or surface system line. Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles indicate that fishing debris can wrap around the neck, flipper, or body of the sea turtle and severely restrict swimming or feeding (Balazs 1985). If a sea turtle is entangled when young, the line could become tighter and more constricting as the sea turtle grows, cutting off blood flow and causing deep gashes, some severe enough to remove an appendage.

Drowning may occur immediately as a result of the weight of the gear or, at a later time, if trailing gear becomes lodged between rocks and ledges below the surface. Entangled sea turtles are sometimes released alive but are also found dead (as a result of forced submergence) upon retrieval of the gear as a result of forced submergence. Sea turtles released alive may later succumb to injuries sustained at the time of capture (NMFS 2008d). Of the entangled sea turtles that do not die from their wounds, some may suffer impaired swimming or foraging abilities,

altered migratory behavior, or altered breeding or reproductive patterns due to injuries resulting from the entanglement.

Leatherback sea turtles seem to be the most vulnerable turtle to entanglement in fishing gear. This susceptibility may be a result of their body type (larger size, long pectoral flippers, and the lack of a hard shell), and their attraction to the gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface. The leatherback's diet is composed predominantly of jellyfish species. A number of researchers have suggested that leatherbacks may be attracted to the buoys which could appear as jellyfish. Similarly, leatherback entanglements in lobster gear may be more prevalent at certain times of the year when these turtles are feeding on jellyfish species in nearshore waters (*i.e.*, Cape Cod Bay) where lobster fishing gear is concentrated. The factors influencing loggerhead sea turtle entanglements in pot/trap fishing gear are unclear.

Anecdotal evidence indicates that when leatherbacks encounter lobster pot gear, they may swim in circles resulting in multiple wraps around a flipper. Long pectoral flippers along with extremely active behavior make leatherback sea turtles vulnerable to entanglement. Leatherbacks may also be more susceptible to drowning as compared to other sea turtles due to their unusual physiology and metabolic processes. The dive behavior of leatherbacks consists of continuous aerobic activity. When entanglement occurs, available oxygen decreases allowing anaerobic glycolysis to take over producing high levels of lactic acid in the blood (Lutcavage and Lutz 1997). Leatherbacks lack calcium which aids in neutralizing the build up of lactic acid by increasing bicarbonate levels. The softer epidermal tissue of leatherbacks may also make them more susceptible to serious injuries from entangling gear. Constriction of the neck and flippers can amputate limbs which may lead to death by infection. If the turtle is cut loose with line attached, the flipper may eventually become occluded, infected and necrotic. Entangled leatherbacks are also more vulnerable to collision with boats, particularly if the entanglement occurs at or near the surface (Lutcavage *et al.* 1997).

NMFS has considered other factors that might affect the likelihood that sea turtle will become entangled in American lobster fishing gear. These other factors include the behavior of sea turtles in the presence of fishing gear, as well as the effect of certain oceanographic features and fishery practices on population distributions and abundances.

Intensity of biological activity in the Gulf of Maine has been associated with oceanographic fronts, including nutrient fluxes and biological productivity. Particular oceanographic features and processes that influence biological activity are vertical mixing by tides; the seasonal cycle of heating and cooling that leads to winter convection and vertical stratification in summer; pressure gradients from density contrasts set up by deep water inflows and lower salinity waters; and influxes of the cold, but fresher waters associated with Scotian Shelf Water (Townsend *et al.* 2006). Such oceanographic features occurring in the same area as the operation of lobster gear may increase the risk of interactions between lobster gear and ESA-listed species that would be attracted to these areas for feeding. However, at present there is no information to clearly

indicate any of these are influencing ESA-listed species interactions in American lobster trap/pot gear.

Based on the best currently available information, cetacean and sea turtle interactions with American lobster gear are likely at times when, and in areas where, cetacean and sea turtle distribution overlaps with operation of the fishery.

6.2 Anticipated Effects of the Proposed Action

NMFS has identified that the proposed action is likely to adversely affect ESA-listed cetaceans and sea turtles when the animals come into physical contact with American lobster fishing gear. Such contact can result in injuries, including severe injuries and death. No other direct effects to cetaceans or sea turtles are expected as a result of the proposed action. No indirect effects to cetaceans or sea turtles are expected as a result of the proposed action. In this section of the Opinion, NMFS will determine, given the currently available information, the anticipated number of cetaceans and sea turtles (by species) that will be affected by the continued operation of the American lobster fishery over the next ten years.

As mentioned in section 2.3, the GARFO may issue a small number of EFPs and/or EEAs exempting the collection of a limited number of American lobster from Northeast federal waters from American Lobster FMP regulations. We expect that future EFPs and/or EEAs will propose fishing types and associated fishing effort similar to that analyzed in this Opinion and therefore not introducing significant increase over effort levels for the overall fishery considered in this Opinion. Therefore, we consider the issuance of EFPs and EEAs by the GARFO to be within the scope of the effects that are analyzed below. If an EFP or EEAA is proposed which modifies this agency action in a manner that causes an effect to listed species or critical habitat not considered in this Opinion then consultation will be reinitiated.

The analyses in this section are based upon the best available commercial and scientific data on sea turtle and cetacean biology and the effects of the proposed action. Data pertaining to the American lobster fishery, relative to interactions with sea turtles and cetaceans are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Much of the information used to estimate interaction levels for this fishery was generated from past data, which was collected when fishing effort was likely higher than it will be in at least the near future. Fishing effort in the near future will likely remain at reduced levels allowing lobster stocks to grow. However, future levels of reduced fishing effort were not taken into considerations in this Opinion and we assumed that fishing will occur at historic levels; this results in a worst case scenario for listed species (i.e., we are assuming that more fishing effort may occur in the future than may actually occur), however it allows us to be conservative in predictions about effects to listed species.

6.2.1 Anticipated Cetacean Interactions in American Lobster Gear

No method has yet been identified for predicting the level of overall or species-specific cetacean bycatch in the American lobster fishery. Some whale mortalities may never be observed, thus

the actual annual number of documented mortalities are likely to be a subset of the actual number of entanglement related mortalities that occur. Additionally, assignment of a specific fishery to an observed entanglement is rarely possible because even in those rare cases where gear is retrieved, identification remains problematic because the same gear (*e.g.*, lines and webbing) is used in multiple fisheries.

Although 40% of the lobster effort is located in federal waters (*i.e.*, the EEZ), typically offshore lobster trap gear poses a greater risk of serious injury or mortality to ESA-listed large whales since these events are more difficult to respond to decreasing the chance of a disentanglement attempt. Since the majority of lobster fishing effort is concentrated in the northeastern waters when right, humpback, fin, and sei whales are present, risk of gear interactions increases during the summer and fall for these species.

The newly implemented measures to the ALWTRP incorporate several provisions that may reduce the frequency or severity of whale entanglements. The gear modification requirements fall generally into four categories: buoy line requirements, weak link requirements, set restriction requirements, and gear marking requirements. The discussion below examines the impact of each of these measures on whale entanglement risks.

Buoy Line Requirements: The requirement to increase the number of traps per trawl in the Northeast is designed to reduce the amount of vertical lines in the water and thus, benefit large whales by reducing the frequency or severity of entanglement in buoy lines and associated gear. In an average month, roughly 227,000 total trap/pot vertical lines are deployed in the Northeast. The restrictions on the number of buoy lines in the Northeast region when combined with other restrictions (closures) would result in estimated reductions of 30.1% of endlines in the water and a 38.2% reduction in co-occurrence of vertical lines and large whales. NMFS believes the requirement to ‘trawl up’ will result in a decrease in the risk of entanglement to large whales.

Weak Link Requirements: The requirement that lobster and other trap/pot gear employ a weak link on all floatation and/or weighted devices attached to the buoy line is specifically designed to reduce entanglements and serious injury due to entanglements in and around the mouth as a result of interactions with buoy lines and surface systems. In such a case, the theory of operation is that the forward motion of the whale will pull the buoy line through the whale's mouth until the buoy and weak link impinge against the baleen. At this point, the combination of the whale's momentum and the weight of the gear on the lower end of the buoy line or drag created by towing gear will cause the load to increase until the weak link parts, allowing the buoy and weak link to detach from the line and remain outside the whale's mouth. The bitter end of the buoy line would then continue to be pulled through the baleen until it exits the whale's mouth. Adding a weak link on all devices attached to the buoy line increases the likelihood that a line sliding through a whale's mouth will break away quickly at the buoy before the whale begins to thrash and become more entangled. Thus, the risk of serious injury or mortality would be reduced.

Set Restrictions and Gear Stowing Requirements: Several restrictions on how trap/pot gear can be set have been put in place. The requirement that vessels in the Southeast Federal waters remove their gear from the water and stow it on board before returning to port is designed to

ensure that any interactions between gear and whales would be observed and reported in a timely fashion, permitting a more rapid response.

Gear Marking Requirements: Currently the gear marking system only requires one mark. In place of the current standards, gillnet, lobster trap/pot, and other trap/pot vessels are required to identify buoy lines with a mark equal to 12” in length and buoy lines must be marked three times (top, middle, bottom). This will result in larger and more frequent marks. This is expected to result in the incorporation of approximately 393,000 new marks into the gear subject to ALWTRP regulations. The gear marking provisions are designed to improve NMFS' ability to identify the gear involved in an entanglement. These provisions will have neither direct impact on the probability of whales becoming entangled nor will they affect the severity of an entanglement should one occur. The gear marking requirements will help to generate information on the nature of the gear involved in an entanglement. In addition, these provisions will in some cases allow NMFS to identify the owner of the gear, and thus, allow the agency to gather additional information on where, when, and how the gear was set. By increasing scientific understanding of the nature of large whale entanglements, gear marking measures will allow NMFS, over time, to improve the effectiveness of the ALWTRP. Thus, these measures are expected to contribute indirectly to the preservation and restoration of whale stocks.

In addition to gear modification requirements, the changes to the ALWTRP include a range of restrictions on the location and timing of fishing activity. These include the seasonal closures of known right whale habitat areas. The general objective of all these potential changes is to limit the frequency and severity of interactions between whales and regulated trap/pot gear while avoiding implementation of costly requirements that yield limited risk reduction.

North Atlantic right whales

From 2007 to 2011, the average reported mortality or serious injury to right whales due to fishery entanglement from U.S. gear or gear from an unknown origin was 3.25 (NEFSC 2014). Documented entanglements most likely underestimate the extent of the entanglement problem since not all entanglements are likely to be observed. Consequently, the total level of interaction between fisheries and right whales is unknown. However, studies have estimated that more than 60% of right whales exhibit scars consistent with fishery interactions. Broad based gear modifications and the implementation of the vertical line strategy developed under the ALWTRP are expected to reduce the number and severity of right whale entanglements.

Between 2007 and 2011, 39 entangled right whales were reported. Of these 39, one case was identified as gear from the lobster fishery; this entanglement did not result in a serious injury or mortality. In this time period, approximately 42% of all the reported right whale entanglements resulted in serious injury or mortality (NEFSC 2014). Of the entanglements that resulted in serious injury or mortality, 13.5 had unknown gear, 0.75 had hook and line, and two had pot/trap gear not from the lobster fishery.

Entanglements of right whales in pot/trap gear continue to occur despite the measures implemented by the ALWTRP. The ALWTRP has recently added new measures affecting trap/pot gear in the Northeast U.S. While the measures of the ALWTRP are expected to reduce

the lethal effect of trap/pot gear on right whales, the lobster fishery has the potential to seriously injure or kill an average of 3.25 right whales per year.

Humpback whales

Humpback whale entanglements in lobster gear have been documented. Between 2007 and 2011, 89 humpback whale entanglements were documented. Eight of those entanglements were in gear identified as coming from the American lobster fishery, averaging 1.6 per year (NEFSC 2014). From 2007 to 2011, there were two documented humpback SI/M as a result of entanglement in lobster gear. However, 38 of the humpback entanglements from 2007-2011 were in undocumented gear types and resulted in serious injury or mortality. Because serious injuries or mortalities of humpbacks in lobster gear have occurred in the past, we expect that the American lobster fishery has the potential to seriously injure or kill an average of 9.05 humpback whales per year.

Fin whales

Fin whales are vulnerable to entanglement in lobster trap gear while foraging and migrating in areas where gear is present. Entanglements of fin whales have been documented but are considered to occur at an insignificant level approaching zero mortality and serious injury rate. From 2007-2011, no fin whales were documented entangled in pot/trap gear set by the American lobster fishery. However, in that time period there were 11 events where the gear was not identified or recovered and it is possible that some of that gear originated from the lobster fishery (NEFSC 2014).

Although some entangled whales may be freed of gear (either by their own actions or with the assistance of the disentanglement network), given the limited survey coverage in the action area, the limited observer coverage in the fishery, that gear is not continuously tended, and the logistical difficulties of disentanglement efforts in offshore areas, and the known serious injury or mortality of other whales resulting from lobster gear, we assume that in the future, fin whales may be entangled in lobster gear and that an average of 1.7 entanglements may result in serious injury or mortality per year.

Sei whales

From 2007 to 2011, there has been one documented cases of a sei whale entangled with unidentified gear; no entanglements have occurred in gear that was identified as lobster gear. While interactions with sei whales are possible, this species does not frequent inshore waters and therefore is not likely to encounter lobster gear. Based on documented entanglements, the average annual rate of sei whale entanglements is approximately 0.2. No sei whale mortalities have been reported as a result of entanglement in lobster fishing gear (NEFSC 2014), although it is possible. Documentation suggests an average of 0.2 serious injury or mortality due to entanglement of sei whales may occur per year.

6.2.2 Anticipated Sea Turtle Interactions in American Lobster Gear

The following sections describe the data used, the processes, and the results of NMFS' analyses for estimating the number or amount of sea turtle interactions by the federal American lobster

fishery. When calculating the sea turtle interaction rate, we used STDN vertical line stranding and entanglement records documented during 2002 through 2013 in state and federal waters. We believe this approach is reasonable for a number of reasons. The species of sea turtles that occur in the action area are all highly migratory and found in both state and federal waters. Trap construction requirements are very similar in the state and federal fisheries, and effort throughout the seasons is similar. The vast majority of both state and federal fishing effort occurs in the depth range (0-36 meters, or 0-120 feet) where sea turtles are known to occur most frequently; thus neither fishery is known to have a disproportionate rate of sea turtle entanglements based on the distributions of sea turtles and lobster fishery effort.

The formation of the STDN in 2002 has increased the detail and accuracy of sea turtle entanglement data. As previously stated, entanglement data may be skewed to show more entanglements in coastal waters that are highly utilized by recreational boaters and therefore have a greater likelihood of being observed. Recreational boaters provide the majority of the entanglement reports. For the purposes of this Opinion, the estimate of sea turtle interactions by the lobster fishery is calculated using confirmed and probable events reported to the STDN between the years 2002 and 2013. Any of the estimates that produced fractional numbers were rounded up to complete the final estimates.

We use the best available sea turtle entanglement data to estimate the total number of sea turtle interactions by the American lobster fishery. An annual average of sea turtle interactions was calculated based on the number of reliable entanglement reports in the time period. A percentage of unidentified gear was assumed to come from a specific fishery based on percentages of identified gear that was obtained. The American lobster fishery occurs in state and federal waters by vessels with state and/or federal permits. Of the total effort in state and federal waters, approximately 20% of the American lobster fishery operates their gear in federal waters. Approximately 40% of lobster traps fished (in both state and Federal waters combined) is by vessels holding a federal permit. For the purposes of this Opinion, the federal portion of the lobster fishery is defined by those vessels with federal permits, regardless of whether the vessel is fishing in state or federal waters. (NMFS GARFO 2014; American Lobster Stock Assessment Review Team 2009). Therefore, NMFS calculated interactions in the Federal portion of the lobster fishery by multiplying the total number of estimated interactions by 40%; this assumes that interactions in state vs. federal fisheries is proportional to the distribution of total amount of lobster traps fished (i.e., 40% federal, 60% state or recreational).

Leatherback Sea Turtle Interactions

Lobster is sparsely distributed in much of the southern extent of the action area. Reported landings from Delaware southward are typically less than 0.1% of total landings. Since 2004, federal trap tags ordered from NJ vessels represent less than 5% of the total federal trap tags ordered. No trap tags have been purchased for vessels from DE, MD, VA, and NC since 2004. Delaware through North Carolina have been granted *de minimus* status under the ASMFCs Interstate Fishery Management Plan (ISFMP). This means that there is minimal presence of either lobster or lobster-related activities in these coastal economies. Whelk pot gear is the dominant vertical line gear in waters south of NJ and has been identified as the cause of entanglement in the majority of cases in that area. For the aforementioned reasons, the

geographic scope of leatherback entanglement data used to estimate interactions in this Opinion will be confined to waters from ME through NJ.

There were 209 confirmed or probable vertical line entanglement reports of leatherbacks from ME to NJ during 2002-2013. The number of documented leatherback entanglements from ME to NJ averaged 17.42 annually from 2002-2013. For the purposes of this Opinion, unconfirmed reports will not be considered. Eight-one leatherback events involved lobster gear, 37 events involved gear identified to be from a different source other than the lobster fishery, and 91 events the gear could not be assigned to a specific fishery. From the total of 118 events involving a verified gear, 69% came from the lobster fishery.

For this Opinion, the percentage of all identified gear that proved to be lobster gear (69%) will be applied to the unverified gear total to determine the number that will be assumed to also be lobster gear. Therefore, 63 (69%) of the 91 entanglement events with unverified gear will be assumed to have involved lobster trap/pot gear, resulting in a total of 144 entangled leatherbacks in lobster gear from 2002-2013. Given that the opportunistic STDN data are considered biased towards state waters and entanglements are considered to occur at the same rate in the federal and state fishery, the observed state fishery entanglement rate will be applied to the federal portion of the fishery. As previously stated, 13 of the 80 lobster gear entanglements were confirmed to involve gear from vessels holding federal permits. In 16 of the entanglements, it was unverified if the gear came from a state, federal, or recreational fishery. The conservative approach is to assume leatherback entanglements in unknown lobster gear involved state permitted lobster gear; thus, 67 of the 80 (84%) lobster gear entanglements were confirmed to involve gear from vessels that are permitted to operate in the state fishery but not the federal fishery. Therefore, of the 144 entanglements, 121 are estimated to have involved state permitted lobster gear, which represents an annual average of 10.08 entanglements in state lobster gear from 2002-2013. If the rate of entanglements observed through opportunistic STDN reports (considered to cover the entirety of the lobster fishery in state waters, or 60% of the total lobster fishery) was the same in the federal portion (40% of lobster fishery), then we would expect the average of 10.08 entanglements in state gear to be indicative of a total average of 16.8 leatherback entanglements in the entire fishery. This means that we would expect an average of 6.72 entanglements of leatherbacks to occur annually in the federal portion of the fishery.

The actual number of entangled leatherbacks per year may be larger; however, the actual number of entanglements cannot be extrapolated from the existing data. Since approximately 40% of the lobster fishery involves federally permitted vessels, the Federal lobster fishery is assumed to have been responsible for at least 6.72 leatherback entanglements annually. We expect an average of seven leatherback turtle entanglements in the federal lobster fishery to be observed annually. Due to the relatively low amount of reports of entanglements, which impedes our ability to evaluate the rate of serious injury/mortality, and the fact that fewer entanglements in the EEZ may be able to be responded to in a timely manner, which would translate into a lower chance of a successful disentanglement and/or more time for the animal to suffer injuries from the gear, we assume that these entanglements could all result in serious injury or mortality.

Stranding and sighting records suggest that both adult and immature leatherback sea turtles occur within the action area where the American lobster fishery operates (NMFS and USFWS 1992, NMFS SEFSC 2001). Tracking of tagged leatherbacks also demonstrates the movement of sexually mature leatherbacks over U.S. continental shelf waters (James *et al.* 2005a; 2005b). Immature and sexually mature leatherback sea turtles are known to be captured in lobster gear. Between 2002 and 2013 leatherbacks entangled in lobster gear ranged from 106-183 cm curved carapace length (CCL) (STDN 2014). TEWG (2007) states subadults as 100-145 cm and adults as >145 cm CCL. Therefore, either immature or sexually mature leatherback sea turtles could be entangled and killed in lobster pot gear since both age classes occur in areas where the lobster fishery operates.

Loggerhead Sea Turtle Interactions

The five life stages recognized for loggerhead sea turtles are: (1) Hatchling, size 4 cm curved carapace length (CCL); (2) Post-hatching, size range of 4-6 cm CCL; (3) Oceanic juvenile, size range of 8.5-64 cm CCL; (4) Neritic juvenile, size range 46-87 cm CCL; (5) Adult, neritic or oceanic, male size > 83 cm CCL, female size > 87 cm CCL (NMFS and USFWS 2008).

There is insufficient data of loggerhead sea turtles observed entangled in American lobster gear to determine estimated sizes of future entanglements. Based on observer measurements and known distribution ranges of loggerhead sea turtles captured in the other fisheries, NMFS expects that both neritic immature and sexually mature loggerhead sea turtles may be captured in lobster trap gear as a result of the continued operation of the American lobster fishery.

As previously stated, documentation of loggerhead sea turtle interaction with lobster trap/pot gear is limited. From 2002-2013, there were only two documented cases of a loggerhead entangled in vertical line gear in the area from ME to NJ. In both events, the gear on the animal was not identified to a particular fishery. During this same time period there were 18 confirmed reports of loggerheads entangled in vertical line gear south of NJ and they were all in VA. Fifteen of these entanglements involved fishing gear that identified to a particular fishery; all 15 were in VA, and eight involved whelk pot gear and seven involved blue crab pot/trap gear. Despite the lack of reported interactions of loggerheads with lobster gear, the possibility exists that interactions will occur. We realize that more turtles might be entangled than are actually reported, therefore, we anticipate one loggerhead sea turtle interaction will be observed annually in the American lobster fishery. For loggerhead sea turtle interactions in lobster gear, the low occurrence of these observations does not allow valid determinations on the anticipated levels of lethal interactions for these events; therefore, we assume that this interaction could be lethal or non-lethal.

6.3 Summary of Anticipated Interactions of Cetaceans and Sea Turtles

Based on NMFS' large whale entanglement data for the years 2007-2011 (Table 8), the annual mean rates of fin whale and sei whale entanglements resulting in serious injury or mortality (SI/M) have been 1.7 and 0.2, respectively. The type of gear was unidentified in all of the fin and sei whale entanglement events with the exception of one fin whale entanglement in hook and line gear. Entanglements resulting in serious injury and/or mortality to fin and sei whales

caused by the American lobster fishery operation are considered to occur rarely and at an insignificant level.

The annual mean rate of SI/M from fishery gear entanglements is 3.25 and 9.05, respectively, for right and humpback whales in U.S. and unknown gear for 2007-2011 (Table 8). During that time period, two humpback whales entangled in lobster gear resulted in a serious injury or mortality.

The American lobster fishery does pose a risk of serious injury and mortality to right and humpback whales as a result of entanglement in pot/trap gear. The continued implementation and development of ALWTRP measures, along with an overall reduction in American lobster fishery effort provide cause to anticipate the number of right and humpback whale entanglements in trap/pot gear should decline or, at least, not increase.

The American lobster fishery is likely to have the greatest effect on sea turtles from May through November in Mid-Atlantic waters and waters of the GOM. As a result of the continued operation of the American lobster fishery over the next ten years, NMFS anticipates the observed interaction of up to one loggerhead sea turtle annually and up to seven leatherback sea turtles annually. Interactions of leatherback and loggerhead sea turtles could be lethal or non-lethal.

7.0 CUMULATIVE EFFECTS

Cumulative effects as defined in 50 CFR 402.02 include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. For that reason, future effects of other federal fisheries are not considered in this section of the document; all federal fisheries that may affect listed species are the subject of formal section 7 consultations. Effects of ongoing federal activities, including other fisheries operating in Canadian and state waters not regulated by the FMP, are considered in the *Environmental Baseline and Status of the Species sections* of this Opinion and are also factored into the *Integration and Synthesis of Effects* section below.

Sources of human-induced mortality, injury, and/or harassment of cetaceans and sea turtles in the action area that are reasonably certain to occur in the future include interactions in state-regulated fishing activities, vessel collisions, ingestion of plastic debris, pollution, global climate change, coastal development, and catastrophic events. While the combination of these activities may affect populations of ESA-listed cetaceans and sea turtles, preventing or slowing a species' recovery, the magnitude of these effects is currently unknown.

State Water Fisheries - Fishing activities are considered one of the most significant causes of death and serious injury for sea turtles. A 1990 National Research Council report estimated that 550 to 5,500 sea turtles (juvenile and adult loggerheads and Kemp's ridleys) die each year from all other fishing activities other than shrimp fishing. Fishing gear in state waters, such as bottom

trawls, gillnets, trap/pot gear, and pound nets, interact with sea turtles each year. NMFS is working with state agencies to address interactions of sea turtles in state-water fisheries within the action area of this consultation where information exists to show that these fisheries interact with sea turtles. Action has been taken by some states to reduce or remove the likelihood of sea turtle interactions in one or more gear types. However, given that state managed commercial and recreational fisheries along the Atlantic coast are reasonably certain to occur within the action area in the foreseeable future, additional interactions of sea turtles in these fisheries are anticipated. There is insufficient information on the number of sea turtle interactions presently occurring in state water fisheries and on the number of sea turtles injured or killed as a result. While actions have been taken to reduce sea turtle interactions in some state water fisheries, the overall effect of these actions is unknown, and the future effects of state water fisheries on sea turtles cannot be quantified.

Right and humpback whale entanglements in gear set in Canadian and state waters not regulated by the FMP also occur. Entanglements in state lobster pot/traps and in croaker sink gillnet gear have been reported (Waring *et al.* 2007; Glass *et al.* 2008). Actions have been taken to reduce the risk of entanglement to large whales, although more information is needed to assess the effectiveness of these actions. Canadian and state water fisheries continue to pose a risk of entanglement to large whales to a level that cannot be fully quantified.

Vessel Interactions – NMFS' STSSN data indicate that vessel interactions are responsible for a large number of sea turtles strandings within the action area each year. Such collisions are reasonably certain to continue into the future. Collisions with boats can stun or kill sea turtles, and many stranded turtles have obvious propeller or collision marks (Dwyer *et al.* 2003). However, it is not always clear whether the collision occurred pre- or post-mortem. NMFS believes that sea turtle vessel interactions will continue. An estimate of the number of sea turtles that will likely be killed by vessels is not available from data at this time.

Collisions of ESA-listed right, humpback, fin and sei whales with large vessels are known to occur, and are a source of serious injury and mortality for these species. As described in section 4.4.7, NMFS has implemented a ship strike reduction program to reduce the number of right whale strikes by large vessels. The program consists of both regulatory and non-regulatory components, such as requiring vessels to reduce speed in certain areas at certain times when right whales are likely to be present. The program is not specific to areas or times when other species of large whales are likely to be present in the vicinity of large ports of shipping lanes. The program does not require reduced speeds in all areas where right whales may occur. Although these measures are designed to reduce interactions of ESA-listed whales as a result of vessel strikes, the risk of interaction has not been fully removed since interactions may still occur at times when large whales and vessels occupy the same areas.

Pollution and Contaminants – Human activities in the action area causing pollution are reasonably certain to continue, as are impacts from them on cetaceans and sea turtles. However, the level of impacts cannot be projected. Marine debris (*e.g.*, discarded fishing line or lines from boats) can entangle turtles in the water and drown them. Turtles commonly ingest plastic or mistake debris for food. Chemical contaminants may also have an effect on sea turtle

reproduction and survival. Excessive turbidity due to coastal development and/or construction sites could influence sea turtle foraging ability. As mentioned previously, turtles are not very sensitive to changes in water quality or increased suspended sediments, but if these alterations make habitat less suitable for turtles and hinder their capability to forage, eventually they would leave or tend to avoid these areas (Ruben and Morreale 1999).

Contaminant studies have confirmed that right whales are exposed to and accumulate contaminants. Antifouling agents and flame retardants that have been proven to disrupt reproductive patterns and have been found in other marine animals, which raises new concerns about their effects on right whales (Kraus *et al.* 2007). Recent data also support a hypothesis that chromium, an industrial pollutant, may be a concern for the health of the North Atlantic right whales and that inhalation may be an important exposure route (Wise *et al.* 2008). The impacts of biotoxins on marine mammals are also poorly understood, yet data is showing that marine algal toxins may play significant roles in mass mortalities of these animals (Rolland *et al.* 2007). Although there are no published data concerning the effects of biotoxins on right whales, researchers have discovered that right whales are being exposed to measurable quantities of paralytic shellfish poisoning (PSP) toxins and domoic acid via trophic transfer through the copepods upon which they feed (Durbin *et al.* 2002; Rolland *et al.* 2007; Leandro *et al.* 2009). Other large whales are likely similarly affected. Between November 1987 and January 1988, at least 14 humpback whales died after consuming Atlantic mackerel containing a dinoflagellate saxitoxin (Geraci *et al.* 1989; Waring *et al.* 2009). In July 2003, dead humpback whales tested positive for low levels of domoic acid (Waring *et al.* 2009). However, domoic acid poisoning could not be confirmed as the cause of death (Waring *et al.* 2009).

Noise pollution has been raised primarily as a concern for marine mammals but may be a concern for other marine organisms, including sea turtles. The potential effects of noise pollution on marine mammals and sea turtles range from minor behavioral disturbance to injury and death. The noise level in the ocean is thought to be increasing at a substantial rate due to increases in shipping, seismic exploration, offshore drilling, and sonar used by military and research vessels (NMFS 2007b). Because under some conditions low frequency sound travels very well through water, few oceans are free of human noise. While there is no hard evidence of a whale population being adversely impacted by noise, scientists think it is possible that masking, the covering up of one sound by another, could interfere with marine mammals' ability to feed and to communicate for mating (NMFS 2007b). Masking is a major concern about shipping, but only a few species of marine mammals have been observed to demonstrate behavioral changes to low level sounds. Concerns about noise in the action area are primarily related to increasing commercial shipping and recreational vessels.

Global climate change is expected to continue and may impact ESA-listed marine mammals, sea turtles, and their habitats in the action area. However, as noted in the *Status of the Species* and *Environmental Baseline* sections above, given the likely rate of change associated with climate impacts (*i.e.*, the century scale), it is unlikely that climate related impacts will have a significant effect on the status of any species of marine mammals or sea turtles in the short-term future (*i.e.*, over the next decade or so) or that in this time period, the abundance, distribution, or

behavior of these species in the action area will change as a result of climate change related impacts.

Coastal development – Along the Mid-Atlantic and Southeast coastline, beachfront development, lighting, and beach erosion potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. Coastal counties are presently adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Some of these measures were drafted in response to lawsuits brought against the counties by concerned citizens who charged the counties with failing to uphold the ESA by allowing unregulated beach lighting that results in negative effects to hatchlings.

Catastrophic events- An increase in commercial vessel traffic/shipping increases the potential for oil/chemical spills. The pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo *et al.* 1986). There have been a number of documented oil spills in the northeastern U.S.

8.0 INTEGRATION AND SYNTHESIS OF EFFECTS

The *Status of Affected Species*, *Environmental Baseline*, *Climate Change*, and *Cumulative Effects* sections of this Opinion discuss the natural and human-related phenomena that caused right, humpback, fin and sei whales as well as loggerhead and leatherback sea turtles to become endangered or threatened and may continue to place the species at high risk of extinction. “Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The present section of this Opinion applies that definition by examining the effects of the proposed action in the context of information presented in the status of the species, environmental baseline, climate change, and cumulative effects sections to determine: (a) if the effects of the proposed action would be expected to reduce the reproduction, numbers, or distribution of the previously listed cetaceans and sea turtles, and (b) if any reduction in the reproduction, numbers, or distribution of these species causes an appreciable reduction in the species’ likelihood of surviving and recovering in the wild.

In the NMFS/U.S. Fish and Wildlife Section 7 Handbook, *Survival* is defined as:

For determination of jeopardy/adverse modification: the species’ persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species’ entire life cycle, including reproduction, sustenance, and shelter.

Recovery is defined as:

Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act.

This Opinion has identified in Section 6 (*Effects of the Action*) that the proposed action--continued operation of the fishery under the American Lobster FMP may directly affect right, humpback, fin, and sei whales as a result of entanglement in pot/trap gear fished in the American lobster fishery. No other direct or indirect effects to ESA-listed cetaceans are expected as a result of the activity. This Opinion has also identified that the proposed action may directly affect loggerhead and leatherback sea turtles as a result of interaction with lobster trap gear used in the American lobster fishery. No other direct or indirect effects to ESA-listed sea turtles are expected as a result of this activity. The discussion below provide NMFS' determinations of whether there is a reasonable expectation that right, humpback, fin, and sei whales as well as loggerhead and leatherback sea turtles will experience reductions in reproduction, numbers, or distribution in response to these effects, and whether any reductions in the reproduction, numbers, or distribution of these species can be expected to appreciably reduce the species' likelihood of surviving and recovering in the wild. It is important to consider that the assessments in sections 8.1.1 through 8.1.5 are based on historical data and do not fully account for the trend in reduction of effort in the American lobster fishery and other fisheries. Thus, the assessments in these sections could be considered worst case expectations as the relatively recent reductions in commercial fisheries effort could result in decreased opportunities for entanglements of ESA-listed species.

8.1 North Atlantic Right Whale

In order to assess the impact of fisheries mortality on the North Atlantic right whale population, NMFS NEFSC developed a population viability analysis (PVA) to examine the influence of anthropogenic mortality reduction on survival and recovery for the species (Pace, in review). The PVA included simulation models that re-sampled from observed calving records and a set of survival rates estimated from re-sightings histories of cataloged individuals collected over a 30 year period, and used these to assess the influence that simple and per capita reductions in anthropogenic mortality might have on population trajectories. Status quo simulations project forward assuming conditions are similar to those experienced from 1980 to 2009 – *i.e.*, without any reductions in mortality from entanglements or ship strikes, continuing the observed population trends experienced over the past 30 year period into the future. In short, the PVA evaluated how the populations would fare without entanglement mortalities compared to the status quo (*i.e.*, with entanglement mortalities). The PVA evaluated several scenarios, including removing the mortality of one right whale (random life stage and sex) per year and one adult female per year. The PVA also evaluated the removal of right whale mortality on a per capita basis (meaning that as the population went up or down, the mortality reduction would go up or down relative to the population size). The three per capita scenarios evaluated the effect of the removal of the mortality of one animal (random life stage and sex), one adult female, and three animals (random life stage and sex).

Since submission of the draft for publication in 2010, technical issues were raised during peer review of the modeling done by Pace (in review) that has required additional analysis prior to resubmission. The primary concern raised was that the analysis conducted was likely biased towards underestimating the viability of the population. Since then, the PVA has been resubmitted and is currently in review. Since the modeling done by Pace (in review) has not completed the peer review process, this document will not be used as part of the effects analysis in this Opinion. Considering that the results of the PVA are consistent with the information presented in the 2013 SAR for North Atlantic right whales, the 2013 SAR is considered to be the best and most up to date information available and will be used to support the effects analysis for right whales in this Opinion. The PVA is expected to be included in the effect analysis for right whales in future biological opinions once the document has undergone peer review and is finalized.

As described in Table 8, for 2007-2011, the average reported mortality and serious injury to right whales due to fishery entanglement in U.S. or unknown gear was 3.25 whales per year (NEFSC 2014). In the majority of cases, an entanglement report does not contain the necessary information to assign the event to a particular fishery. From 2007-2011, lobster gear of U.S. or undocumented origin was not recorded in any SI/M entanglement events with right whales (Table 8). Although there are no documented cases of SI/M to right whales from lobster gear in 2007-2011, SI/M has previously been documented for right whales as a result of entanglement in lobster gear. Based on the serious injury and mortality data for the past five years, we expect to see an average of 3.25 right whales seriously injured or killed per year as a result of entanglement in U.S. fishing gear.

For the purposes of this assessment, we are assuming that on a five year average, 3.25 right whales are observed to be seriously injured or killed as a result of U.S. fisheries. Because serious injury or mortality could result from the lobster fishery, this Opinion assumes that serious injury or mortality could and would occur as a result of the lobster fishery.

PBR for the western Atlantic stock of North Atlantic right whale stock is 0.9 whales (Waring *et al.* 2014). As indicated above, the annual average rate of documented SI/M events for right whales attributable to lobster gear is less than PBR ($0 < 0.9$) and the overall annual rate of documented serious injury/mortality events attributed to all U.S. commercial fishing gear for right whales is 0.2, which is also below the PBR value of 0.9. The term “potential biological removal level” means 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. It is important to note that optimum sustainable population is a population level that is significantly higher than that required for the survival and recovery of the species for purposes of ESA section 7. The 2013 SAR indicates that the level of serious injuries or mortalities of North Atlantic right whales attributable to U.S. commercial fisheries meets the level necessary to allow for growth to the optimum sustainable population level. However, what we must consider in this Opinion is whether the continued operation of the lobster fishery over the next ten years will result in interactions with right whales that will result in serious injuries or mortalities that are likely to appreciably reduce the survival and recovery of North Atlantic right

whales for purposes of ESA section 7. If so, then we would have to determine if that appreciable reduction in survival and recovery for the western Atlantic stock resulted in an appreciable reduction in survival and recovery for North Atlantic right whales.

According to the 2013 SAR, the minimum population size estimate for North Atlantic right whales is 455 animals. A total of 338 right whale calves were born from 1993 to 2011 (Waring *et al.* 2014). The mean calf production for this 19-year period is estimated to be 17.8/year (Waring *et al.* 2014). Calving numbers have been variable, with large differences among years, including a second largest calving season in 2000/2001 with 31 right whale births (Waring *et al.* 2014). The three calving years (97/98; 98/99; 99/00) prior to this record year provided low recruitment levels with only 11 calves born. The 2000-2011 calving seasons were remarkably better with 31, 21, 19, 17, 28, 19, 23, 23, 39, 19, and 22 births, respectively (Waring *et al.* 2014). Examination of the minimum number alive population index calculated from the individual sightings database for the years 1990-2010 suggest a positive and slowly accelerating trend in population size with a mean growth rate of 2.8% (Waring *et al.* 2014).

The 2013 SAR concludes that the North Atlantic right whale stock is increasing in size. It is important to consider that the action being considered in this Opinion is not new, it is ongoing and the right whale population has been increasing while lobster fishing in U.S. federal, state, and Canadian waters has continued to occur and continued to interact with right whales. No changes to the fishery are being proposed that would increase the potential for interactions between the U.S. lobster fishery and right whales. Additionally, the vertical line strategy and the most recent groundline regulations under the ALWTRP and the ship strike measures have not been in place long enough for there to be an opportunity to detect and evaluate their effect on the population of North Atlantic right whales. Given all of the available data, it is logical to conclude that commercial fishery interactions are not threatening the survival of North Atlantic right whales, particularly in light of the increasing population trend.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that North Atlantic right whales will survive in the wild. Here, we consider the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail, or destroy the habitat or range of the species since it will result in the average mortality of 3.25 individuals which is not expected to cause an appreciable change in the increasing trend of this population and therefore it will not

affect the overall distribution of right whales. The proposed action will not utilize right whales for recreational, scientific or commercial purposes or affect the adequacy of existing regulatory mechanisms to protect this species. The loss of these individuals will not change the status or trend of the species, which is increasing and would not result in an appreciable reduction in the likelihood of improvement in the status of right whales throughout their range. The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction. Below, we consider effects of the action on the downlisting criteria identified for right whales in the most recent recovery plan.

The goal of the 2005 revised Recovery Plan for North Atlantic Right Whale is to recover North Atlantic right whales to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The revised Recovery Plan states that North Atlantic right whales may be considered for *reclassifying to threatened* when all of the following have been met: 1) the population ecology (range, distribution, age structure, and gender ratios, etc.) and vital rates (age-specific survival, age-specific reproduction, and lifetime reproductive success) of right whales are indicative of an increasing population; 2) the population has increased for a period of 35 years at an average rate of increase equal to or greater than 2% per year; 3) none of the known threats to North Atlantic right whales (summarized in the five listing factors) are known to limit the population's growth rate; and 4) given current and projected threats and environmental conditions, the right whale population has no more than a 1% chance of quasi-extinction in 100 years.

The revised Recovery Plan for North Atlantic Right Whales states that the most significant need for North Atlantic right whale recovery is to reduce or eliminate deaths and injuries from anthropogenic activities, namely shipping and commercial fishing operations. As described in this Opinion, there are numerous management and regulatory initiatives implemented and underway to meet this need. Several significant management measures have been implemented recently, and their effects would not yet be expected to be seen in the population in terms of an increased population growth rate. Three of the more significant measures designed to reduce the risk from these anthropogenic activities are the implementation of the ALWTRP measures in 2009 (*e.g.*, broad based gear modifications requiring the use of sinking groundlines for gillnet and pot/trap gear), implementation of the vertical line strategy under the ALWTRP in 2014, and the Ship Strike Reduction Program, including the 2008 regulations requiring large ships to reduce speeds to 10 knots in areas where right whales feed and reproduce, as well as along migratory routes. Any positive impacts on right whales from these measures would not be observed for some time in the population and were not included in the latest stock assessment report (Waring *et al.* 2014). Another significant event that has taken place over the last decade is the reduction in fishing capacity and effort in U.S. Atlantic fisheries. For example, effort in the Northeast multispecies fisheries as a result of Amendment 16 is expected to be reduced by nearly 75% when compared to fishing effort and capacity in the early 1990s (NEFMC 2009). While some fishing effort may increase in the future as fisheries stocks respond to management measures to rebuild them, there are measures in place that will prevent overcapacity from redeveloping (*i.e.*, nearly all U.S. Atlantic commercial fisheries are closed/limited access).

Furthermore, as fish stocks increase, another possible outcome will be increased catches/landings with constant or even reduced fishing effort.

The threshold of achieving a 2.0% growth rate over a 35 year period is a downlisting and not a recovery threshold. Downlisting criteria identify conditions which when reached indicate that the population is no longer endangered (at risk of extinction) and is more properly classified as threatened (likely to become endangered). When one looks at the actual observed growth rate in the population (2.8%), the population is increasing at a rate targeted for downlisting (2% growth rate over 35 years) as identified in the species' recovery plan. The observed mean growth rate of 2.8% over a 20 year period (1990 – 2010) indicates that if the status quo continues (including serious injuries and mortalities and other impacts from lobster fishing in Canadian and state waters) and this growth rate is maintained, the downlisting criteria will be met. The population appears to be on the correct trajectory to meet the downlisting criteria if the status quo can be maintained. Any improvements in the status quo would increase the population growth and increase the rate of recovery or decrease the time period to recovery.

An additional downlisting criteria states that the right whale population should have no more than a 1% chance of quasi-extinction in 100 years. No information is currently available that analyzes the risk of quasi-extinction to the right whale population. However, as described in the SAR, the population is increasing at a rate targeted for downlisting (if maintained for 35 years) as identified in the species' recovery plan. The species has persisted and is projected to do so into the future. The observed mean population growth for the past 20 years provides evidence that the species has sufficient resilience to allow for recovery from endangerment. It is important to consider that the action being considered in this Opinion is not new, it is ongoing and the right whale population has been increasing while lobster fishing in U.S. federal and state waters and Canadian waters has continued to occur and continued to impact right whales. No changes to the fishery are being proposed that would increase the potential for interactions between the U.S. lobster fishery and right whales.

Another important factor to consider is that the observed population growth rate does not take into account any benefits to the species as a result of recently implemented regulations to reduce the risk of entanglement from vertical lines and groundlines under the ALWTRP, nor do they consider the benefits from the ship speed regulations. These actions have been implemented, but have not been in place long enough for their full beneficial effect to be realized in the population. It is anticipated that it would take at least five years after implementation to be able to detect any changes in the population as a result of these management measures. Additionally, fishing effort in the American lobster fishery is expected to be reduced as a result of lobster trap effort control and trap transferability measures approved by the Atlantic States Marine Fisheries Commission and in evaluation by the NMFS (NMFS 2010i). Given this information, we believe the population currently appears to be meeting the downlisting criteria of having no more than a 1% chance of quasi-extinction in 100 years.

Given this analysis, the effects of the proposed action will not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted.

Therefore, the proposed action will not appreciably reduce the likelihood that right whales can be brought to the point at which they are no longer listed as endangered or threatened.

Based on the analysis described above, the average serious injury or mortality of 3.25 right whales per year as a result of fisheries entanglement in U.S. gear over the next ten years is not likely to reduce appreciably the likelihood of both survival and recovery of North Atlantic right whales, taking into account the environmental baseline and cumulative effects including lobster fishing in Canadian waters and in state waters.

8.2 Humpback Whale

As established above, the use of pot/trap gear for the proposed activity is expected to result in the entanglement of humpback whales. An annual average of 0.4 SI/M events of humpbacks in lobster gear has been documented for the period 2007-2011 (Table 8). During that same time period, the average documented SI/M events for humpbacks in all entangling gear were 9.05 annually (Table 8). It should be noted that this database includes a large number of entanglements with undocumented gear types, which may include non-fishery related gear like anchoring systems and mooring gear. Based on the serious injury and mortality data for the past five years, we expect to see an average of 9.05 humpback whales seriously injured or killed each year as a result of entanglement in U.S. fishing gear.

For the purposes of this assessment, we are assuming that on a five year average, 9.05 humpback whales are observed to be seriously injured or killed as a result of U.S. fisheries. Because serious injury or mortality could result from the lobster fishery, this Opinion assumes that serious injury or mortality could and would occur as a result of the lobster fishery.

Potential biological removal (PBR) for the Gulf of Maine humpback whale stock is 2.7 whales (Waring *et al.* 2014). As indicated above, while the annual average rate of documented serious injury/mortality events for humpback whales attributable to lobster gear is less than PBR ($0.4 < 2.7$), the overall annual rate of documented serious injury/mortality events with all U.S. commercial fishing gear for humpback whales is 1.95, which is below the PBR value of 2.7. The term “potential biological removal level” means 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. It is important to note that optimum sustainable population is a population level that is significantly higher than survival and recovery. The 2013 SAR indicates that the level of serious injuries or mortalities of Gulf of Maine humpback whales attributable to U.S. commercial fisheries is below the level necessary to allow for growth to the optimum sustainable population level. However, what we must consider in this Opinion is whether the continued operation of the lobster fishery over the next ten years will result in interactions with humpback whales that will result in serious injuries or mortalities that are likely to appreciably reduce the survival and recovery of the Gulf of Maine stock of humpback whales. If so, then we would have to determine if that appreciable reduction in survival and recovery for the Gulf of Maine stock resulted in an appreciable reduction in survival and recovery for humpback whales, which as previously noted, are listed as a single global species that is endangered throughout its range.

According to the latest final stock assessment report, the best abundance estimate for Gulf of Maine humpback whales was 823 animals, and the minimum population estimate is 823 animals. The Gulf of Maine feeding population is estimated to be increasing at a rate of 6.5% for the period 1979-1991 (Barlow and Clapham, 1997). However, using data from 1992 through 2000, the population showed a lower growth rate of 0-4% (Clapham *et al.* 2003). A more precise estimate was not possible with available data; the lower estimate assumed a calf survival rate of 0.51 and the higher estimate was based on a calf survival rate of 0.875. The authors hypothesized that the apparent decline in growth rate during this later period could have resulted from a shift in humpback whale distribution to areas less sampled, a reduction in adult female survival, increased interbirth intervals or high mortality of first-year whales (such as off the Mid-Atlantic coast (Barco *et al.* 2002; Clapham *et al.* 2003). They considered reduced calf survival to be the most likely explanation and noted an apparent improvement after 1996. A subsequent study confirmed both low average reproductive rates and calf survival during much of that period (Robbins, 2007). The average estimated calf survival rate for the period 2000-2005 (0.664, 95% CI: 0.517-0.784) fell between the values assumed by Clapham *et al.* (2003), and did not include neonatal mortality prior to arrival on the feeding ground (Robbins 2007). Regardless of the cause of lower calf survival between 1992 and 1995, Clapham *et al.* (2003) conclude that calf survival appears to have returned to near-previous levels beginning in 1996 and that it is likely that population growth is now comparable to that observed between 1979 and 1991 (6.5%). Given all of the available data, the 2013 stock assessment concludes that the Gulf of Maine humpback whale stock is steadily increasing in size. It is important to consider that the action being considered in this Opinion is not new, it is ongoing, and the Gulf of Maine humpback stock population has been increasing while the lobster fishery has continued to occur and continued to impact this stock. No changes to the fishery are being proposed that would increase the potential for interactions between the fishery and humpback whales.

The 2013 stock assessment concludes that the North Atlantic population of humpback whales overall had an estimated average population increase of 3.1% over the time period 1979-1993 (Waring *et al.* 2014; Stevich *et al.* 2003). Given that U.S. commercial fishery interactions are not currently threatening the survival of the Gulf of Maine stock of humpback whales, it is logical to conclude that they are not threatening the survival of the overall stock of North Atlantic humpback whales, particularly in light of the increasing population trend.

The 2013 stock assessment concludes that human impacts (vessel collisions and entanglements) may be slowing recovery of humpback whale populations. In this Opinion, we must consider whether impacts associated with fishing authorized under the American Lobster FMP are likely to result in an appreciable reduction in the likelihood of recovery of humpback whales.

The goal of the 1991 Recovery Plan for the Humpback Whale (Plan) is to assist humpback whale populations to grow and to reoccupy areas where they were historically found. The long-term numerical goal of the Plan is to increase humpback whale populations to at least 60% of the number of existing before commercial exploitation or of current environmental carrying capacity. With those levels undetermined, an intermediate goal was specified as a “doubling of extant populations within the next 20 years.”

The 1991 Plan used the 1986 population estimate for the Gulf of Maine feeding aggregation of humpback whales, which was 240 (95% CI = 147 to 333) (NMFS 1991b). The most recent best estimate of abundance for Gulf of Maine humpback whales is 847 animals (CV =0.55). The current minimum population estimate is 847 animals (Waring *et al.* 2014). Based on these numbers, it does appear that the Gulf of Maine stock of humpback whales has more than doubled in the 20 years since the 1991 plan was published.

The Recovery Plan for Humpback Whales set out four major objectives to proceed on a path toward recovery. One of the four objectives specifically addresses fishery interactions by identifying the need to, “identify and reduce human-related mortality, injury, and disturbance,” to humpback whales. As described in this Opinion, there are numerous management and regulatory initiatives implemented and underway to meet this need. Several significant management measures have been implemented recently, and their effects would not yet be expected to be seen in the population in terms of an increased population growth rate. Three of the more significant measures designed to reduce the risk from these anthropogenic activities are the implementation of the ALWTRP measures in 2009 (*e.g.*, broad based gear modifications requiring the use of sinking groundlines for gillnet and pot/trap gear), implementation of the vertical line strategy under the ALWTRP in 2014, and the Ship Strike Reduction Program, including the 2008 regulations requiring large ships to reduce speeds to 10 knots in areas where right whales feed and reproduce, as well as along migratory routes. Any positive impacts on humpback whales from these measures would not be observed for some time in the population, and do not appear in the latest stock assessment report.

As part of a large-scale assessment called More of North Atlantic Humpbacks (MoNAH) project, extensive sampling was conducted on humpbacks in the Gulf of Maine/Scotian Shelf region and the primary wintering ground on Silver Bank during 2004-2005. These data are being analyzed along with additional data from the U.S. Mid-Atlantic to estimate abundance and refine knowledge of population structure. This work is intended to update the YONAH population estimate and is being used in an ongoing status review under the ESA.

Another, significant event that has taken place over the last decade is the reduction in fishing capacity and effort in U.S. Atlantic fisheries. For example, effort in the Northeast multispecies fisheries as a result of Amendment 16 is expected to be reduced by nearly 75% when compared to fishing effort and capacity in the early 1990’s (NEFMC 2009). Fishing effort in the American lobster fishery is expected to be reduced as a result of lobster trap effort control and trap transferability measures approved by the Atlantic States Marine Fisheries Commission and in evaluation by the NMFS (NMFS 2010i). While some fishing effort may increase in the future as fisheries stocks respond to management measures to rebuild them, there are measures in place that will prevent overcapacity from redeveloping (*i.e.*, nearly all U.S. Atlantic commercial fisheries are closed/limited access). Furthermore, as fish stocks increase, another possible outcome will be increased catches/landings with constant or even reduced fishing effort.

Specific downlisting criteria for humpback whales have not been developed. However, the estimated increases in the Gulf of Maine stock and the North Atlantic populations of humpback

whales indicate that these populations are recovering despite continued interactions with commercial fisheries inside the U.S. EEZ (in addition to interactions with commercial lobster fishing in Canadian and state waters). Additionally, there are indications of increasing abundance for the eastern and central North Pacific stocks (Waring *et al.* 2014) which are not impacted by the action under consideration in this Opinion.

The rate of humpback entanglements in fishing gear continues to be of concern to resource managers. The new vertical line strategy and the relatively new broad based gear modifications of the ALWTRP are expected to reduce the risk of SI/M due to humpback whale entanglement. The most recent data indicates the humpback whale population is steadily increasing despite the anthropogenic and cumulative effects previously discussed in this Opinion. While the average of 9.05 interactions of humpback whales per year resulting in serious injury or mortality may occur under the continued authorization of the American Lobster FMP over the next ten years, the interaction level is not expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of this species.

8.3 Fin and Sei Whales

Serious injury and mortality entanglements of fin and sei whales have been documented but occur at a level below PBR for both species (Waring *et al.* 2014). This indicates that the level of serious injuries or mortalities of fin and sei whales attributable to U.S. commercial fisheries still allows these stocks to maintain population levels and growth rates needed to reach or maintain their optimum sustainable population. Additionally, effort in the American lobster fishery is expected to be reduced, the vertical line strategy and the broad based gear modifications of the ALWTRP have been implemented. While interactions with fin and sei whales may occur under the continued authorization of the American Lobster FMP over the next ten years and due to lobster fishing in Canadian and state waters, the interaction level is not expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of these species.

8.4 NWA DPS Loggerhead Sea Turtle

The *Northwest Atlantic DPS of loggerhead sea turtles* is listed as “threatened” under the ESA. It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in the Status of the Species/Environmental Baseline and Cumulative Effects sections above, loggerhead sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration, dredging, power plant intakes and other factors that result in mortality of individuals at all life stages. Negative impacts causing death of various age classes occur both on land and in the water. Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, many remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. Based on the reviews of nesting data, as well as information on population abundance and trends, NMFS and USFWS determined in the September 2011 listing rule that the NWA DPS should be listed as threatened. They found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats.

It is unclear whether nesting beach trends, in-water abundance trends, or some combination of both, best represents the actual status of loggerhead sea turtle populations in the Atlantic. Estimates of the total loggerhead population in the Atlantic are not currently available. However, as part of the Atlantic Marine Assessment Program for Protected Species (AMAPPS), aerial line transect sightings surveys and turtle telemetry studies were conducted along the Atlantic Coast in the summer of 2010. The calculated preliminary regional abundance estimate is about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS NEFSC 2011). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified turtle sightings. Also, a recent loggerhead population estimate prepared by Richards *et al.* (2011) using data from 2001-2010 states that the loggerhead adult female population in the western North Atlantic is 38,334 individuals (SD =2,287). They estimated adult female subpopulation sizes to range from a minimum of 258 females for the Dry Tortugas RU to a maximum of 45,048 females for the Peninsular Florida RU. Although there is much uncertainty in these population estimates, they provide some context for evaluating the size of the likely population of loggerheads in the Atlantic.

As described above, the use of pot/trap gear in the American lobster fishery is expected to adversely affect loggerhead sea turtles as a result of entanglement in gear. This Opinion has identified in Section 6.2.2 that the proposed activity, continued operation of the fishery under the American Lobster FMP, will directly affect loggerhead sea turtles by entangling up to one loggerhead sea turtle annually in pot/trap gear. As a result of being entangled in the fishing gear, one loggerhead sea turtle annually is expected to die or sustain serious injuries leading to death or failure to reproduce. The trap gear fixed on benthic habitat as a result of the fishing activities will have an insignificant effect on loggerhead sea turtles prey or habitat, as discussed in Section 4.1.1. No other direct or indirect effects to loggerhead sea turtles are expected as a result of the proposed action.

The lethal removal of up to one loggerhead sea turtle annually from the action area would be expected to reduce the number of loggerhead sea turtles from the recovery unit of which they originated as compared to the number of loggerheads that would have been present in the absence of the proposed action (assuming all other variables remained the same). However, this does not necessarily mean that these recovery units will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced. The final revised recovery plan for loggerheads compiled the

most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit.

It is likely that the loggerhead sea turtles entangled in lobster gear originate from several of the recovery units. Limited information is available on the genetic makeup of sea turtles in the mid-Atlantic. Cohorts from each of the five western Atlantic subpopulations are expected to occur in the action area. Genetic analysis of samples collected from immature loggerhead sea turtles captured in pound nets in the Pamlico-Albemarle Estuarine Complex in North Carolina from September-December of 1995-1997 indicated that cohorts from all five western Atlantic subpopulations were present (Bass et al. 2004). In a separate study, genetic analysis of samples collected from loggerhead sea turtles from Massachusetts to Florida found that all five western Atlantic loggerhead subpopulations were represented (Bowen et al. 2004). Bass et al. (2004) found that 80 percent of the juveniles and sub-adults utilizing the foraging habitat originated from the south Florida nesting population, 12 percent from the northern subpopulation, 6 percent from the Yucatan subpopulation, and 2 percent from other rookeries. The previously defined loggerhead subpopulations do not share the exact delineations of the recovery units identified in the 2008 recovery plan. However, the PFRU encompasses both the south Florida and Florida panhandle subpopulations, the NRU is roughly equivalent to the northern nesting group, the Dry Tortugas subpopulation is equivalent to the DTRU, and the Yucatan subpopulation is included in the GCRU.

Based on the genetic analysis presented in Bass et al. (2004) and the small number of loggerheads from the DTRU or the NGMRU likely to occur in the action area it is extremely unlikely that the loggerhead likely to be killed due to interactions with lobster gear will originate from either of these recovery units. The majority, at least 80% of the loggerheads entangled, are likely to have originated from the PFRU, with the remainder from the NRU and GCRU. As explained above, only one loggerhead mortality is expected to result annually from the continued operation of the lobster fishery over the next ten years. As it is impossible to predict whether this turtle will be from the PFRU, the NRU or the GCRU, NMFS considers below the effects of the annual mortality of one loggerhead from any of the these three recovery units.

As noted above, the most recent population estimates indicate that there are approximately 15,735 females nesting annually in the PFRU and approximately 1,272 females nesting per year in the NRU. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was

estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit; however, the 2008 recovery plan indicates that the Yucatan nesting aggregation has at least 1,000 nesting females annually. As the numbers outlined here are only for nesting females, the total number of loggerhead sea turtles in each recovery unit is likely significantly higher. The loss of one loggerhead represents an extremely small percentage of the number of sea turtles in the PFRU. Even if the total population was limited to 15,735 loggerheads, the loss of one individual would represent approximately 0.006% of the population. Similarly, the loss of one loggerhead from the NRU represents an extremely small percentage of the recovery unit. Even if the total population was limited to 1,272 sea turtles, the loss of one individual would represent approximately 0.08% of the population. The loss of one loggerhead from the GCRU, which is expected to support at least 1,000 nesting females, represents less than 0.1% of the population. The loss of such a small percentage of the individuals from any of these recovery units represents an even smaller percentage of the species as a whole. Assuming that the loggerhead interaction in the fishery is female, and assuming that the interaction is of an adult to assume a worst case scenario as far as reproductive value to the population, the loggerhead mortality as a result of the American lobster fishery would result in the removal of less than 0.01 percent of the adult female loggerhead population in the Western Atlantic (1 out of 38,334, using the estimated adult female population from Richards *et al.* 2011). As such, it is unlikely that the death of one loggerhead sea turtle will have a detectable effect on the numbers and population trends of loggerheads in these recovery units or the number of loggerheads in the population as a whole. Additionally, this action is not likely to reduce distribution of loggerheads because the action will only result in temporary delays for foraging and migrating loggerheads and will not impede any loggerheads from accessing suitable foraging grounds and or disrupt other migratory behaviors.

In general, while the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species, this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of loggerhead sea turtles because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, and there are several thousand individuals in the population.

Based on the information provided above, the death of no more than one loggerhead sea turtle as a result of the continued operation of the lobster fishery over the next ten years will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect loggerheads in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent loggerheads from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because, annually,: (1) the death of one loggerhead represents an extremely small percentage of the species as a whole; (2) the loss of this loggerhead will not change the status or trends of any

nesting aggregation, recovery unit or the species as a whole; (3) the loss of one loggerhead is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of one loggerhead is likely to have an undetectable effect on reproductive output of any nesting aggregation or the species as a whole; and, (4) the action will have no effect on the distribution of loggerheads in the action area or throughout its range; and, (6) the action will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that loggerheads will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate.

Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (*i.e.*, “endangered”), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (*i.e.*, “threatened”) because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action will not appreciably reduce the likelihood of survival of the loggerhead sea turtle species. Also, it is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of loggerheads in any geographic area and since it will not affect the overall distribution of loggerheads. The proposed action will not utilize loggerheads for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect any of these species of sea turtles, or affect their continued existence. As explained above, the proposed action is likely to result in the mortality of up to 1 loggerhead annually; however, as explained above, the loss of this individual over this time period is not expected to affect the persistence of loggerhead sea turtles. In summary, the effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the action will not prevent the species from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because while the action may result in a small reduction in the number of loggerheads and a small reduction in the amount of potential reproduction due to the loss of one individual, these effects will be undetectable over the long-term and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not appreciably reduce the likelihood that loggerhead sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual loggerhead sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While NMFS is not able to predict with precision how climate change will continue to impact loggerhead sea turtles in the action area or how the species will adapt to climate-change related environmental impacts, no additional effects related to climate change to loggerhead sea turtles in the action area are anticipated over the life of the proposed action. NMFS has considered the effects of the proposed action in light of cumulative effects explained above, including climate change, and has concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the mortality of no more than one loggerhead per year over the next ten years, is not likely to appreciably reduce the survival and recovery of the NWA DPS of loggerhead sea turtles.

8.5 Leatherback Sea Turtle

Leatherback sea turtles are known to become entangled in lobster trap gear. Between 2002 and 2013 there have been 80 confirmed interactions between leatherbacks and lobster gear. Additionally, during the period 1980-2000 there were 119 reported leatherback sea turtles entangled in lobster trap gear from Maine to New York.

Leatherback sea turtles will continue to be captured, entangled, or hooked by fisheries other than the federal lobster fishery considered in this Opinion. An unknown number of turtles may also be injured or killed from non-fishery related effects such as direct harvest, vessel collisions, or ingestion of debris. Adverse effects to sea turtle habitat, including loss of nesting sites or degradation of nesting or foraging areas, are also expected to continue.

Interactions of leatherback sea turtles in the American lobster fishery are reasonably likely to occur given: (1) that the distribution of leatherbacks overlaps with operation of American lobster fishery, and (2) interactions of leatherback sea turtles lobster trap gear have been observed. Based on STDN data, the capture of leatherback sea turtles in pot gear operating within the action area, including lobster gear, would be an expected event. However, given the lack of observer coverage in the American lobster fishery as well as other fisheries in the action area, it is likely that some interactions have occurred but were not observed or reported. Based on previous estimates and the current leatherback sea turtle entanglement data, NMFS anticipates seven leatherback sea turtles interactions per year in federal waters as a result of the continued operation of the American Lobster FMP over the next ten years.

The lethal removal of seven leatherback sea turtles annually, whether male or female or immature or mature, would be expected to reduce the number of Atlantic leatherback sea turtles as compared to the number of leatherback sea turtles in the Atlantic that would have been present in the absence of the proposed action assuming all other variables remained the same. The loss of seven female leatherback sea turtles annually, would be expected to reduce the reproduction of Atlantic leatherback sea turtles as compared to the reproductive output of leatherback sea

turtles in the Atlantic in the absence of the proposed action. The lethal removal of seven leatherback sea turtles annually from the Atlantic as a result of the continued operation of the American lobster fishery over the next ten years will not appreciably reduce the likelihood of survival for the species for the following reasons. Unlike leatherbacks in the Pacific, the nesting trend (in terms of number of nests laid) for leatherbacks in the Atlantic is stable or increasing for nearly all Atlantic leatherback nesting sites. The TEWG (2007) report identified seven leatherback populations or groups of populations in the Atlantic: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil. The Leatherback TEWG concluded that there was an increasing or stable trend in nesting for all of these with the exception of the Western Caribbean and West Africa. For example, the Florida Statewide Nesting Beach Survey Program has documented an increase in leatherback nesting numbers in that state from 98 in 1988 to between 800 and 900 nests in the early 2000s (NMFS and USFWS 2007b). In 2001, the number of nests for Suriname and French Guiana, the largest known nesting areas for leatherbacks worldwide, was 60,000 (Hilterman and Govere 2004).

This is one of the highest numbers observed for this region in 35 years (Hilterman and Govere 2004). A stable trend in nesting suggests that leatherbacks are able to maintain current levels of nesting as well as current numbers of adult females despite the activities described in the *Environmental Baseline*, *Cumulative Effects*, and the *Status of the Species* sections (for those activities that occur outside of the action area of this Opinion). An increasing trend in nesting suggests that the combined impact to Atlantic leatherbacks from these on-going activities is less than what has occurred in the past. The result of which is that more female leatherbacks are maturing and subsequently nesting, and/or are surviving to an older age and producing more nests across their lifetime.

As described in the *Status of the Species* and *Environmental Baseline* sections, action has been taken to reduce anthropogenic effects to Atlantic leatherbacks. These include regulatory measures to reduce the number and severity of leatherback interactions with the two leading known causes of leatherback fishing mortality in the Atlantic: the U.S. Atlantic longline fisheries (measures first implemented in 2000 and subsequently revised) and the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (measures implemented in 2002). Reducing the number of leatherback sea turtles injured and killed as a result of these activities is expected to increase the number of Atlantic leatherbacks, and increase leatherback reproduction in the Atlantic. Since the regulatory measures are relatively recent, it is unlikely that current nesting trends reflect the benefit of these actions to Atlantic leatherbacks. Therefore, the current nesting trends for Atlantic leatherbacks are likely to improve as a result of regulatory action taken for the U.S. Atlantic longline fisheries and the U.S. South Atlantic and Gulf of Mexico shrimp fisheries. There are no new known sources of injury or mortality for leatherback sea turtles in the Atlantic.

Based on the information provided above, the loss of seven leatherback sea turtles annually in the Atlantic as a result of the continued operation of the American lobster fishery over the next ten years will not appreciably reduce the likelihood of survival for leatherbacks in the Atlantic given the increased and stable nesting trend at the Atlantic nesting sites, and given measures that reduce the number of Atlantic leatherback sea turtles injured and killed in the Atlantic (which should result in increases to the numbers of leatherbacks in the Atlantic that would otherwise

have not occurred in the absence of those regulatory measures). The American lobster fishery has no effects on leatherback sea turtles that occur outside of the Atlantic. Therefore, since the continued operation of the American lobster fishery over the next ten years will not appreciably reduce the likelihood of survival for leatherbacks in the Atlantic, the proposed action will not appreciably reduce the likelihood of survival of the species.

The five-year status review for the species reviewed the recovery criteria provided with the 1992 recovery plan for leatherbacks in the Atlantic, and the progress made in meeting each objective (NMFS and USFWS 2007b). These are: (1) the adult female population increases over the next 25 years as evidenced by a statistically significant trend in the number of nests at Culebra (Puerto Rico), St. Croix (U.S. Virgin Islands), and along the East Coast of Florida; (2) nesting habitat encompassing at least 75% of nesting activity in Puerto Rico, U.S. Virgin Islands, and Florida is in public ownership; and (3) all priority one tasks have been implemented (address a multitude of measures in areas of nesting habitat protection, scientific studies, marine debris, oil and gas exploration, amongst others) (NMFS and USFWS 1992). As described in this Opinion, the continued operation of the American lobster fishery over the next ten years is expected to kill up to seven leatherback sea turtles annually. No other effects to leatherbacks are expected as a result of the proposed action. The continued operation of the fishery will not affect ownership of nesting habitat, nor will it affect the protection of nesting beaches and the marine environment or compromise the ability of researchers to conduct scientific studies. Therefore, the continued operation of the American lobster fishery over the next ten years within the constraints of the FMP will have no effect on recovery criteria #2 and #3.

The lethal interaction of up to seven leatherback sea turtles with lobster gear annually, as a result of the proposed action is expected to reduce the number of leatherbacks in the Atlantic compared to the number that would have been present in the absence of the proposed action, and will, similarly, reduce leatherback reproduction in the Atlantic as a result of the capture and killing if the leatherbacks are females. These conclusions are relevant to recovery criteria #1 of the 1992 recovery plan for leatherbacks in the Atlantic. As described in the five-year status review, the number of nests counted in Puerto Rico increased from 9 in 1978 to a minimum of 469-882 nests recorded each year from 2000 to 2005. Based on the nesting numbers, the annual female population growth rate was positive for the 28-year time period from 1978 to 2005. In St. Croix, U.S. Virgin Islands, leatherback nesting increased from a low of 143 in 1990 to a high of 1,008 in 2001. Based on the nesting numbers, the annual female population growth rate was positive for the 19-year time period from 1986 to 2004. In Florida, nests have increased from 98 nests in 1989 to 800-900 nests per season in the early 2000s (NMFS and USFWS 2007b). Based on the nesting numbers, the annual female population growth rate was positive for the 18-year time period from 1989-2006 (NMFS and USFWS 2007b). The annual loss of up to seven leatherback sea turtles, together with an increase in nesting, is not expected to affect the positive growth rate in the female population of leatherback sea turtles nesting in Puerto Rico, St. Croix, and Florida. Therefore, the continued operation of the American lobster fishery over the next ten years within the constraints of the current American Lobster FMP will not appreciably reduce the likelihood of recovery for leatherback sea turtles in the Atlantic. Since the American lobster fishery has no effects on leatherback sea turtles that occur outside of the Atlantic, its continued operation will not appreciably reduce the likelihood of survival and recovery for the species.

9.0 CONCLUSION

After reviewing the current status status of the species, the environmental baseline, climate change, cumulative effects in the action area, and the effects of the continued operation of the American lobster fishery over the next ten years, it is our biological opinion that the proposed action may adversely affect, but is not likely to jeopardize, the continued existence of North Atlantic right whales, humpback whales, fin whales, and sei whales, or loggerhead (specifically, the NWA DPS) and leatherback sea turtles.

10.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species of fish and wildlife. “Fish and wildlife” is defined in the ESA “as any member of the animal kingdom, including without limitation any mammal, fish, bird (including any migratory, non-migratory, or endangered bird for which protection is also afforded by treaty or other international agreement), amphibian, reptile, mollusk, crustacean, arthropod or other invertebrate, and includes any part, product, egg, or offspring thereof, or the dead body or parts thereof.” 16 U.S.C. 1532(8). “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS to include any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. “Otherwise lawful activities” are those actions that meet all State and Federal legal requirements except for the prohibition against taking in ESA Section 9 (51 FR 19936, June 3, 1986), which would include any state endangered species laws or regulations. Section 9(g) makes it unlawful for any person “to attempt to commit, solicit another to commit, or cause to be committed, any offense defined [in the ESA.]” 16 U.S.C. 1538(g). A “person” is defined in part as any entity subject to the jurisdiction of the United States, including an individual, corporation, officer, employee, department or instrument of the Federal government (see 16 U.S.C. 1532(13)). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of carrying out an otherwise lawful activity is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. In issuing ITs, NMFS takes no position on whether an action is an “otherwise lawful activity.”

When a proposed NMFS action is found to be consistent with section 7(a)(2) of the ESA, section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of incidental taking, if any. It also states that reasonable and prudent measures necessary to minimize impacts of any incidental take be provided along with implementing terms and conditions. The measures described below are non-discretionary and must therefore be undertaken in order for the exemption in section 7(o)(2) to apply. Failure to implement the terms and conditions through enforceable measures may result in a lapse of the protective coverage section of 7(o)(2).

NMFS is not including an incidental take authorization for right, humpback, fin, and sei whales in connection with this biological opinion because (1) an incidental take statement cannot be lawfully issued under the ESA for a marine mammal unless incidental take authorization exists for that marine mammal under the MMPA (see 16 U.S.C. § 1536(b)(4)(C)) and (2) the incidental take of ESA-listed whales by the American lobster fishery has not been authorized under section 101(a)(5) of the MMPA. Because no ITS is included, no incidental take by the American lobster fishery is authorized under the ESA. Following the issuance of such authorizations, NMFS may amend this Opinion to include an incidental take allowance for these species, as appropriate.

NMFS recognizes that an ITS normally identifies the level of incidental take that requires reinitiation of ESA section 7 consultation. While NMFS cannot include an ITS for marine mammals in this biological opinion under the language of the ESA, it has included numerical “triggers” for reinitiation of ESA section 7 consultation. Specifically, as set forth in Section 12 below, reinitiation will occur if (1) the annual average SI/M is \geq the species’ trigger (3.25 for right whales, 9.05 for humpback whales, 1.7 for fin whales, and 0.2 for sei whales) at the conclusion of the five-year period; or (2) at any time during the five-year period the number of SI/M make it statistically impossible for the average to be $<$ the species’ trigger at the end of the five-year period. As explained above, NMFS has concluded that if the average number of serious injuries or mortalities were to occur for the whale species at a number \leq the species’ trigger, it would not likely reduce appreciably the likelihood of both survival and recovery of the whale species.

NMFS recognizes that further efforts among stakeholders are necessary to reduce interactions between authorized federal fisheries and right, humpback, fin, and sei whales in order to achieve the MMPA’s goal of insignificant levels of incidental mortality and serious injury of marine mammals approaching a zero mortality and serious injury rate, taking into consideration the economics of the fishing industry, the availability of existing technology, and existing State or regional fishery management plans. NMFS continues to work toward this zero mortality goal of the MMPA through the means identified in the pertinent subsections of section 4.4 above, including continued development and implementation of the ALWTRP with the collaboration of the ALWTRT. Although NMFS has concluded that the American lobster fishery is not likely to jeopardize the continued survival or recovery of right, humpback, fin, and sei whales for purposes of ESA section 7, the need for further efforts among stakeholders to reduce whale/fishery interactions and achieve the zero mortality goal of the MMPA is not diminished by this no-jeopardy conclusion.

Anticipated Amount or Extent of Incidental Take

Based on data from STDN, estimates of sea turtle take in trap/pot gear used in the American lobster fishery, and the distribution and abundance of turtles in the action area, NMFS anticipates that the continued implementation of the American Lobster FMP, may result in the taking of sea turtles in federal waters as follows:

- for loggerhead sea turtles, NMFS anticipates the annual lethal or non-lethal take of up to one individual in American lobster pot/trap gear;
- for leatherback sea turtles, NMFS anticipates the annual lethal or non-lethal take of up to seven individuals in American lobster pot/trap gear.

Anticipated Impact of Incidental Take

NMFS has concluded that the continued operation of the American lobster fishery may adversely affect but is not likely to jeopardize loggerhead and leatherback sea turtles. Nevertheless, NMFS must take action to minimize these takes. The following Reasonable and Prudent Measures (RPMs) have been identified as ways to minimize sea turtle interactions with the American lobster fishery now and to generate the information necessary in the future to continue to minimize incidental takes. These measures are non-discretionary and must be implemented by NMFS.

Reasonable and Prudent Measures

NMFS has determined that the following RPMs are necessary or appropriate to minimize impacts of the incidental take of sea turtles in the American lobster fishery:

1. NMFS must seek to ensure that any sea turtles incidentally taken in American lobster fishing gear are handled in such a way as to minimize stress to the animal and increase its survival rate.
2. NMFS must seek to ensure that monitoring and reporting of any sea turtles encountered in American lobster fishing gear: (1) detects any adverse effects such as injury or mortality; (2) assesses the realized level of incidental take in comparison with the anticipated incidental take documented in this Opinion; (3) detects whether the anticipated level of take has occurred or been exceeded; and (4) collects data from individual encounters.
3. NMFS must continue to investigate and implement, within a reasonable time frame following sound research, gear modifications for gear used in the American lobster fishery to reduce incidental takes of sea turtles and/or the severity of the interactions that occur.

4. NMFS must continue to review available data to determine whether there are areas or conditions within the action area where sea turtle interactions with fishing gear used in the American lobster fishery are more likely to occur.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, and regulations issued pursuant to section 4(d), NMFS must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

1. To comply with RPM #1 above, NMFS must continue to distribute any updated information to federal American lobster permit holders specifying handling or resuscitation requirements fishermen must undertake for any sea turtles taken. At a minimum, handling and resuscitation requirements listed in 50 CFR 223.206(d)(1) must be implemented. NMFS must also distribute the NER STDN Disentanglement Guidelines to federal American lobster permit holders. Use of the sea turtle handling and release protocols described in Epperly *et al.* (2004) and NMFS SEFSC (2008) should also be considered. When updates to methods become available, these methods must be evaluated and implemented.
2. To comply with RPM #2 above, NMFS must continue to use entanglement reports, observer reports, and any other information available to it, to monitor the incidental take of sea turtles in the federal American lobster fishery. Along with the NER STDN Disentanglement Guidelines, NMFS must also distribute the sea turtle entanglement reporting requirements to permit holders that use trap/pot gear. Entangled sea turtles are required to be reported to NMFS within 24 hours by calling the STDN hotline (1-866-755-NOAA (6622)) or by email (incidental.take@noaa.gov).
3. To also comply with RPM #2 above, NMFS must require that disentanglement responders collect detailed information on the gear involved in entanglements, and submit all information on the gear to NMFS. NMFS must evaluate the gear information regarding entanglements, and summarize the information on entanglements that were reported in the previous year.
4. To also comply with RPM #2 above, NMFS must continue to implement sea turtle serious injury criteria for fisheries in the NE Region in order to better assess and evaluate injuries sustained by sea turtles observed in fishing gear, and their potential impact on sea turtle populations.
5. Bycatch data must be combined with quantitative stock assessments to provide improved understanding of how listed species are adversely affected by estimated bycatch levels. Thus, to also comply with RPM #2 above, NMFS must improve its quantitative stock assessment of incidentally caught species. A sufficient quantitative stock assessment includes, but is not limited to, an integrative modeling framework for quantitative stock

assessment and the necessary fishery independent data needed to support such assessments. Progress towards this goal must be reported annually.

6. To comply with RPM #3 above, NMFS must continue to investigate modifications of trap/pot gear and its effects on sea turtles through research and development, as resources allow. Within a reasonable amount of time following completion of an experimental gear trial from or by any source, NMFS must review all data collected from the experimental gear trials, determine the next appropriate course of action (*e.g.*, expanded gear testing, further gear modification, rulemaking to require the gear modification), and initiate action based on the determination.
7. To comply with RPM #4 above, NMFS must continue to review all data available on the observed/documented take of sea turtles in trap/pot fisheries and other suitable information (*i.e.*, data on observed sea turtle interactions for other fisheries, vertical line density information, sea turtle distribution information, or fishery surveys in the area where the lobster fishery operates) to assess whether there is sufficient information to undertake any additional analysis to attempt to identify correlations with environmental conditions or other drivers of incidental take within some or all of the action area. If such additional analysis is deemed appropriate, within a reasonable amount of time after completing the review, NMFS will take appropriate action to reduce sea turtle interactions and/or their impacts.

Monitoring

NMFS must continue to monitor levels of sea turtle bycatch in the American lobster fishery. Entanglement reports have been used as the principal means to estimate sea turtle bycatch in the American lobster fishery and to monitor incidental take levels. NMFS will continue to use entanglement reports to monitor sea turtle bycatch in commercial trap/pot gear that catches American lobster as a target species. NMFS should also continue to support NEFOP's development of a video monitoring pilot project to evaluate its utility for various fishing gear types including trap/pot. If video monitoring proves to be a feasible supplement to observer coverage, the utility of video in identifying sea turtle bycatch events should be investigated. In the future, video could potentially be used to evaluate compliance with VTR requirements for incidentally taken sea turtles.

For the purposes of monitoring this ITS, NMFS will continue to use STDN data as the primary means of collecting incidental take information. NMFS will evaluate takes annually in the American lobster fishery using all available and current STDN entanglement data. Using these data, NMFS will determine if the annual incidental take level in this Opinion has been met or exceeded.

Large Whale Monitoring

NMFS will continue to monitor levels of large whale entanglement in the American lobster fishery. Serious injury determinations and stock assessment reports have been used as the

principal means to estimate the large whale entanglement rate in the American lobster fishery and to monitor SI/M levels. NMFS has recently developed a monitoring strategy for the ALWTRP and will produce an annual report stating the most up-to-date SI/M five year rolling average. To provide the most up-to-date rolling average possible, the five year average will consist of the most recently available year's data from the annual SI/M report averaged with the previous 4 years of data obtained from the U.S. Atlantic and Gulf of Mexico Marine Mammal SAR. Analyzing the data in this way will reduce the two year lag associated with using SAR estimates alone by one year.

For the purposes of monitoring large whale SI/M, NMFS will use the serious injury determination reports, SARs, and the ALWTRP monitoring reports to collect entanglement information. NMFS will re-examine SI/M annually in the American lobster fishery. Using these data, NMFS will determine if the annual SI/M is significantly different than what was evaluated in this Opinion.

11.0 CONSERVATION RECOMMENDATIONS

In addition to section 7(a)(2), which requires agencies to ensure that proposed actions are not likely jeopardize the continued existence of listed species, section 7(a)(1) of the ESA places a responsibility on all federal agencies to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Conservation Recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following additional measures are recommended regarding incidental take and sea turtle and marine mammal conservation:

1. NMFS should continue to collect and analyze biological samples from sea turtles incidentally taken in fishing gear targeting lobster to determine the nesting origin of sea turtles taken in the lobster fishery in order to better assess the effects of the fishery on nesting groups and recovery units and address those effects accordingly. NMFS should review its policies/protocols for the processing of genetics samples to determine what can be done to improve the efficiency and speed for obtaining results of genetic samples taken from all incidentally taken sea turtles.
2. NMFS should establish a protocol for bringing to shore any sea turtle incidentally taken in American lobster fishing gear that is fresh dead, that dies on the vessel shortly after the gear is retrieved, or dies following attempts at resuscitation in accordance with the regulations. Such protocol should include the steps to be taken to ensure that the carcass can be safely and properly stored on the vessel and properly transferred to appropriate personnel for examination. The protocol should also identify the purpose for examining the carcass and the samples to be collected. Port samplers and observers should also be trained in the protocols for notification of the appropriate personnel in the event that a vessel comes into port with a sea turtle carcass.

3. NMFS should work with states to promote the permitting of activities (*e.g.*, state permitted fisheries, state agency in-water surveys) that are known to incidentally take ESA-listed species.
4. NMFS should support studies on seasonal ESA-listed species distribution and abundance in the action area, behavioral studies to improve our understanding of ESA-listed species interactions with fishing gear, and foraging studies including prey abundance/distribution studies (which may influence distribution), as well as studies and analysis necessary to develop population estimates for sea turtles and marine mammals.
5. NMFS should continue to monitor and evaluate the effectiveness of the ALWTRP, particularly the impacts of the broad based gear requirements implemented in 2008 and 2009, as well as the implementation of the vertical line strategy. As part of the monitoring plan for the ALWTRP, NMFS' goal should be to detect a change in the frequency of entanglements and/or serious injuries and mortalities associated with entanglements. Metrics to consider in detecting this change could include: observed time lapses between detected large whale entanglements, known large whale serious injuries and mortalities due to entanglement, and analysis of whale scarring data.
6. NMFS should continue to undertake and support aerial surveys, passive acoustic monitoring, and the Sighting Advisory System.
7. NMFS should continue to develop and implement measures to reduce the risk of ship strikes of large whales.
8. NMFS should continue to undertake and support disentanglement activities, in coordination with the states, other members of the disentanglement and stranding network, and with Canada.
9. NMFS should continue to cooperate with the Canadian government to compare research findings and facilitate implementation in both countries of the most promising risk-reduction practices for large whales and sea turtles.

12.0 REINITIATING CONSULTATION

This concludes formal consultation on the continued operation of the American lobster fishery as it operates under the American Lobster FMP. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In the event that the amount or extent of take is exceeded, NMFS, GARFO must immediately request reinitiation of formal consultation.

In addition to the reinitaiton criteria provided above, numerical reinitiation triggers have been developed for each ESA-listed whale species. The triggers are based on the average SI/M data for the past five years (2007-2011) and will be used as a trigger for reinitiation should this average be exceeded as described below. Each species' trigger is as follows:

Right whale: 3.25

Humpback whale: 9.05

Fin whale: 1.7

Sei whale: 0.2

Utilizing these numbers as triggers for reinitiation, entanglement data for each species during the next five-year period (2012-2016) will be averaged cumulatively and compared to each species' trigger. If each species has an average number of SI/M < their trigger at the end of the five-year period, a new five-year period (2017-2021) will begin with the same triggers in place. The years noted above are in reference to the years associated with the final peer reviewed data years contained in the respective SARs.

Reinitiation will be required if NMFS determines that (1) the annual average SI/M is \geq the species' trigger at the conclusion of the five-year period; or (2) at any time during the five-year period the number of SI/M make it statistically impossible for the average to be < the species' trigger at the end of the five-year period.

In summary, reinitiation of formal consultation is required if:

- The average SI/M data for either of the large whale species identified above is greater than or equal to the reinitiation triggers identified above at the conclusion of the five-year period (2012 through 2016);
- At any time during the five-year period (2012 through 2016) the five-year average of the SI/M data for the species identified above is statistically greater than or equal to its respective reinitiation trigger so as not to meet the trigger at the conclusion of the five-year period;
- Any of the standard four re-initiation triggers identified above are met; or
- The conclusion of the ten-year time frame for this biological opinion is reached (data year 2021 which will be completed in calender year 2024).

Reinitiation of the consultation is not triggered if:

- The five-year average of the SI/M data for the species identified above is less than its respective reinitiation trigger at the conclusion of the five-year period (2012 through 2016), and the new five-year period would begin (2017 through 2021) with the orginal reinitiation triggers remaining in place.

Literature Cited

- Ackerman, R.A. 1997. The nest environment and embryonic development of sea turtles. Pages 83-106 in P.L. Lutz and J.A. Musick, eds. *The Biology of Sea Turtles*. New York: CRC Press.
- Agler, B.A., R.L., Schooley, S.E. Frohock, S.K. Katona, and I.E. Seipt. 1993. Reproduction of photographically identified fin whales, *Balaenoptera physalus*, from the Gulf of Maine. *J. Mamm.* 74:577-587.
- Aguilar, A. and C. Lockyer. 1987. Growth, physical maturity and mortality of fin whales (*Balaenoptera physalus*) inhabiting the temperate waters of the Northeast Atlantic. *Can. J. Zool.* 65:253-264.
- Aguilar, A. 2002. Fin whale, *Balaenoptera physalus*. Pages 435-438 in W.F. Perrin, B. Würsig, and J.G.M. Thewissen (eds.). *Encyclopedia of Marine Mammals*. San Diego: Academic Press.
- Allen, B.M., and R. P. Angliss. 2010. Alaska Marine Mammal Stock Assessments, 2009. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-206, 276 p.
- Allen, B. M., and R. P. Angliss. 2011. Alaska marine mammal stock assessments, 2010. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-223, 292 p.
- Andersen, M. S., K. A. Forney, T. V. N. Cole, T. Eagle, R. Angliss, K. Long, L. Barre, L. Van Atta, D. Borggaard, T. Rowles, B. Norberg, J. Whaley, and L. Engleby. Differentiating Serious and Non-Serious Injury of Marine Mammals: Report of the Serious Injury Technical Workshop, 10-13 September 2007, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-39, 94 p.
- Angliss, R.P. and D.P. DeMaster. 1998. Differentiating serious and non-serious injury of marine mammals taken incidental to commercial fishing operations: Report of the serious injury workshop 1-2 April 1997, Silver Spring, Maryland. NOAA Technical Memorandum NMFS-OPR-13. January, 1998.
- Angliss, R.P., D.P. DeMaster, and A.L. Lopez. 2001. Alaska marine mammal stock assessments, 2001. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-124, 203 p.
- Angliss, R.P. and R.B. Outlaw. 2007. Alaska Marine Mammal Stock Assessments, 2006. NOAA Technical Memorandum NOAA-TM-AFSC-168. 244p.
- Andrews, H.V., and K. Shanker. 2002. A significant population of leatherback turtles in the Indian Ocean. *Kachhapa*. 6:19.

- Andrews, H.V., S. Krishnan, and P. Biswas. 2002. Leatherback nesting in the Andaman and Nicobar Islands. *Kachhapa*. 6:15-18.
- Antonelis, G.A., J.D. Baker, T.C. Johanos, R.C. Braun and A.L. Harting. 2006. Hawaiian monk seal (*Monachus schauinslandi*): status and conservation issues. *Atoll Research Bulletin* 543: 75-101.
- Atlantic States Marine Fisheries Commission (ASMFC). 1999. Amendment 3 to the Interstate Fishery Management Plan for American Lobster. Atlantic States Marine Fisheries Commission. December 1997.
- Atlantic States Marine Fisheries Commission (ASMFC). 2002. Amendment 4 to the Interstate Fishery Management Plan for weakfish. Fishery Management Report No. 39. Washington, D.C.: Atlantic States Marine Fisheries Commission.
- Atlantic States Marine Fisheries Commission (ASMFC). 2004. Horseshoe crab 2004 stock assessment. Washington, D.C.: Atlantic States Marine Fisheries Commission.
- Atlantic States Marine Fisheries Commission (ASMFC). 2007. Estimation of Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic. Washington, D.C.: Atlantic States Marine Fisheries Commission. 95pp.
- Atlantic States Marine Fisheries Commission (ASMFC). 2009. American Lobster Stock Assessment Report No. 09-01. Washington, D.C.: Atlantic States Marine Fisheries Commission.
- Atlantic Sturgeon Status Review Team. 2007. Status Review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.
- Attrill, M. J., J. Wright, and M. Edwards. 2007. Climate-related increases in jellyfish frequency suggest a more gelatinous future for the North Sea. *Limnology and Oceanography*, Vol. 52, No. 1 (Jan., 2007), pp. 480-485.
- Avens, L., J.C. Taylor, L.R. Goshe, T.T. Jones, and M. Hastings. 2009. Use of skeletochronological analysis to estimate the age of leatherback sea turtles *Dermochelys coriacea* in the western North Atlantic. *Endangered Species Research* 8:165-177.
- Baker J.D., C.L. Littnan, D.W. Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. *Endang Species Res* 2:21-30.
- Balazs, G.H. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-54:387-429.

- Barco, S., W.A. McLellan, J. Allen, R. Asmutis, R. Mallon-Day, E. Meagher, D.A. Pabst, J. Robbins, R. Seton, R.M. Swingle, M.T. Weinrich, and P. Clapham. 2002. Population identity of humpback whales in the waters of the U.S. Mid-Atlantic states. *Journal of Cetacean Research and Management* 4:135-141.
- Barlow, J., and P. J. Clapham. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. *Ecology*, 78: 535-546.
- Barlow, J. and K.A. Forney. 2007. Abundance and population density of cetaceans in the California Current ecosystem. *Fishery Bulletin* 105:509-526.
- Bass, A.L., S.P. Epperly, and J. Braun-McNeill. 2004. Multiyear analysis of stock composition of a loggerhead turtle (*Caretta caretta*) foraging habitat using maximum likelihood and Bayesian methods. *Conservation Genetics* 5:783-796.
- Baumgartner, M.F., T.V.N. Cole, R.G. Campbell, G.J. Teegarden, 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.
- Baumgartner, M.F. and B.R. Mate. 2005. Summer and fall habitat of North Atlantic right whales (*Eubalaena glacialis*) inferred from satellite telemetry. *Canadian Journal of Fisheries and Aquatic Sciences* 62: 527-543.
- Baumgartner, M.F., N.S.J. Lysiak, C. Schuman, J. Urban-Rich, and F.W. Wenzel. 2011. Diel vertical migration behavior of *Calanus finmarchicus* and its influence on right and sei whale occurrence. *Marine Ecology Progress Series* 423:167-184.
- Best, P.B., J. L. Bannister, R.L. Brownell, Jr., and G.P. Donovan (eds.). 2001. Right whales: worldwide status. *J. Cetacean Res. Manage.* (Special Issue). 2. 309pp.
- Bjork, M., F. Short, E. McLeod, and S. Beers. 2008. Managing seagrasses for resilience to climate change. IUCN, Gland.
- Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. Pages 199-233 in: Lutz, P.L. and J.A. Musick, eds., *The Biology of Sea Turtles*. CRC Press, New York. 432 pp.
- Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, and B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. *Endangered Species Research* 2:51-61.
- Bolten, A.B., K.A. Bjorndal, H.R. Martins, T. Dellinger, M.J. Biscoito, S.E. Encalada, and B.W. Bowen. 1998. Transatlantic developmental migrations of loggerhead sea turtles demonstrated by mtDNA sequence analysis. *Ecological Applications* 8:1-7.

- Bolten, A.B. 2003. Variation in sea turtle life history patterns: neritic vs. oceanic developmental stages. Pages 243-257 in P.L. Lutz, J. Musick and J. Wyneken (editors), *The Biology of Sea Turtles*, Volume II. CRC Press, Boca Raton, FL.
- Bowen, B.W. 2003. What is a loggerhead turtle? The genetic perspective. Pages 7-27 in A.B. Bolten and B.E. Witherington, eds. *Loggerhead Sea Turtles*. Washington, D.C.: Smithsonian Press.
- Bowen, B.W., A.L. Bass, S.-M. Chow, M. Bostrom, K.A. Bjorndal, A.B. Bolten, T. Okuyama, B.M. Bolker., S. Epperly, E. Lacasella, D. Shaver, M. Dodd, S.R. Hopkins-Murphy, J.A. Musick, M. Swingle, K. Rankin-Baransky, W. Teas, W.N. Witzell, and P.H. Dutton. 2004. Natal homing in juvenile loggerhead turtles (*Caretta caretta*). *Molecular Ecology* 13:3797-3808.
- Bowen, B.W., A.L. Bass, L. Soares, and R.J. Toonen. 2005. Conservation implications of complex population structure: lessons from the loggerhead turtle (*Caretta caretta*). *Molecular Ecology* 14:2389-2402.
- Bowen, B.W., and S.A. Karl. 2007. Population genetics and phylogeography of sea turtles. *Molecular Ecology* 16:4886-4907.
- Bowman, R., E. Lyman, D. Mattila, C. Mayo, M. Brown. Habitat Management Lessons From a Satellite-Tracked Right Whale. 2003. Presentation to the ARGOS Animal Tracking Symposium. March 24-26, 2003. Annapolis, Maryland.
- Braun, J., and S.P. Epperly. 1996. Aerial surveys for sea turtles in southern Georgia waters, June 1991. *Gulf of Mexico Science* 1996(1):39-44.
- Braun-McNeill, J., and S.P. Epperly. 2004. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). *Marine Fisheries Review* 64(4):50-56.
- Braun-McNeill J., Epperly, S.P., Avens, L., Snover, M.L. and Taylor, J.C. 2008. Life stage duration and variation in growth rates of loggerhead (*Caretta caretta*) sea turtles from the western north Atlantic. *Herpetological Conservation and Biology* 3(2): 273-281.
- Brodeur, R.D., C.E. Mill, J.E. Overland, G.E. Walters, and J.D. Schumacher. 1999. Evidence for substantial decrease in gelatinous zooplankton in the Bering Sea, with possible links to climate change. *Fish Oceanogr.* 8:296-306.
- Brown, S.G. 1986. Twentieth-century records of right whales (*Eubalaena glacialis*) in the Northeast Atlantic Ocean. In: R.L. Brownell Jr., P.B. Best, and J.H. Prescott (eds.) *Right whales: Past and Present Status*. IWC Special Issue No. 10. p. 121-128.

- Brown, M. W., and M.K. Marx. 2000. Surveillance, Monitoring and Management of North Atlantic Right Whales, *Eubalaena glacialis*, in Cape Cod Bay, Massachusetts: January to Mid-May, 2000. Final report.
- Brown, M.B., O.C. Nichols, M.K. Marx, and J.N. Ciano. 2002. Surveillance of North Atlantic right whales in Cape Cod Bay and adjacent waters. 2002. Final report to the Division of Marine Fisheries, Commonwealth of Massachusetts. 29 pp., September 2002.
- Burke, V.J., E.A. Standora, and S.J. Morreale. 1993. Diet of juvenile Kemp's ridley and loggerhead sea turtles from Long Island, New York. *Copeia*. 4:1176-1180
- Burke, V.J., S.J. Morreale, and E.A. Standora. 1994. Diet of the Kemp's ridley sea turtle, *Lepidochelys kempii*, in New York waters. *Fishery Bulletin*. 92:26-32
- Calambokidis, J., E. A. Falcone, T.J. Quinn., A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D. Matilla, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urban, D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific. Final Report for Contract AB133F-03-RP-00078; 57pp.
- Caldwell, D.K. 1962. Comments on the nesting behavior of Atlantic loggerhead sea turtles, based primarily on tagging returns. *Q.J. Florida Acad. Sci.* 25:287-302.
- Carreras, C., S. Pont, F. Maffucci, M. Pascual, A. Barceló, F. Bentivegna, L. Cardona, F. Alegre, M. SanFélix, G. Fernández, and A. Aguilar. 2006. Genetic structuring of immature loggerhead sea turtles (*Caretta caretta*) in the Mediterranean Sea reflects water circulation patterns. *Mar Biol* 149:1269–1279.
- Carretta, J.V., K.A. Forney, E. Oleson, K. Martien, M.M. Muto, M.S. Lowry, J. Barlow, J. Baker, B. Hanson, D. Lynch, L. Carswell, R.L. Brownell Jr., J. Robbins, D.K. Mattila, K. Ralls, and Marie C. Hill. 2011. U.S. Pacific Marine Mammal Stock Assessments: 2010. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-SWFSC-476, 352 p.
- Casale, P., P. Nicolosi, D. Freggi, M. Turchetto, and R. Argano. 2003. Leatherback turtles (*Dermochelys coriacea*) in Italy and in the Mediterranean basin. *Herpetological Journal* 13:135-139.
- Castroviejo, J., J.B. Juste, J.P. Del Val, R. Castelo, and R. Gil. 1994. Diversity and status of sea turtle species in the Gulf of Guinea islands. *Biodiversity and Conservation* 3:828-836.
- Caswell, H., M. Fujiwara, and S. Brault. 1999. Declining survival probability threatens the North Atlantic right whale. *Proc. Nat. Acad. Sci.* 96: 3308-3313.

- Caulfield, R.A. 1993. Aboriginal subsistence whaling in Greenland: the case of Qeqertarsuaq municipality in West Greenland. *Arctic* 46:144-155.
- Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report or the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.
- Chaloupka, M., and C. Limpus. 2001. Trends in the abundance of sea turtles resident in southern Great Barrier Reef waters. *Biological Conservation* 102:235-249.
- Chevalier, J., X. Desbois, and M. Girondot. 1999. The reason for the decline of leatherback turtles (*Dermochelys coriacea*) in French Guiana: a hypothesis p.79-88. In Miaud, C. and R. Guyétant (eds.), *Current Studies in Herpetology, Proceedings of the ninth ordinary general meeting of the Societas Europea Herpetologica, 25-29 August 1998 Le Bourget du Lac, France.*
- Church, J., J.M. Gregory, P. Huybrechts, M. Kuhn, K. Lambeck, M.T. Nhuan, D. Qin, P.L. Woodworth. 2001. Changes in sea level. In: Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. Vander Linden, X. Dai, K. Maskell, C.A. Johnson CA (eds.) *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, p 639-694
- Clapham, P.J. and C.A. Mayo. 1990. Reproduction of humpback whales (*Megaptera novaengliae*) observed in the Gulf of Maine. *Rep. Int. Whal. Commn. Special Issue 12:* 171-175.
- Clapham, P.J. 1992. Age at attainment of sexual maturity in humpback whales, *Megaptera novaengliae*. *Can. J. Zool.* 70:1470-1472.
- Clapham, P. 2002. Humpback whale, *Megaptera novaengliae*. pp. 589-592, *In:* W.F. Perrin, B. Wiirsig, and J.G.M. Thewissen (eds.) *Encyclopedia of Marine Mammals.* Academic Press, San Diego, CA
- Clapham, P.J., S.B. Young, R.L. Brownell, Jr. 1999. Baleen whales: conservation issues and the status of the most endangered populations. *Mammal Review* 29(1): 35-60.
- Clapham, P., S. Brault, H. Caswell, M. Fujiwara, S. Kraus, R. Pace and P. Wade. 2002. Report of the Working Group on Survival Estimation for North Atlantic Right Whales.
- Clapham, P., Barlow, J., Bessinger, M., Cole, T., Mattila, D., Pace, R., Palka, D., Robbins, J. and Seton, R. 2003. Abundance and demographic parameters of humpback whales from the Gulf of Maine, and stock definition relative to the Scotian Shelf. *Journal of Cetacean Research and Management*, Vol. 5:13-22.

- Clark, C.W. 1995. Application of U.S. Navy underwater hydrophone arrays for scientific research on whales. Reports of the International Whaling Commission 45: 210-212.
- Cole, T.V.N., D.L. Hartly, and R.L. Merrick. 2005. Mortality and serious injury determinations for large whale stocks along the eastern seaboard of the United States, 1999-2003. U. S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 05-08. 20 pp.
- Cole TVN, Henry AG. 2013. Serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2007-2011. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-24; 14 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://nefsc.noaa.gov/publications/>
- Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.
- Daniels, R. C., T. W. White, and K. K. Chapman. 1993. Sea-level rise: destruction of threatened and endangered species habitat in South Carolina. Environmental Management 17(3):373-385.
- Davenport, J., and G.H. Balazs. 1991. 'Fiery bodies' – Are pyrosomas an important component of the diet of leatherback turtles? British Herpetological Society Bulletin 37:33-38.
- Dodd, C.K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report 88(14):1-110.
- Dodd, M.G. and A.H. Mackinnon. 1999. Loggerhead turtle (*Caretta caretta*) nesting in Georgia, 1999: implications for management. Georgia Department of Natural Resources unpublished report. 41 pages.
- Dodd, M.G. and A.H. Mackinnon. 2000. Loggerhead turtle (*Caretta caretta*) nesting in Georgia, 2000: implications for management. Georgia Department of Natural Resources unpublished report. 47 pages.
- Dodd, M.G. and A.H. Mackinnon. 2001. Loggerhead turtle (*Caretta caretta*) nesting in Georgia, 2001. Georgia Department of Natural Resources unpublished report submitted to the U.S. Fish and Wildlife Service for grant E-5-1 "Coastal Endangered Species Management." 46 pages.
- Dodd, M.G. and A.H. Mackinnon. 2002. Loggerhead turtle (*Caretta caretta*) nesting in Georgia, 2002. Georgia Department of Natural Resources unpublished report submitted to the U.S.

- Fish and Wildlife Service for grant E-5-2 "Coastal Endangered Species Management." 46 pages.
- Dodd, M.G. and A.H. Mackinnon. 2003. Loggerhead turtle (*Caretta caretta*) nesting in Georgia, 2003. Georgia Department of Natural Resources unpublished report submitted to the U.S. Fish and Wildlife Service for grant E-5-3 "Coastal Endangered Species Management." 46 pages.
- Dodd, M.G. and A.H. Mackinnon. 2004. Loggerhead turtle (*Caretta caretta*) nesting in Georgia, 2004. Georgia Department of Natural Resources unpublished report submitted to the U.S. Fish and Wildlife Service for grant E-5-4 "Coastal Endangered Species Management." 44 pages.
- Donovan, G.P. 1991. A review of IWC stock boundaries. Rep. Int. Whal. Comm., Spec. Iss. 13:39-63.
- Durbin, E, G. Teegarden, R. Campbell, A. Cembella, M.F. Baumgartner, B.R. Mate. 2002. North Atlantic right whales, *Eubalaena glacialis*, exposed to Paralytic Shellfish Poisoning (PSP) toxins via a zooplankton vector, *Calanus finmarchicus*. *Harmful Algae*. 1: 243-251.
- Dutton, P.H., C. Hitipeuw, M. Zein, S.R. Benson, G. Petro, J. Pita, V. Rei, L. Ambio, and J. Bakarbesy. 2007. Status and genetic structure of nesting populations of leatherback turtles (*Dermochelys coriacea*) in the Western Pacific. *Chelonian Conservation and Biology* 6(1):47-53.
- Dwyer, K.L., C.E. Ryder, and R. Prescott. 2002. Anthropogenic mortality of leatherback sea turtles in Massachusetts waters. Poster presentation for the 2002 Northeast Stranding Network Symposium.
- Dwyer, K.L., C.E. Ryder, and R. Prescott. 2003. Anthropogenic mortality of leatherback sea turtles in Massachusetts waters. Page 260 in J.A. Seminoff, compiler. Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503.
- Eckert, S.A. 1999. Global distribution of juvenile leatherback turtles. Hubbs Sea World Research Institute Technical Report 99-294.
- Eckert, S.A. and J. Lien. 1999. Recommendations for eliminating incidental capture and mortality of leatherback sea turtles, *Dermochelys coriacea*, by commercial fisheries in Trinidad and Tobago. A report to the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). Hubbs-Sea World Research Institute Technical Report No. 2000-310, 7 pp.
- Eckert, S.A., D. Bagley, S. Kubis, L. Ehrhart, C. Johnson, K. Stewart, and D. DeFreese. 2006. Internesting and postnesting movements of foraging habitats of leatherback sea turtles (*Dermochelys coriacea*) nesting in Florida. *Chel. Cons. Biol.* 5(2): 239-248.

- Ehrhart, L.M., D.A. Bagley, and W.E. Redfoot. 2003. Loggerhead turtles in the Atlantic Ocean: geographic distribution, abundance, and population status. Pages 157-174 in A.B. Bolten and B.E. Witherington, eds. *Loggerhead Sea Turtles*. Washington, D.C.: Smithsonian Institution Press.
- Ehrhart, L.M., W.E. Redfoot, and D.A. Bagley. 2007. Marine turtles of the central region of the Indian River Lagoon System, Florida. *Florida Scientist* 70(4):415-434.
- Encyclopedia Britannica. 2011. Neritic Zone Defined. Retrieved January 29, 2010, from Encyclopedia Britannica Online:
<http://www.britannica.com/EBchecked/topic/409490/neritic-zone>
- Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. *Fishery Bulletin* 93:254-261.
- Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995b. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. *Bulletin of Marine Science* 56(2):547-568.
- Epperly, S.P., J. Braun, and A. Veishlow. 1995c. Sea turtles in North Carolina waters. *Conservation Biology* 9(2):384-394.
- Epperly, S.P., and W.G. Teas. 2002. Turtle Excluder Devices - Are the escape openings large enough? *Fishery Bulletin* 100:466-474.
- Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of Southeast U.S. waters and the Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFSC-490:1-88.
- Epperly, S., L. Stokes, and S. Dick. 2004. Careful release protocols for sea turtle release with minimal injury. NOAA Technical Memorandum NMFS-SEFSC-524,42 pp.
- Epperly, S.P., J. Braun-McNeill, and P.M. Richards. 2007. Trends in catch rates of sea turtles in North Carolina, USA. *Endangered Species Research* 3:283-293.
- Ernst, C.H. and R.W. Barbour. 1972. *Turtles of the United States*. Univ. Press of Kentucky, Lexington. 347 pp.
- Eyler, S., T. Meyer, S. Michaels, and B. Spear. 2007. Review of the fishery management plan in 2006 for horseshoe crab (*Limulus polyphemus*). Prepared by the ASMFC Horseshoe Crab Plan Review Team. 15pp.

- Feely, R.A., C.L. Sabine, J.M. Hernandez-Ayon, D. Ianson, and B. Hales. 2008. Evidence for upwelling of corrosive "acidified" water onto the continental shelf. *Science* 320:1490-1492.
- Finkbeiner, E.M., B.P. Wallace, J.E. Moore, R.L. Lewison, L.B. Crowder. 2011. Cumulative estimates of sea turtle bycatch and mortality in U.S.A. fisheries between 1990-2007. *Biological Conservation* 144:2719-2727.
- Fish, M.R., I.M. Cote, J.A. Gill, A.P. Jones, S. Renshoff, A.R. Watkinson. 2005. Predicting the impact of sea-level rise on Caribbean sea turtle nesting habitat. *Conserv Biol* 19: 482–491.
- Flinn, R. D., A. W. Trites and E. J. Gregr. 2002. Diets of fin, sei, and sperm whales in British Columbia: An analysis of commercial whaling records, 1963-1967. *Mar. Mamm. Sci.* 18(3): 663-679.
- Florida Power and Light Company (FPL) and Quantum Resources, Inc. 2005. Florida Power and Light Company, St. Lucie Plant Annual Environmental Operating Report, 2002. 57 pages.
- Forney, K.A. 2007. Preliminary estimates of cetacean abundance along the U.S. west coast and within four National Marine Sanctuaries during 2005. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-406. 27p.
- Franklin IR. 1980. Evolutionary change in small populations. In: Soule ME, Wilcox BA, editors. *Conservation Biology: An Evolutionary-Ecological perspective*. Sunderland (MA): Sinauer; p.135-150.
- Frasier, T.R., B.A. McLeod, R.M. Gillett, M.W. Brown and B.N. White. 2007. Right Whales Past and Present as Revealed by Their Genes. Pp 200-231. In: S.D. Kraus and R.M. Rolland (eds) *The Urban Whale*. Harvard University Press, Cambridge, Massachusetts, London, England. vii-xv + 543pp.
- Frazer, N.B. and J.I. Richardson. 1985. Annual variation in clutch size and frequency for loggerhead turtles, *Caretta caretta*, nesting at Little Cumberland Island, Georgia, USA. *Herpetologica* 41(3):246-251.
- Fritts, T.H. 1982. Plastic bags in the intestinal tracts of leatherback marine turtles. *Herpetological Review* 13(3):72-73.
- Fujiwara, M., and H. Caswell. 2001. Demography of the endangered North Atlantic right whale. *Nature* 414: 537-541
- Gagosian, R.B. 2003. Abrupt climate change: should we be worried? Prepared for a panel on abrupt climate change at the World Economic Forum, Davos, Switzerland, January 27, 2003. 9pp.

- Gambell, R. 1993. International management of whales and whaling: an historical review of the regulation of commercial and aboriginal subsistence whaling. *Arctic* 46:97-107.
- Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. NOAA Technical Memorandum NMFS-SEFSC-591:1-58.
- Garrison, L.P. and L. Stokes. 2010. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fishing fleet during 2009. NOAA Technical Memorandum NOAA NMFS-SEFSC-607, 63pp.
- Garrison, L.P. and Stokes, L. 2011a. Preliminary estimates of protected species bycatch rates in the U.S. Atlantic pelagic longline fishery from 1 January to 30 June, 2010. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL, SEFSC Contribution #PRD-2010-10, Revised April 2011, 20 pp.
- Garrison, L.P. and Stokes, L. 2011b. Preliminary estimates of protected species bycatch rates in the U.S. Atlantic pelagic longline fishery from 1 July to 31 December, 2010. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL, SEFSC Contribution # PRD-2011-03, May 2011, 22 pp.
- Garrison, L.P., and L. Stokes. 2012. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2010. NOAA Technical Memorandum NMFS-SEFSC-624:1-53.
- Geraci, Joseph R., Daniel M. Anderson, R.J. Timperi, David J. St. Aubin, Gregory A. Early, John H. Prescott, and Charles A. Mayo. 1989. Humpback Whales (*Megaptera novaeangliae*) Fatally Poisoned by Dinoflagellate Toxin. *Can. J. Fish. and Aquat. Sci.* 46(11): 1895-1898
- Girondot, M. and J. Fretey. 1996. Leatherback turtles, *Dermochelys coriacea*, nesting in French Guiana 1978-1995. *Chelonian Conserv Biol* 2: 204–208.
- Girondot, M., M.H. Godfrey, L. Ponge, and P. Rivalan. 2007. Modeling approaches to quantify leatherback nesting trends in French Guiana and Suriname. *Chelonian Conservation and Biology* 6(1):37-46.
- Glass, A. H., T. V. N. Cole, M. Garron, R. L. Merrick, and R. M. Pace III. 2008. Mortality and Serious Injury Determinations for Baleen Whale Stocks Along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2002-2006. Northeast Fisheries Science Center Document 08-04; 18 pp.
- Glass A.H., T. V. N. Cole, and M. Garron. 2009. Mortality and serious injury determinations for baleen whale stocks along the United States eastern seaboard and adjacent Canadian Maritimes, 2003-2007 (2nd Edition). US Dep Commer, Northeast Fish Sci Cent Ref Doc. 09-04; 19 p.

- Glass A., T. V. N. Cole, and M. Garron. 2010. Mortality and Serious Injury Determinations for Baleen Whale Stocks along the United States and Canadian Eastern Seaboards, 2004–2008. NOAA Technical Memorandum NMFS-NE-214 19 pp.
- Glen, F., A.C. Broderick, B.J. Godley, and G.C. Hays. 2003. Incubation environment affects phenotype of naturally incubated green turtle hatchlings. *Journal of the Marine Biological Association of the United Kingdom* 83(5):1183-1186.
- Glen, F. and N. Mrosovsky. 2004. Antigua revisited: the impact of climate change on sand and nest temperatures at a hawksbill turtle (*Eretmochelys imbricata*) nesting beach. *Global Change Biology* 10:2036–2045.
- Goff, G.P. and J.Lien. 1988. Atlantic leatherback turtle, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. *Can. Field Nat.*102(1):1-5.
- Goldenberg, S.B., C.W. Landsea, A.M. Mestas-Nunez, W.M. Gray. 2001. The recent increase in Atlantic hurricane activity: causes and implications. *Science* 293:474–479
- Grabowski JH, Clesceri EJ, Baukus AJ, Gaudette J, Weber M, et al. (2010) Use of Herring Bait to Farm Lobsters in the Gulf of Maine. *PLoS ONE* 5(4): e10188. doi:10.1371/journal.pone.0010188
- Graff, D. 1995. Nesting and hunting survey of the turtles of the island of São Tomé e Príncipe. Report July 1995, ECOFAC Componente de São Tomé e Príncipe, 33 pp.
- Greene, C.H., A.J. Pershing, R.D. Kenney, and J.W. Jossi. 2003. Impact of climate variability on the recover of endangered North Atlantic right whales. *Oceanography*. 16: 96-101.
- Greene, C.H and A.J. Pershing. 2004. Climate and the conservation biology of North Atlantic right whales: the right whale at the wrong time? *Frontiers in Ecology and the Environment*. 2(1): 29-34.
- Greene, C.H., A.J. Pershing, T.M. Cronin, and N. Ceci. 2008. Arctic climate change and its impacts on the ecology of the North Atlantic. *Ecology* 89(11) Supplement 2008:S24-S38.
- GMFMC (Gulf of Mexico Fishery Management Council). 2007. Amendment 27 To The Reef Fish Fishery Management Plan and Amendment 14 To The Shrimp Fishery Management Plan with a Supplemental Environmental Impact Statement, Regulatory Impact Review, and Regulatory Flexibility Act Analysis. Gulf of Mexico Fishery Management Council. June 2007.
- Hain, J.H.W., M.A. Hyman, R.D. Kenney and H.E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. *Mar. Fish. Rev.* 47(1):13-17.

- Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf. Reports of the International Whaling Commission 42: 653-669.
- Hamann, M., C.J. Limpus, and M.A. Read. 2007. Chapter 15 Vulnerability of marine reptiles in the Great Barrier Reef to climate change. *In*: Johnson JE, Marshall PA (eds) Climate change and the Great Barrier Reef: a vulnerability assessment, Great Barrier Reef Marine Park Authority and Australia Greenhouse Office, Hobart, p 465-496.
- Hamilton, P.K., and C.A. Mayo. 1990. Population characteristics of right whales (*Eubalaena glacialis*) observed in Cape Cod and Massachusetts Bays, 1978-1986. Reports of the International Whaling Commission, Special Issue No. 12: 203-208.
- Hamilton, P.K., M.K. Marx, and S.D. Kraus. 1998. Scarification analysis of North Atlantic right whales (*Eubalaena glacialis*) as a method of assessing human impacts. Final report to the Northeast Fisheries Science Center, NMFS, Contract No. 4EANF-6-0004.
- Hammond, P.S., K.Macleod, L. Burt, A. Cañadas, S. Lens, B.Mikkelsen, E. Rogan, B. Santos, A. Uriarte, O.Van Canneyt, and J.A Vázquez. Abundance of baleen whales in the European Atlantic. Paper SC/63/RMP24 presented to the IWC. Scientific Committee, June 2011, Tromsø, Norway (unpublished). 22pp.
- Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2005. Status of nesting loggerhead turtles *Caretta caretta* at Bald head Island (North Carolina, USA) after 24 years of intensive monitoring and conservation. *Oryx* 39(1):65-72.
- Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2007. Investigating the potential impacts of climate change on a marine turtle population. *Global Change Biology* 13:1-10.
- Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2009. Climate change and marine turtles. *Endangered Species Research* 7: 137-159.
- Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. *Current Biology* 16: 990-995.
- Hays, G.C., A.C. Broderick, F. Glen, B.J. Godley, J.D.R. Houghton, and J.D. Metcalfe. 2002. Water temperature and internesting intervals for loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. *Journal of Thermal Biology* 27:429-432.
- Henry A.G., T.V.N. Cole, M. Garron, and L. Hall. 2011. Mortality and Serious Injury Determinations for Baleen Whale Stocks along the Gulf of Mexico, United States and Canadian Eastern Seaboards, 2005-2009. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-18; 24 pp.

- Hilterman, M.L. and E. Goverse. 2004. Annual report of the 2003 leatherback turtle research and monitoring project in Suriname. World Wildlife Fund - Guianas Forests and Environmental Conservation Project (WWF-GFECF) Technical Report of the Netherlands Committee for IUCN (NC-IUCN), Amsterdam, the Netherlands, 21p.
- Hirth, H.F. 1997. Synopsis of the biological data of the green turtle, *Chelonia mydas* (Linnaeus 1758). USFWS Biological Report 97(1):1-120.
- Horwood, J. 2002. Sei whale, *Balaenoptera borealis*. Pages 1069-1071 in W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds. Encyclopedia of Marine Mammals. San Diego: Academic Press.
- Innis, C., C. Merigo, K. Dodge, M. Tlusty, M. Dodge, B. Sharp, A. Myers, A. McIntosh, D. Wunn, C. Perkins, T.H. Herdt, T. Norton, and M. Lutcavage. 2010. Health evaluation of leatherback turtles (*Dermochelys coriacea*) in the Northwestern Atlantic during direct capture and fisheries gear disentanglement. *Chel. Conserv. Biol.* 9, 205–222.
- IPCC (Intergovernmental Panel on Climate Change). 2007. Summary for Policymakers. 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, New York, USA.
- International Council for the Exploration of the Sea (ICES). 2005. Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries (SGBYSAL). ICES CM 2005 (ACFM:13), 41 pp.
- International Union for Conservation of Nature (IUCN). 2008. IUCN Red List of threatened species: 2001 categories & criteria (version 3.1)
http://www.iucnredlist.org/info/categories_criteria2001
- International Whaling Commission (IWC). 1979. Report of the sub-committee on protected species. Annex G., Appendix I. Rep. Int. Whal. Comm. 29: 84-86.
- International Whaling Commission (IWC). 1986. Right whales: past and present status. Reports of the International Whaling Commission, Special Issue No. 10; Cambridge, England.
- International Whaling Commission (IWC). 1992. Report of the comprehensive assessment special meeting on North Atlantic fin whales. Reports of the International Whaling Commission 42:595-644.
- International Whaling Commission (IWC). 1995. Report of the Scientific Committee, Annex E. Rep. Int. Whal. Comm. 45:121-138.

- International Whaling Commission (IWC). 1997. Report of the IWC workshop on climate change and cetaceans. *Report of the International Whaling Commission* **47**, 293–313.
- International Whaling Commission (IWC). 2002. Report of the subcommittee on the Comprehensive Assessment of North Atlantic humpback whales. *Journal of Cetacean Research and Management*. 4: 230-260.
- International Whaling Commission (IWC). 2003. Report of the subcommittee on the Comprehensive Assessment of North Atlantic humpback whales. *Journal of Cetacean Research and Management*. 5: 293-323.
- James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005a. Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle. *Proc. R. Soc. B*, 272: 1547-1555.
- James, M.C., C.A. Ottensmeyer, and R.A. Myers. 2005b. Identification of high-use habitat and threats to leatherback sea turtles in northern waters: new directions for conservation. *Ecol. Lett.* 8:195-201.
- Jefferson, T.A., M.A. Webber, and R.L. Pitman. (2008). *Marine Mammals of the World, A Comprehensive Guide to their Identification*. Amsterdam, Elsevier. Pp. 47-50.
- Johnson, J.H. and A.A. Wolman. 1984. The humpback whale, *Megaptera novaengliae*. *Mar. Fish. Rev.* 46(4): 30-37.
- 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 A.R., W. Gladstone, N.J. Hacking. 2007. Australian sandy beach ecosystems and climate change: ecology and management. *Aust Zool* 34:190–202
- Kamel, S.J. and N. Mrosovsky. 2004. Nest site selection in leatherbacks (*Dermochelys coriacea*): individual patterns and their consequences. *Animal Behaviour* 68:357-366.
- Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginias sea turtles: 1979-1986. *Virginia J. Sci.* 38(4): 329-336.
- Kelle, L., N. Gratiot, I. Nolibos, J. Therese, R. Wongsopawiro, and B. DeThoisy. 2007. Monitoring of nesting leatherback turtles (*Dermochelys coriacea*): contribution of remote sensing for real time assessment of beach coverage in French Guiana. *Chelonian Conserv Biol* 6: 142–149.
- Kenney, R.D. 2001. Anomalous 1992 spring and summer right whale (*Eubalaena glacialis*) distribution in the Gulf of Maine. *Journal of Cetacean Research and Management (special Issue)* 2: 209-23.

- Kenney, R.D. 2002. North Atlantic, North Pacific and Southern Right Whales. pp. 806-813, *In*: W.F. Perrin, B. Würsig, and J.G.M. Thewissen (eds.). *Encyclopedia of Marine Mammals*. Academic Press, San Diego, CA.
- Kenney, R.D., H.E. Winn, and M.C. Macaulay. 1995. Cetaceans in the Great South Channel, 1979-1989: right whale (*Eubalaena glacialis*). *Cont. Shelf. Res.* 15: 385-414.
- Kenney, R.D., M.A.M. Hyman, R.E. Owen, G.P. Scott, and H.E. Winn. 1986. Estimation of prey densities required by Western North Atlantic right whales. *Mar. Mamm. Sci.* 2(1): 1-13.
- Khan, C., T.V.N. Cole, P. Duley, A. Glass, M. Niemeyer, and C. Christman. 2009. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2008 Results Summary. NEFSC Reference Document 09-05; 7 pp.
- Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2010. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2009 Results Summary. NEFSC Reference Document 10-07; 7 pp.
- Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2011. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2010 Results Summary. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-05. 6 pp.
- Knowlton, A. R., J. Sigurjonsson, J.N. Ciano, and S.D. Kraus. 1992. Long-distance movements of North Atlantic right whales (*Eubalaena glacialis*). *Mar. Mamm. Sci.* 8(4): 397-405.
- Knowlton, A.R., S.D. Kraus, and R.D. Denney. 1994. Reproduction in North Atlantic right whales, *Eubalaena glacialis*. *Canadian Journal of Zoology.* 72: 1297-1305
- Knowlton, A.R., L. A. Cooper, P. K. Hamilton, M. K. Marx, H. M. Pettis, and S. D. Kraus. 2008. Analysis of scarring on North Atlantic right whales (*Eubalaena glacialis*): Monitoring rate of entanglement interaction- 1980 – 2004. Final report to the Northeast Fisheries Science Center, NMFS, Contract No. EA133F-03-SE-0323. New England Aquarium: 25pp.
- Knowlton, A.R., P.K. Hamilton, M.K. Marx, H.M. Pettis, and S.D. Kraus 2012. Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: a 30 year retrospective. *Mar. Ecol. Prog. Ser.* 466:293-302.
- Kraus, S.D., J. H. Prescott, and A. R. Knowlton. 1986. Wintering right whales (*Eubalaena glacialis*) along the Southeastern coast of the United, 1984-1986. New England Aquarium: 15pp.
- Kraus, S.D., M.J. Crone, and A.R. Knowlton. 1988. The North Atlantic right whale. Pages 684-98 *in* W.J. Chandler, ed. *Audubon wildlife report 1988/1989*. Academic Press, San Diego, CA.

- Kraus, S.D., P.K. Hamilton, R.D. Kenney, A.R. Knowlton, and C.K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. *J. Cetacean Res. Manage.* 2: 231-236.
- Kraus, S.D., M.W. Brown, H. Caswell, C.W. Clark, M. Fujiwara, P.K. Hamilton, R.D. Kenney, A.R. Knowlton, S. Landry, C.A. Mayo, W.A. McLellan, M.J. Moore, D.P. Nowacek, D.A. Pabst, A.J. Read, R.M. Rolland. 2005. North Atlantic Right Whales in Crisis. *Science*, 309:561-562.
- Kraus S.D., R. M. Pace III and T.R. Frasier. 2007. High Investment, Low Return: The Strange Case of Reproduction in *Eubalaena Glacialis*. Pp 172-199. *In*: S.D. Kraus and R.M. Rolland (eds) *The Urban Whale*. Harvard University Press, Cambridge, Massachusetts, London, England. vii-xv + 543pp.
- LaCasella E.L., P.H. Dutton and S.P. Epperly. 2005. Genetic stock composition of loggerheads (*Caretta caretta*) encountered in the northeast Atlantic distant (NED) longline fishery using mtDNA analysis. NOAA-NMFS-SEFSC Technical Memorandum. National Technical Information Service, Springfield, Virginia.
- Lacroix, G.L. and D. Knox. 2005. Distribution of Atlantic salmon (*Salmo salar*) postsmolts of different origins in the Bay of Fundy and Gulf of Maine and evaluation of factors affecting migration, growth, and survival. *Can. J. Fish. Aquat. Sci.* 62: 1363–1376.
- Lageux, C.J., C. Campbell, L.H. Herbst, A.R. Knowlton and B. Weigle. 1998. Demography of marine turtles harvested by Miskitu Indians of Atlantic Nicaragua. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-412:90.
- Lagueux, K.M., Xani, M.A., Knowlton, A.R., Kraus, S.D. Response by vessel operators to protection measures for right whales *Eubalaena glacialis* in the southeast US calving ground. *Endangered Species Research* 14:69-77. 2011.
- Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet, M. Podesta. 2001. Collisions between ships and whales. *Marine Mammal Science* 17(1):35-75.
- Lalli, C.M. and T.R. Parsons. 1997. *Biological oceanography: An introduction – 2nd Edition*. Pages 1-13. Butterworth-Heinemann Publications. 335 pp.
- Laurent, L., J. Lescure, L. Excoffier, B.W. Bowen, M. Domingo, M. Hadjichristophorou, L. Kornaraky & G. Trabuchet. 1993. Genetic studies of relationships between Mediterranean and Atlantic populations of loggerhead *Caretta caretta* with a mitochondrial marker. *Comptes Rendus de l'Academie Des Sciences, Paris* 316:1233-1239.
- Leandro L.F., G.J Teegarden, P.B Roth, Z. Wang, G.J. Doucette. 2009. The copepod *Calanus finmarchicus*: a potential vector for trophic transfer of the marine algal biotoxin, domoic acid. *J Exp Mar Biol Ecol* doi:10.1016/j.jembe. 2009.11.002

- Learmonth JA, MacLeod CD, Santos MB, Pierce GJ, CrickHQP, Robinson RA .2006. Potential effects of climate change on marine mammals. *Oceanogr Mar Biol Annu Rev* 44:431–464
- Lewison, R.L., L.B. Crowder, and D.J. Shaver. 2003. The impact of turtle excluder devices and fisheries closures on loggerhead and Kemp’s ridley strandings in the western Gulf of Mexico. *Conservation Biology* 17(4):1089-1097.
- Lewison, R.L., S.A. Freeman, and L.B. Crowder. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. *Ecology Letters* 7: 221-231.
- Limpus, C.J. and D.J. Limpus. 2000. Mangroves in the diet of *Chelonia mydas* in Queensland, Australia. *Mar Turtle Newsl* 89: 13–15.
- Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. *Copeia*. 2:449-456
- Lutcavage, M.E., and P.L. Lutz. 1997. Diving physiology. Pages 277-296 in P.L. Lutz and J.A. Musick, eds. *The Biology of Sea Turtles*. Boca Raton, Florida: CRC Press.
- Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival. Pages 387-409 in P.L. Lutz and J.A. Musick, eds. *The Biology of Sea Turtles*. Boca Raton, Florida: CRC Press.
- MacLeod, C.D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis. *Endang Species Res* 7, 125-136.
- Magnuson, J.J., K.A. Bjorndal, W.D. DuPaul, G.L. Graham, D.W. Owens, P.C.H. Pritchard, J.I. Richardson, G.E. Saul, and C.W. West. 1990. *Decline of the sea turtles: causes and prevention*. National Academy Press, Washington, D.C. 274 pp.
- Maier, P.P., A.L. Segars, M.D. Arendt, and J.D. Whitaker. 2005. Examination of local movement and migratory behavior of sea turtles during spring and summer along the Atlantic coast off the southeastern United States. Annual report for grant number NA03NMF4720281. 29pp.
- Maier, P.P., A.L. Segars, M.D. Arendt, J.D. Whitaker, B.W. Stender, L. Parker, R. Vendetti, D.W. Owens, J. Quattro, and S.R. Murphy. 2004. Development of an index of sea turtle abundance based on in-water sampling with trawl gear. Final report to the National Marine Fisheries Service. 86 pp.
- Malik, S., M. W. Brown, S.D. Kraus and B. N. White. 2000. Analysis of mitochondrial DNA diversity within and between North and South Atlantic right whales. *Mar. Mammal Sci.* 16:545-558.

- Mangin, E. 1964. Croissance en Longueur de Trois Esturgeons d'Amerique du Nord: *Acipenser oxyrhynchus*, Mitchill, *Acipenser fulvescens*, Rafinesque, et *Acipenser brevirostris* LeSueur. Verh. Int. Ver. Limnology 15:968-974.
- Mansfield, K. L. 2006. Sources of mortality, movements, and behavior of sea turtles in Virginia. Ph.D. dissertation, College of William and Mary. 343 pp.
- Mansfield, K.L., J.A. Musick, and R.A. Pemberton. 2001. Characterization of the Chesapeake Bay pound net and whelk pot fisheries and their potential interactions with marine sea turtle species. Final Report to the National Marine Fisheries Service under Contract No. 43EANFO30131. 75 pp.
- Mansfield, K.L., V.S. Saba, J. Keinath, and J.A. Musick. 2009. Satellite telemetry reveals a dichotomy in migration strategies among juvenile loggerhead sea turtles in the northwest Atlantic. *Marine Biology*. 156:2555-2570.
- Marcano, L.A. and J.J. Alio-M. 2000. Incidental capture of sea turtles by the industrial shrimping fleet off northwestern Venezuela. U.S. department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-436:107.
- Martin, R.E. 1996. Storm impacts on loggerhead turtle reproductive success. *Mar Turtle Newsl* 73:10–12.
- Mate, B.M., S.L. Nieu Kirk, R. Mescar, and T. Martin. 1992. Application of remote sensing methods for tracking large cetaceans: North Atlantic right whales (*Eubalaena glacialis*). Final Report to the Minerals Management Service, Contract No. 14-12-0001-30411, 167 pp.
- Mate, B.M., S.L. Nieu Kirk, and S.D. Kraus. 1997. Satellite monitored movements of the North Atlantic right whale. *J. Wildl. Manage.* 61:1393-1405.
- Mazaris A.D., G. Mastinos, J.D. Pantis. 2009. Evaluating the impacts of coastal squeeze on sea turtle nesting. *Ocean Coast Manag* 52:139–145.
- McClellan, C.M., and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. *Biology Letters* 3:592-594.
- McMahon C.R. and G.C. Hays. 2006. Thermal niche, large-scale movements and implications of climate change for a critically endangered marine vertebrate. *Global Change Biol* **12**, 1330–1338.
- Merrick, R. and H. Haas. 2008. Analysis of Atlantic sea scallop (*Placopecten magellanicus*) fishery impacts on the North Atlantic population of loggerhead sea turtles (*Caretta caretta*). U.S. Dep. Commer., Northeast Fish. Sci. Center. NOAA Tech. Memo. NMFS-NE-207, 22pp.

- Meylan, A. 1982. Estimation of population size in sea turtles. Pages 135-138 in K.A. Bjorndal, ed. *Biology and Conservation of Sea Turtles*. Washington, D.C.: Smithsonian Institution Press.
- Meylan, A., B.E. Witherington, B. Brost, R. Rivero, and P.S. Kubilis. 2006. Sea turtle nesting in Florida, USA: Assessments of abundance and trends for regionally significant populations of *Caretta*, *Chelonia*, and *Dermochelys*. Pages 306-307 in M. Frick, A. Panagopoulou, A. Rees, and K. Williams, compilers. *Twenty-sixth Annual Symposium on Sea Turtle Biology and Conservation, Book of Abstracts*.
- Mid-Atlantic Fishery Management Council (MAFMC). 2007a. 2008 Atlantic mackerel, squid, and butterfish specifications, including an Environmental Assessment, Regulatory Impact Review, and Initial Flexibility Analysis. Mid-Atlantic Fishery Management Council. November 2007.
- Mid-Atlantic Fishery Management Council (MAFMC). 2007b. 2008 Summer flounder, scup, and black sea bass specifications including an Environmental Assessment, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Essential Fish Habitat Assessment. Mid-Atlantic Fishery Management Council. November 2007.
- Mid-Atlantic Fishery Management Council (MAFMC). 2010. Spiny Dogfish Specifications, Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis. Mid-Atlantic Fishery Management Council. March 2010.
- Mid-Atlantic Fishery Management Council (MAFMC) and Atlantic States Marine Fisheries Commission (ASMFC). 1998. Amendment 1 to the Bluefish Fishery Management Plan with a Supplemental Environmental Impact Statement and Regulatory Impact Review. Mid-Atlantic Fishery Management Council. October 1998.
- Miller C.A., D. Reeb, P.B. Best, A.R. Knowlton, M.W. Brown, M.J. Moore. 2011. Blubber thickness in right whales *Eubalaena glacialis* and *Eubalaena australis* related with reproduction, life history status and prey abundance. *Mar Ecol Prog Ser* 438:267-283.
- Minton, G., Collins, T., Pomilla, C., Findlay, K.P., Rosenbaum, H., Baldwin, R. & Brownell Jr., R.L. 2008. *Megaptera novaeangliae* (Arabian Sea subpopulation). In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.2. <www.iucnredlist.org>. Downloaded on 12 August 2010.
- Mitchell, E., V.M. Kozicki, and R.R. Reeves. 1986. Sightings of right whales, *Eubalaena glacialis*, on the Scotian Shelf, 1966-1972. *Reports of the International Whaling Commission* (Special issue). 10: 83-107.
- Mitchell, G.H., R.D. Kenney, A.M. Farak, and R.J. Campbell. 2003. Evaluation of occurrence of endangered and threatened marine species in naval ship trial areas and transit lanes in the

Gulf of Maine and offshore of Georges Bank. NUWC-NPT Technical Memo 02-121A. March 2003. 113 pp.

- Mizroch, S.A. and A.E. York. 1984. Have pregnancy rates of Southern Hemisphere fin whales, *Balaenoptera physalus*, increased? Reports of the International Whaling Commission, Special Issue No. 6:401-410.
- Monzón-Argüello, C., A. Marco, C. Rico, C. Carreras, P. Calabuig and L.F. López-Jurado. 2006. Transatlantic migration of juvenile loggerhead turtles (*Caretta caretta*): magnetic latitudinal influence. P. 106 in Frick M., A. Panagopoulou, A.F. Rees and K. Williams (compilers). Book of Abstracts of the Twenty-sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece.
- Moore, JC and E. Clark. 1963. Discovery of Right Whales in the Gulf of Mexico. Science 141: 269.
- Moore M.J., A.R., Knowlton, S.D. Kraus, W.A. McLellan, R.K. Bonde. 2004. Morphometry, gross morphology and available histopathology in North Atlantic right whale (*Eubalaena glacialis*) mortalities (1970–2002). Journal of Cetacean Research and Management. 6(3):199-214.
- Moore, M.J., W.A. McLellan, P. Daous, R.K. Bonde and A.R. Knowlton. 2007. Right Whale Mortality: A Message from the Dead to the Living. Pp 358-379. In: S.D. Kraus and R.M. Rolland (eds) *The Urban Whale*. Harvard University Press, Cambridge, Massachusetts, London, England. vii-xv + 543pp
- Morreale, S.J., and E.A. Standora. 1993. Occurrence, movement, and behavior of the Kemp's ridley and other sea turtles in New York waters. Okeanos Ocean Research Foundation Final Report April 1988-March 1993. 70 pp.
- Morreale, S.J., and E.A. Standora. 1998. Early life stage ecology of sea turtles in northeastern U.S. waters. NOAA Technical Memorandum NMFS-SEFSC-413:1-49.
- Morreale, S.J. and E.A. Standora. 2005. Western North Atlantic waters: Crucial developmental habitat for Kemp's ridley and loggerhead sea turtles. Chel. Conserv. Biol. 4(4):872-882.
- Morreale, S.J., C.F. Smith, K. Durham, R.A. DiGiovanni, Jr., and A.A. Aguirre. 2005. Assessing health, status, and trends in northeastern sea turtle populations. Interim report - Sept. 2002 - Nov. 2004. Gloucester, Massachusetts: National Marine Fisheries Service.
- Mrosovsky, N. 1981. Plastic jellyfish. Marine Turtle Newsletter 17:5-6.
- Mrosovsky, N. 1988. Pivotal temperatures for loggerhead turtles from northern and southern nesting beaches. Canadian Journal of Zoology 66:661-669.

- Mrosovsky, N., G.D. Ryan and M.C. James 2009. Leatherback turtles: the menace of plastic. *Marine Pollution Bulletin* 58:287–289.
- Murdoch, P.S., J.S. Baron, and T.L. Miller. 2000. Potential effects of climate change on surface-water quality in North America. *Journal of the American Water Resources Association* 36:347-366.
- Murphy, T.M., S.R. Murphy, D.B. Griffin, and C. P. Hope. 2006. Recent occurrence, spatial distribution and temporal variability of leatherback turtles (*Dermochelys coriacea*) in nearshore waters of South Carolina, USA. *Chel. Cons. Biol.* 5(2): 216-224.
- Murphy, T.M., and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. Final Report to the National Marine Fisheries Service. 73pp.
- Murray, K.T. 2004. Bycatch of sea turtles in the Mid-Atlantic sea scallop (*Placopecten magellanicus*) dredge fishery during 2003. NEFSC Reference Document 04-11; 25 pp.
- Murray, K.T. 2006. Estimated average annual bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic bottom otter trawl gear, 1996-2004. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 06-19, 26pp.
- Murray, K.T. 2007. Estimated bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic scallop trawl gear, 2004-2005, and in sea scallop dredge gear, 2005. NEFSC Reference Document 07-04; 30 pp.
- Murray, K.T. 2008. Estimated average annual bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic bottom otter trawl gear, 1996-2004 (2nd edition). NEFSC Reference Document 08-20; 32 pp.
- Murray, K.T. 2009a. Characteristics and magnitude of sea turtle bycatch in U.S. Mid-Atlantic gillnet gear. *Endangered Species Research* 8:211-224.
- Murray, K.T. 2009b. Proration of estimated bycatch of loggerhead sea turtles in U.S. Mid-Atlantic sink gillnet gear to vessel trip report catch, 2002-2006. NEFSC Reference Document 09-19; 7 pp.
- Musick, J.A., and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pages 137-164 in P.L. Lutz and J.A. Musick, eds. *The Biology of Sea Turtles*. Boca Raton, Florida: CRC Press.
- NAST (National Assessment Synthesis Team). 2000. *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Washington, D.C.: U.S. Global Change Research Program.

- National Marine Fisheries Service (NMFS). 1991a. Final recovery plan for the North Atlantic right whale (*Eubalaena glacialis*). Prepared by the Right Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 86 pp.
- National Marine Fisheries Service (NMFS). 1991b. Final recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the national Marine Fisheries Service, Silver Spring, Maryland. 105 pp.
- National Marine Fisheries Service (NMFS). 1995. Endangered Species Act Section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion. September 15, 1995.
- National Marine Fisheries Service (NMFS). 1996. Endangered Species Act Section 7 Consultation on the proposed shock testing of the SEAWOLF submarine off the Atlantic Coast of Florida during the summer of 1997. Biological Opinion. December 12, 1996.
- National Marine Fisheries Service (NMFS). 1997. Endangered Species Act Section 7 consultation on Navy activities off the southeastern United States along the Atlantic Coast. Biological Opinion. May 15, 1997.
- National Marine Fisheries Service (NMFS). 1998a. Final recovery plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. October 1998.
- National Marine Fisheries Service (NMFS). 1998b. Unpublished. Draft recovery plans for the fin whale (*Balaenoptera physalus*) and sei whale (*Balaenoptera borealis*). Prepared by R.R. Reeves, G.K. Silber, and P.M. Payne for the National Marine Fisheries Service, Silver Spring, Maryland. July 1998.
- National Marine Fisheries Service (NMFS). 1998c. Second reinitiation of Endangered Species Act Section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion. June 8, 1998b.
- National Marine Fisheries Service (NMFS). 1999. Endangered Species Act Section 7 Consultation on the Fishery Management Plan for the Atlantic Bluefish Fishery and Amendment 1 to the Fishery Management Plan. July 12.
- National Marine Fisheries Service (NMFS). 2001a. Biological Opinion. Authorization of fisheries under the Northeast Multispecies Fishery Management Plan. June 14, 2001.
- National Marine Fisheries Service (NMFS). 2001d. Biological Opinion. NMFS' approval of the Tilefish Fishery Management Plan June 14, 2001.

- National Marine Fisheries Service (NMFS). 2002a. Endangered Species Act Section 7 Consultation on Shrimp Trawling in the Southeastern United States, under the Sea Turtle Conservation Regulations and as Managed by the Fishery Management Plans for Shrimp in the South Atlantic and Gulf of Mexico. Biological Opinion. December 2, 2002.
- National Marine Fisheries Service (NMFS). 2002b. Biological Opinion. Reinitiation of Consultation on Federal Lobster Management in the Exclusive Economic Zone for Implementation of Historical Participation. October 31, 2002.
- National Marine Fisheries Service (NMFS). 2002c. Biological Opinion. Implementation of the Deep-Sea Red Crab, *Chaceon quinquedens*, Fishery Management Plan. February 6, 2002.
- National Marine Fisheries Service (NMFS). 2003a. Essential fish habitat consultation on Amendment 13 of the Northeast Multispecies Fishery Management Plan. Memorandum to the file. December 19, 2003.
- National Marine Fisheries Service (NMFS). 2003b. Biological Opinion. Authorization of fisheries under Monkfish Fishery Management Plan. April 14, 2003.
- National Marine Fisheries Service (NMFS). 2004a. Endangered Species Act Section 7 Reinitiated Consultation on the Continued Authorization of the Atlantic Pelagic Longline Fishery under the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). Biological Opinion. June 1, 2004.
- National Marine Fisheries Service (NMFS). 2004b. Final Environmental Assessment and Regulatory Impact Review Regulatory Flexibility Act Analysis on Sea Turtle Conservation Measures for the Pound Net Fishery in Virginia Waters of the Chesapeake Bay. April, 2004.
- National Marine Fisheries Service (NMFS). 2005a. Recovery Plan for the North Atlantic Right Whale (*Eubalaena glacialis*). National Marine Fisheries Service, Silver Spring, MD.
- National Marine Fisheries Service (NMFS). 2005b. Endangered Species Act Section 7 Consultation on the Continued Authorization of the Hawaii-based Pelagic, Deep-Set, Tuna Longline Fishery based on the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Biological Opinion, October 4.
- National Marine Fisheries Service (NMFS). 2006a. Draft Environmental Impact Statement (DEIS) to Implement the Operational Measures of the North Atlantic Right Whale Ship Strike Reduction Strategy. National Marine Fisheries Service. July 2006.
- National Marine Fisheries Service (NMFS). 2006b. Endangered Species Act Section 7 Consultation on the United States Navy Sinking Exercises (SINKEX) in the Western North Atlantic Ocean. Biological Opinion, September 22.

- National Marine Fisheries Service (NMFS). 2007a. Final Environmental Impact Statement for amending the Atlantic Large Whale Take Reduction Plan: broad-based gear modifications. Volume I of II.
- National Marine Fisheries Service (NMFS). 2007b. Endangered Species Act Section 7 consultation on the Northeast Fisheries Science Center Research Vessel Activities. Biological Opinion. August 20, 2007.
- National Marine Fisheries Service (NMFS). 2008a. Summary Report of the Workshop on Interactions Between Sea Turtles and Vertical Lines in Fixed-Gear Fisheries. M.L. Schwartz (ed.), Rhode Island Sea Grant, Narragansett, Rhode Island. 54 pp.
- National Marine Fisheries Service (NMFS). 2008b. Endangered Species Act Section 7 Consultation on the Atlantic Sea Scallop Fishery Management Plan. Biological Opinion. March 14, 2008.
- National Marine Fisheries Service (NMFS). 2008c. Endangered Species Act Section 7 Consultation on the U.S. Navy Atlantic Fleet's conduct of active sonar training along the Atlantic Coast of the United States and in the Gulf of Mexico from January 2009 to January 2014. Biological Opinion. January 16, 2008.
- National Marine Fisheries Service (NMFS). 2008d. Summary Report of the Workshop on Interactions Between Sea Turtles and Vertical Lines in Fixed-Gear Fisheries. M.L. Schwartz (ed.), Rhode Island Sea Grant, Narragansett, R.I. 54pp.
- National Marine Fisheries Service (NMFS). 2009a. Endangered Species Act Section 7 Consultation on the U.S. Navy Atlantic Fleet's conduct of active sonar training along the Atlantic Coast of the United States and in the Gulf of Mexico from January 2009 to January 2010. Biological Opinion. January 21, 2009.
- National Marine Fisheries Service (NMFS). 2009b. Endangered Species Act Section 7 Consultation on U.S. Navy activities in the Virginia Capes, Cherry Point, and Jacksonville Range Complexes from June 2009 to June 2010. Biological Opinion. June 5, 2009.
- National Marine Fisheries Service (NMFS). 2009c. Endangered Species Act Section 7 Consultation on the Atlantic Sea Scallop Fishery Management Plan. Biological Opinion. February 5, 2009.
- National Marine Fisheries Service (NMFS). 2010a. Endangered Species Act Section 7 Consultation on the American Lobster fishery Management Plan. Biological Opinion. October 29, 2010.
- National Marine Fisheries Service (NMFS). 2010b. Endangered Species Act Section 7 Consultation on the Bluefish Fishery Management Plan. Biological Opinion. October 29, 2010.

- National Marine Fisheries Service (NMFS). 2010c. Endangered Species Act Section 7 Consultation on the Atlantic Mackerel, Squid and Atlantic Butterfish Fishery Management Plan. Biological Opinion. October 29, 2010.
- National Marine Fisheries Service (NMFS). 2010d. Endangered Species Act Section 7 Consultation on the Monkfish Fishery Management Plan. Biological Opinion. October 29, 2010.
- National Marine Fisheries Service (NMFS). 2010e. Endangered Species Act Section 7 Consultation on the Northeast Multispecies Fishery Management Plan. Biological Opinion. October 29, 2010.
- National Marine Fisheries Service (NMFS). 2010f. Endangered Species Act Section 7 Consultation on the Northeast Skate Complex Fishery Management Plan. Biological Opinion. October 29, 2010.
- National Marine Fisheries Service (NMFS). 2010g. Endangered Species Act Section 7 Consultation on the Spiny Dogfish Fishery Management Plan. Biological Opinion. October 29, 2010.
- National Marine Fisheries Service (NMFS). 2010h. Endangered Species Act Section 7 Consultation on the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan. Biological Opinion. October 29, 2010.
- National Marine Fisheries Service (NMFS). 2010i. Draft Environmental Impact Statement for Proposed Effort Control Measures for the American Lobster Fishery. Received March 03, 2010.
- NMFS (National Marine Fisheries Service). 2012a. Reinitiation of Endangered Species Act Section 7 Consultation on the Continued Implementation of the Sea Turtle Conservation Regulations, as Proposed to Be Amended, and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in Federal Waters under the Magnuson-Stevens Act. Biological Opinion. May 8, 2012.
- National Marine Fisheries Service (NMFS). 2012b. Reinitiation of Endangered Species Act Section 7 Consultation for the American Lobster Fishery Management Plan. Biological Opinion. August 3, 2012.
- National Marine Fisheries Service (NMFS). 2012c. Reinitiation of Endangered Species Act Section 7 Consultation for the Atlantic Sea Scallop Fishery Management Plan. Biological Opinion. July 12, 2012.
- National Marine Fisheries Service (NMFS). 2014. Reinitiation of Endangered Species Act Section 7 Consultation on the Continued Implementation of the Sea Turtle Conservation

Regulations under the ESA and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in the Federal Waters under the Magnuson-Stevens Fishery Management and Conservation Act. Biological Opinion. April 18, 2014.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991. Recovery plan for U.S. population of Atlantic green turtle (*Chelonia mydas*). National Marine Fisheries Service, Washington, DC. 52 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992a. Recovery plan for the Kemp's ridley sea turtle. National Marine Fisheries Service, Washington, D.C. 40 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992b. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Maryland. 139 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1998a. Recovery Plan for the U.S. Pacific Population of the Loggerhead Turtle (*Caretta caretta*). National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1998b. Recovery Plan for the U.S. Pacific Population of the Leatherback Turtle (*Dermochelys coriacea*). National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007a. Loggerhead sea turtle (*Caretta caretta*) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 65 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007b. Leatherback sea turtle (*Dermochelys coriacea*) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 79 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007c. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 50 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007d. Green sea turtle (*Chelonia mydas*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 102 pp.

- National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2008. Recovery plan for the Northwest Atlantic population of the loggerhead turtle (*Caretta caretta*), Second revision. Washington, D.C.: National Marine Fisheries Service. 325 pp.
- National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC). 2003. Report of the 37th Northeast Regional Stock Assessment Workshop (37th SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. Northeast Fish. Sci. Cent. Ref. Doc. 03-16; 597 p.
- National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC). 2006. 43rd Northeast Regional Stock Assessment Workshop (43rd SAW): 43rd SAW assessment report. US Dep Commer, Northeast Fish Sci Cent Ref Doc 06-25; 400 p.
- National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC). 2009. 48th Northeast Regional Stock Assessment Workshop (48th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-15; 834 p.
- National Marine Fisheries Service (NMFS) Northeast Regional Office (NERO). 2010. NMFS-Northeast Regional Office Sustainable Fisheries Division Lobster Trap Tag Data.
- National Marine Fisheries Service (NMFS) Northeast Regional Office (NERO). 2012. Preliminary summary of western North Atlantic large whale entanglement with Serious Injury and Mortality determinations.
- National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC). 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-455. 343 pp.
- National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC). 2008. Careful release protocols for sea turtle release with minimal injury. NOAA Technical Memorandum NMFS-SEFSC-580, 130 pp.
- National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC). 2009. An assessment of loggerhead sea turtles to estimate impacts of mortality reductions on population dynamics. NMFS SEFSC Contribution PRD-08/09-14. 45 pp.
- National Research Council (NRC). 1990. Decline of sea turtles: causes and prevention. National Academy Press, Washington D.C. 259 pages.
- New England Fishery Management Council (NEFMC). 1982. Fishery Management Plan, Final Environmental Impact Statement, Regulatory Impact Review for Atlantic sea scallops (*Placopecten magellanicus*). Prepared by the New England Fishery Management Council in consultation with Mid-Atlantic Fishery Management Council and South Atlantic Fishery Management Council. January 1982.

- New England Fishery Management Council (NEFMC). 2003. Final Amendment 10 to the Atlantic Sea Scallop Fishery Management Plan with a Supplemental Environmental Impact Statement, Regulatory Impact Review, and Regulatory Flexibility Analysis. New England Fishery Management Council. November 2003.
- New England Fishery Management Council (NEFMC). 2006. Final Amendment 1 to the Fishery Management Plan for Atlantic Herring. Final Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis. New England Fishery Management Council. May 2006.
- New England Fishery Management Council (NEFMC). 2007. Final Amendment 11 to the Atlantic Sea Scallop Fishery Management Plan (FMP) including a Final Supplemental Environmental Impact Statement (FSEIS) and Initial Regulatory Flexibility Analysis (IRFA). Prepared by the New England Fishery Management Council in consultation with the National Marine Fisheries Service and the Mid-Atlantic Fishery Management Council. September 2007.
- New England Fishery Management Council (NEFMC). 2009. Amendment 16 to the Northeast Multispecies Fishery Management Plan including a Final Supplemental Environmental Impact Statement (FSEIS) and Initial Regulatory Flexibility Analysis (IRFA). October 16, 2009.
- National Oceanic and Atmospheric Administration (NOAA). 2008. High numbers of right whales seen in Gulf of Maine: NOAA researchers identify wintering ground and potential breeding ground. NOAA press release; December 31, 2008.
- Nicholls, R.J. 1998. Coastal vulnerability assessment for sea level rise: evaluation and selection of methodologies for implementation. Technical Report R098002, Caribbean Planning for Adaption to Global Climate Change (CPACC) Project. Available at: www.cpacc.org.
- NEFSC (Northeast Fisheries Science Center). 2007. Assessment of Atlantic Sea Scallops. Pages 139-370 in 45th Northeast Regional Stock Assessment Workshop (45th SAW). NEFSC Reference Document 07-16. 380 pp.
- NEFSC (Northeast Fisheries Science Center). 2014. Northeast Fisheries Science Center large whale entanglement data from 2007-2011.
- Northeast Region Essential Fish Habitat Steering Committee (NREFHSC). 2002. Workshop on the effects of fishing gear on marine habitat off the northeastern United States. October 23-25, Boston, Massachusetts. Northeast Fish. Sci. Center Ref. Doc. 02-01, 86pp.
- NRC (National Research Council). 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C.

- Olsen, E., W.P. Budgell, E. Head, L. Kleivane, L. Nottestad, R. Prieto, M.A. Silva, H. Skov, G.A. Vikingsson, G. Waring, and N. Oien. 2009. First satellite-tracked long-distance movement of a sei whale (*Balaenoptera borealis*) in the North Atlantic. *Aquatic Mammals* 35(3):313-318.
- Pace, R.M. III and R.L. Merrick. 2008. Northwest Atlantic ocean habitats important to the conservation of North Atlantic right whales (*Eubalaena glacialis*). U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 08-07; 24 pp.
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. Rep. Int. Whal. Comm. (special issue) 16: 27-50.
- Palka, D. 2000. Abundance and distribution of sea turtles estimated from data collected during cetacean surveys. Pages 71-72 in K.A. Bjorndal and A.B. Bolten, eds. Proceedings of a workshop on assessing abundance and trends for in-water sea turtle populations. NOAA Technical Memorandum NMFS-SEFSC-445.
- Palka, D.L. 2006. Summer abundance estimates of cetaceans in US North Atlantic Navy Operating Areas. Northeast Fish. Sci. Cent. Ref. Doc. 06-03. 41 pp.
- Palmer M.A., C.A. Reidy, C. Nilsson, M. Florke, J. Alcamo, P.S. Lake, and N. Bond. 2008. Climate change and the world's river basins: anticipating management options. *Frontiers in Ecology and the Environment* 6:81-89.
- Parmesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. *Nature* 421:37-42.
- Patino-Martinez, J., A. Marco, L. Quiñones, and L. Hawkes. 2012. A potential tool to mitigate the impacts of climate change to the Caribbean leatherback sea turtle. *Global Change Biology* 18:401-411.
- Patrician, M.R., I.S. Biedron, H. Carter Esch, F.W. Wenzel, L.A. Cooper, P.K. Hamilton, A.H. Glass, M.F. Baumgartner. 2009. Evidence of a North Atlantic right whale calf (*Eubalaena glacialis*) born in northeastern U.S. waters. *Marine Mammal Science*, 25 (2): 462-477.
- Payne, P.M., J.R. Nicolas, L. O'Brien, K.D. Powers. 1986. The distribution of the humpback whale on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel. *Fishery Bulletin* 84 (2): 271-277.
- Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham, and J.W. Jossi. 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. *Fish. Bull.* 88 (4): 687-696.
- Pearce, A.F. 2001. Contrasting population structure of the loggerhead turtle (*Caretta caretta*) using mitochondrial and nuclear DNA markers. Master's thesis, University of Florida. 71 pp.

- Pearce, A.F. and B.W. Bowen. 2001. Final report: Identification of loggerhead (*Caretta caretta*) stock structure in the southeastern United States and adjacent regions using nuclear DNA markers. Project number T-99-SEC-04. Submitted to the National Marine Fisheries Service, May 7, 2001. 79 pp.
- Perry, S.L., D.P. DeMaster, and G.K. Silber. 1999. The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. Mar. Fish. Rev. Special Edition. 61(1): 59-74.
- Pike, D.A., R.L. Antworth, and J.C. Stiner. 2006. Earlier nesting contributes to shorter nesting seasons for the loggerhead sea turtle, *Caretta caretta*. Journal of Herpetology 40(1):91-94.
- Pike, D.A. and J.C. Stiner. 2007. Sea turtle species vary in their susceptibility to tropical cyclones. Oecologia 153: 471–478.
- Pike, D.A. 2008. Environmental correlates of nesting in loggerhead turtles, *Caretta caretta*. Animal Behaviour 76: 603-610
- Plaziat, J.C., and P.G.E.F. Augustinius. 2004. Evolution of progradation/ erosion along the French Guiana mangrove coast: a comparison of mapped shorelines since the 18th century with Holocene data. Mar Geol 208: 127–143.
- Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, *Dermochelys coriacea*, in Pacific, Mexico, with a new estimate of the world population status. Copeia 1982:741-747.
- Pritchard, P.C.H. 2002. Global status of sea turtles: An overview. Document INF-001 prepared for the Inter-American Convention for the Protection and Conservation of Sea Turtles, First Conference of the Parties (COP1IAC), First part August 6-8, 2002.
- Prusty, G., S. Dash, and M.P. Singh. 2007. Spatio-temporal analysis of multi-date IRS imageries for turtle habitat dynamics characterisation at Gahirmatha coast, India. Int J Remote Sens 28: 871–883
- Rahmstorf, S. 1997. Risk of sea-change in the Atlantic. Nature 388: 825–826.
- Rahmstorf, S. 1999. Shifting seas in the greenhouse? Nature 399: 523–524.
- Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida and the Gulf of Mexico. Univ. Miami Press, Coral Gables, Florida.
- Reddin, D.G. 2006. Perspectives on the marine ecology of Atlantic salmon (*Salmo salar*) in the Northwest Atlantic. Canadian Science Advisory Secretariat. Research Document 2006/018.

- Reilly, S.B., Bannister, J.L., Best, P.B., Brown, M., Brownell Jr., R.L., Butterworth, D.S., Clapham, P.J., Cooke, J., Donovan, G.P., Urbán, J. & Zerbini, A.N. 2008. *Eubalaena glacialis*. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. <www.iucnredlist.org>.
- Reilly, S.B., Bannister, J.L., Best, P.B., Brown, M., Brownell Jr., R.L., Butterworth, D.S., Clapham, P.J., Cooke, J., Donovan, G.P., Urbán, J. & Zerbini, A.N. 2008. *Megaptera novaeangliae*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.2. <www.iucnredlist.org>. Downloaded on 12 August 2010.
- Revelles M., L. Cardona, A. Aguilar, M. San Félix, and G. Fernández. 2007. Habitat use by immature loggerhead sea turtles in the Algerian Basin (western Mediterranean): swimming behaviour, seasonality and dispersal pattern. *Marine Biology* 151: 1501–1515.
- Richards, P.M., S.P. Epperly, S.S. Heppell, R.T. King, C.R. Sasso, F. Moncada, G. Nodarse, D.J. Shaver, Y. Medina, J. Zurita. 2011. Sea turtle population estimates incorporating uncertainty: a new approach applied to western North Atlantic loggerheads *Caretta caretta*. *Endang. Species Res.* Vol. 15: 151–158.
- Richardson, T.H. and J.I. Richardson. 1978. Remigration patterns of loggerhead sea turtles (*Caretta caretta*) nesting on Little Cumberland Island and Cumberland Islands, Georgia. Florida Marine Research Publications 33:39-42.
- Richardson, A.J., A. Bakun G.C. Hays and M.J. Gibbons. 2009. The jellyfish joyride: causes, consequences and management responses to a more gelatinous future. *Trends in Ecology and Evolution* Vol.24 No.6:312-322.
- Rivalan, P., P.H. Dutton, E. Baudry, S.E. Roden, and M. Girondot. 2005. Demographic scenario inferred from genetic data in leatherback turtles nesting in French Guiana and Suriname. *Biol Conserv* 1: 1–9.
- Robbins, J., and Mattila, D., 2004. Estimating humpback whale (*Megaptera novaeangliae*) entanglement rates on the basis of scar evidence: Report to the Northeast Fisheries Science Center, National Marine Fisheries Service. Order number 43EANF030121. 21 p.
- Robbins, J. 2007. Structure and dynamics of the Gulf of Maine humpback whale population. PhD thesis, University of St Andrews, St Andrews.
- Robbins, Jooke, Scott Landry and David K. Mattilla. Estimating entanglement related mortality from scar-based studies. 2009. Scientific Committee Meeting of the International Whaling Commission. SC/61/BC3
- Robinson, A., H.Q.P. Crick, J.A. Learmonth, I.M.D. Maclean, C.D. Thomas, F. Bairlein, M.C. Forchhammer, C.M. Francis, J.A. Gill, B.J. Godley, J. Harwood, G.C. Hays, B. Huntley, A.M. Hutson, G.J. Pierce, M.M. Rehfish, D.W. Sims, M.C. Vieira dos Santos,

- T.H. Sparks, D. Stroud, and M.E. Visser. 2009. Travelling through a warming world: climate change and migratory species. *Endangered Species Research* 7:87-99.
- Rolland, R.M, K.E. Hunt, G.J. Doucette, L.G. Rickard and S. K. Wasser. 2007. The Inner Whale: Hormones, Biotoxins, and Parasites. Pp 232-272. *In: S.D. Kraus and R.M. Rolland (eds) The Urban Whale*. Harvard University Press, Cambridge, Massachusetts, London, England. vii-xv + 543pp.
- Ross, J.P. 1996. Caution urged in the interpretation of trends at nesting beaches. *Marine Turtle Newsletter* 74:9-10.
- Ross, J.P. 2005. Hurricane effects on nesting *Caretta caretta*. *Mar Turtle Newsl* 108:13–14.
- Ruben, H.J., and S.J. Morreale. 1999. Draft Biological Assessment for sea turtles in the New York and New Jersey Harbor Complex. Prepared for the National Marine Fisheries Service.
- Sainsbury, J., *Commercial Fishing Methods: An Introduction to Vessels and Gears*, Surrey: London, 1971.
- Sarti, L., S.A. Eckert, N. Garcia, and A.R. Barragan. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. *Marine Turtle Newsletter* 74:2-5.
- Sarti, L., S. Eckert, P. Dutton, A. Barragán, and N. García. 2000. The current situation of the leatherback population on the Pacific coast of Mexico and central America, abundance and distribution of the nestings: an update. Pages 85-87 in H. Kalb and T. Wibbels, compilers. *Proceedings of the Nineteenth Annual Symposium on Sea Turtle Conservation and Biology*. NOAA Technical Memorandum NMFS-SEFSC-443.
- Sarti Martinez, L., A.R. Barragan, D.G. Munoz, N. Garcia, P. Huerta, and F. Vargas. 2007. Conservation and biology of the leatherback turtle in the Mexican Pacific. *Chelonian Conservation and Biology* 6(1):70-78.
- Schaeff, C.M., Kraus, S.D., Brown, M.W., Perkins, J.S., Payne, R., and White, B.N. 1997. Comparison of genetic variability of North and South Atlantic right whales (*Eubalaena*), using DNA fingerprinting. *Can. J. Zool.* 75:1073-1080.
- Schevill, WE., WA Watkins, and KE Moore. 1986. Status of *Eubalaena glacialis* off Cape Cod. Report of the International Whaling Commission, Special Issue 10: 79-82.
- Schick, Robert 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. NRC Research Press Web site at cjfas.nrc.ca. J21103.
- Schmidly, D.J., CO Martin, and GF Collins. 1972. First occurrence of a black right whale (*Balaena glacialis*) along the Texas coast. *The Southwestern Naturalist*.

- Schultz, J.P. 1975. Sea turtles nesting in Surinam. *Zoologische Verhandelingen (Leiden)*, Number 143: 172 pp.
- Scott, J.A. 2006. Use of Satellite Telemetry to Determine Ecology and Management of Loggerhead Turtle (*Caretta caretta*) During the Nesting Season in Georgia. Master's Thesis, University of Georgia. 162 pp.
- SEFSC (Southeast Fisheries Science Center). 2009. An assessment of loggerhead sea turtles to estimate impacts of mortality reductions on population dynamics. NMFS SEFSC Contribution PRD-08/09-14. 45 pp.
- Sears, R 2002. Blue whale, *Balaenoptera musculus*. Pages 112-116 in W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds. *Encyclopedia of Marine Mammals*. San Diego: Academic Press.
- STDN (Sea Turtle Disentanglement Network). 2012. Northeast Region Sea Turtle Disentanglement Network Summary of Entanglement/Disentanglement Data from 2002-2008. Unpublished report compiled by NMFS NERO. 11 pp.
- Seipt, I., P.J. Clapham, C.A. Mayo, and M.P. Hawvermale. 1990. Population characteristics of individually identified fin whales, *Balaenoptera physalus*, in Massachusetts Bay. *Fish. Bull.* 88:271-278.
- Seney, E. E., and J.A. Musick. 2005. Diet analysis of Kemp's ridley sea turtles (*Lepidochelys kempii*) in Virginia. *Chel. Cons. Biol.* 4(4):864-871.
- Seney, E.E., and J.A. Musick. 2007. Historical diet analysis of loggerhead sea turtles (*Caretta caretta*) in Virginia. *Copeia* 2007(2):478-489.
- Shaffer, M.L. 1981. Minimum population sizes for species conservation. *Biosci.* 31: 131-134.
- Shamblin, B.M. 2007. Population structure of loggerhead sea turtles (*Caretta caretta*) nesting in the southeastern United States inferred from mitochondrial DNA sequences and microsatellite loci. Master's thesis, University of Georgia. 59 pp.
- Shoop, C.R. 1987. The Sea Turtles. Pages 357-358 in R.H. Backus and D.W. Bourne, eds. *Georges Bank*. Cambridge, Massachusetts: MIT Press.
- Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. *Herpetological Monographs* 6:43-67.
- Short, F.T. and H.A. Neckles. 1999. The effects of global climate change on seagrasses. *Aquat Bot* 63: 169-196.

- Silber, G.K. and S. Bettridge. An Assessment of the Final Rule to Implement Vessel Speed Restrictions to Reduce the Threat of Vessel Collisions with North Atlantic Right Whales. U.S. Dept. of Commer., NOAA Technical Memorandum NMFS-OPR-48, 114 p. 2012.
- Snover, M. 2005. Population trends and viability analyses for Pacific marine turtles. Pacific Islands Fishery Science Center Internal Report IR-05-08.
- Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? *Chelonian Conservation and Biology* 2: 209-222.
- Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. *Nature* 405(6786):529-530.
- Stein, A. B., K. D. Friedland and M. Sutherland. 2004. Atlantic sturgeon marine by-catch and mortality on the continental shelf of the northeast United States. *N. Am. J. Fish. Manage.* 24(1):171-183.
- Stevenson, J. T., and D. H. Secor. 1999. Age determination and growth of Hudson River Atlantic sturgeon, *Acipenser oxyrinchus*. *Fishery Bulletin* 97: 153-166.
- Stevick P.T., J. Allen, P.J. Clapham, N. Friday, S.K. Katona, F. Larsen, J. Lien, D.K. Matilla, P.J. Palsboll, J. Sigurjonsson, T.D. Smith, N. Oien, P.S. Hammond. 2003. North Atlantic humpback whale abundance and rate of increase four decades after protection from whaling. *Marine Ecology Progress Series*. 258:263-273.
- Stevick, P.T., J. Allen, P.J. Clapham, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsboll, R. Sears, J. Sigurjonsson, T.D. Smith, G. Vikingsson, N. Oien, P.S. Hammond. 2006. Population spatial structuring on the feeding grounds in North Atlantic humpback whales (*Megaptera novaeangliae*). *Journal of Zoology*. 270(2006) 244-255.
- Stewart, K., C. Johnson and M.H. Godfrey. 2007. The minimum size of leatherbacks at reproductive maturity, with a review of sizes for nesting females from the Indian, Atlantic and Pacific Ocean Basins. *Herpetological Journal* 17:123–128.
- Stewart, K., M. Sims, A. Meylan, B. Witherington, B. Brost, and L.B. Crowder. 2011. Leatherback nests increasing significantly in Florida, USA; trends assessed over 30 years using multilevel modeling. *Ecological Applications* 21(1):263–273.
- Stocker, T.F. and A. Schmittner. 1997. Influence of CO2 emission rates on the stability of the thermohaline circulation. *Nature* 388: 862–865.
- Stone, G.S., L. Flores-Gonzalez, and S. Cotton. 1990. Whale migration record. *Nature*. 346: 705.

- Suárez, A. 1999. Preliminary data on sea turtle harvest in the Kai Archipelago, Indonesia. Abstract, 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation, July 15-17, 1999, Sabah, Malaysia.
- Suárez, A., P.H. Dutton, and J. Bakarbesy. 2000. Leatherback (*Dermochelys coriacea*) nesting on the North Vogelkop Coast of Irian Jaya, Indonesia. Page 260 in H.J. Kalb and T. Wibbels, compilers. Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-443.
- Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan, and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. *Mar. Mamm. Sci.* 9: 309-315.
- Thompson, N.B. 1988. The Status of Loggerhead, *Caretta caretta*; Kemp's Ridley, *Lepidochelys kempii*; and Green, *Chelonia mydas*, Sea Turtles in U.S. Waters. *Marine Fisheries Review* 50(3):16-23 pp.
- Titus, J.G. and V.K. Narayanan. 1995. The probability of sea level rise. U.S. Environmental Protection Agency EPA 230-R-95-008. 184 pp.
- Torn, M., and J. Harte. 2006. Missing feedbacks, asymmetric uncertainties, and the underestimation of future warming. *Geophysical Research Letters* 33:L10703. doi:10.1029/2005GL025540.
- Townsend, D.W., A.C. Thomas, L.M. Mayer, M. Thomas and J. Quinlan. 2006. Oceanography of the Northwest Atlantic Continental Shelf. pp. 119-168. In: Robinson, A.R. and K.H. Brink (eds). *The Sea*, Volume 14, Harvard University Press. From a condensed version viewed online 5/02/09 at <http://research.usm.maine.edu/gulfofmaine-census/about-the-gulf/oceanography>.
- Turtle Expert Working Group (TEWG). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409:1-96.
- Turtle Expert Working Group (TEWG). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444:1-115.
- Turtle Expert Working Group (TEWG). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555, 116 pp.
- Turtle Expert Working Group (TEWG). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575:1-131.

- Tynan, C.T. & DeMaster, D.P. 1997. Observations and predictions of Arctic climatic change: potential effects on marine mammals. *Arctic* **50**, 308–322.
- U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1992. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). St. Petersburg, Florida: National Marine Fisheries Service. 40 pp.
- Van Houton, K.S. and O.L. Bass. 2007. Stormy oceans are associated with declines in sea turtle hatching. *Curr Biol* 17: R590.
- Van Houtan, K.S. and J.M. Halley. 2011. Long-term climate forcing in loggerhead sea turtle nesting. *PLoS One* 6:e19043. doi:10.1371/journal.pone.0019043.
- Vargo, S., P. Lutz, D. Odell, E. Van Vleep, and G. Bossart. 1986. Final report: Study of effects of oil on marine turtles. Tech. Rep. O.C.S. study MMS 86-0070. Volume 2. 181 pp.
- Wallace, N. 1985. Debris entanglement in the marine environment. A review. Pp 259-277 in: R.S. Shomura, H.O. Yoshida (eds.) Proceedings of the Workshop on the Fate and Impact of Marine Debris. NOAA Technical Memorandum. NMFS, NOAA-TM-NMFS-SWFC-54.
- Waluda, C.M., Rodhouse, P.G., Podestá, G.P., Trathan, P.N. & Pierce, G.J. 2001. Surface oceanography of the inferred hatching grounds of *Illex argentinus* (Cephalopoda: Ommastrephidae) and influences on recruitment variability. *Marine Biology* **139**, 671–679.
- Warden, M.L. 2011a. Proration of loggerhead sea turtle (*Caretta caretta*) interactions in US Mid-Atlantic bottom otter trawls for fish and scallops, 2005-2008, by managed species landed. NEFSC Reference Document 11-04; 8 pp.
- Warden, M.L. 2011b. Modeling loggerhead sea turtle (*Caretta caretta*) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. *Biological Conservation* 144: 2202–2212.
- Waring, G.T., J. M. Quintal and C. P. Fairfield. 2002. U. S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2002. NOAA Tech. Memo. NMFS-NE-169, 318 pp.
- Waring, G.T., E. Josephson, C.P. Fairfield-Walsh, and K. Maze-Foley. 2007. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2006, 2nd edition, US Department of Commerce, NOAA Technical Memorandum NMFS -NE -201.
- Waring GT, Josephson E, Maze-Foley K, and Rosel PE, editors. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2009. NOAA Tech Memo NMFS NE 213; 528 p.

- Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2010. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2010. NOAA Tech Memo NMFS NE 219.
- Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel (eds.). 2011. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. NOAA Technical Memorandum NMFS-NE-221:1-319.
- Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel (eds.). 2014. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2013. NOAA Technical Memorandum
- Watkins, W.A., and W.E. Schevill. 1982. Observations of right whales (*Eubalaena glacialis*) in Cape Cod waters. Fish. Bull. 80(4): 875-880.
- Watkins, W.A., K.E. Moore, J. Sigurjonsson, D. Wartzok, and G. Notarbartolo di Sciara. 1984. Fin whale (*Balaenoptera physalus*) tracked by radio in the Irminger Sea. Rit Fiskideildar 8(1): 1-14.
- Webster, P.J., G.J. Holland, J.A. Curry, H.R. Chang. 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. Science 309:1844–1846.
- Weisbrod, A.V., D. Shea, M.J. Moore, and J.J. Stegeman. 2000. Organochlorine exposure and bioaccumulation in the endangered Northwest Atlantic right whale (*Eubalaena glacialis*) population. Environmental Toxicology and Chemistry, 19(3):654-666.
- Weishampel, J.F., D.A. Bagley, and L.M. Ehrhart. 2004. Earlier nesting by loggerhead sea turtles following sea surface warming. Global Change Biology 10:1424-1427.
- Whitehead, H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. Mar. Ecol. Prog. Ser. 242: 295-304.
- Wiley, D.N., R.A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortality of humpback whales, *Megaptera novaeangliae*, in the Mid-Atlantic and southeast United States, 1985-1992. Fishery Bulletin 93(1):196-205.
- Wiley, D.N., M. Thompson, R.M. Pace III, and J. Levenson. Modeling speed restrictions to mitigate lethal collisions between ships and whales in the Stellwagen Bank National Marine Sanctuary, USA. Biological Conservation 144:2377-2381.2011.
- Winn, H.E., C.A. Price, and P.W. Sorensen. 1986. The distributional biology of the right whale (*Eubalaena glacialis*) in the western North Atlantic. Reports of the International Whaling Commission (Special issue). 10: 129-138
- Wise, J.P, S.S. Wise, S. Kraus, R. Shaffley, M. Grau, T.L. Chen, C. Perkins, W.D. Thompson, T. Zhang, Y. Zhang, T. Romano and T. O’Hara. 2008. Hexavalent chromium is cytotoxic and

- genotoxic to the North Atlantic right whale (*Eubalaena glacialis*) lung and testes fibroblasts. *Mutation Research - Genetic Toxicology and Environmental Mutagenesis*. 650(1): 30-38.
- Witherington, B., P. Kubilis, B. Brost, and A. Meylan. 2009. Decreasing annual nest counts in a globally important loggerhead sea turtle population. *Ecological Applications* 19:30-54.
- Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. *Herpetological Review* 33(4):266-269.
- Witt, M.J., A.C. Broderick, D.J. Johns, C. Martin, R. Penrose, M.S. Hoogmoed, and B.J. Godley. 2007. Prey landscapes help identify potential foraging habitats for leatherback turtles in the NE Atlantic. *Marine Ecology Progress Series* 337:231-243.
- Witt, M.J., A.C. Broderick, M. Coyne, A. Formia and others. 2008. Satellite tracking highlights difficulties in the design of effective protected areas for critically endangered leatherback turtles *Dermochelys coriacea* during the inter-nesting period. *Oryx* 42: 296–300.
- Witt, M.J., L.A. Hawkes, M.H. Godfrey, B.J. Godley, and A.C. Broderick. 2010. Predicting the impacts of climate change on a globally distributed species: the case of the loggerhead turtle. *Journal of Experimental Biology* 213:901-911.
- Wynne, K. and M. Schwartz. 1999. Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant, Narragansett. 115pp.
- Zemsky, V., A.A. Berzin, Y.A. Mikhailiev, and D.D. Tormosov. 1995. Soviet Antarctic pelagic whaling after WWII: review of actual catch data. Report of the Sub-committee on Southern Hemisphere baleen whales. *Rep. Int. Whal. Comm.* 45:131-135.
- Zug, G.R., and J.F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea*: a skeletochronological analysis. *Chelonian Conservation and Biology*. 2(2):244-249.
- Zurita, J.C., R. Herrera, A. Arenas, M.E. Torres, C. Calderon, L. Gomez, J.C. Alvarado, and R. Villavicencio. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pages 125-127 in J.A. Seminoff, compiler. *Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-503.